



Time: 3 hours

Total mark: 50

Answer *only five* of the following questions:

(Q1) (i) Suppose that O_i , $i \geq 1$, are open subsets of $\mathbb{R}$. Prove that $\cup_{i \geq 1} O_i$ is also open in $\mathbb{R}$. [5 marks]

(ii) Let $S \subset \mathbb{R}$. Show that S is closed if and only if S contains the limit point of every convergent sequence of elements of S . [5 marks]

(Q2) (i) Prove that a sequence of real numbers converges if and only if it is a Cauchy sequence. [6 marks]

(ii) Show that if $(x_n)_{n \geq 1} \subset \mathbb{R}$ is a monotonically increasing sequence that is bounded above, then $x_n \rightarrow \sup_{n \geq 1} x_n$, as $n \rightarrow \infty$. [4 marks]

(Q3) (i) Show that $f : D \subset \mathbb{R} \rightarrow \mathbb{R}$ is continuous at $x_0 \in D$ if and only if the sequence $(f(x_n))_{n \geq 1}$ converges to $f(x_0)$ whenever $(x_n)_{n \geq 1}$ is a sequence in D that converges to x_0 . [6 marks]

(ii) Use the characterization given in (i) to prove the discontinuity at the origin of the function $f(x) = \begin{cases} \cos \frac{1}{x}, & x \neq 0; \\ 0, & x = 0. \end{cases}$ [4 marks]

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(ii) Argue by contradiction to demonstrate that if $f : [a, b] \rightarrow \mathbb{R}$ is continuous then it is uniformly continuous on $[a, b]$. [5 marks]

Please Turn over the page

(Q5) (i) Assume that U, V are open intervals and let $f : U \rightarrow \mathbb{R}$ and $g : V \rightarrow \mathbb{R}$ be two differentiable functions such that $f(U) \subset V$. Prove that $g \circ f$ is differentiable on U and that $(g \circ f)' = (g' \circ f) \cdot f'$ [5 marks]

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With the best of luck,

Prof. Rashwan A. Rashwan,

Dr. Ahmed A. Abdelhakim



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2nd Term 2017/2018
Date: May, 24, 2018

Final Exam for Level 3
Subject: Image Processing
Course No.MC366
Time: 2 Hours

Mathematics Dept.
Faculty of Science
Assiut University

Answer the following questions (50 marks)

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Q2.	a) Compute Z from the following matlab script (6 marks) $x = [150 \ 10 \ 90; 80 \ 50 \ 60; 121 \ 160 \ 20]$ $y = [-1 \ 0 \ 1; -2 \ 0 \ 2; -1 \ 0 \ 1]$ $z = \text{imfilter}(x,y,'corr')$ b) What is the Delta compression and compute the compressed data of the data (6 marks) $220 \ 321 \ 335 \ 211 \ 250 \ 200 \ 233 \ 214 \ 232 \ 212$	(12 marks)
Q3.	a) Write the MATLAB code used to: (4 marks) i. Read any image then use affine transformation matrix for each of the operations below: ii. Flip the image right to left iii. Translation by [25, 15] pixels b) What are the main differences between: (8 marks) i. Global thresholding and optimal thresholding. ii. Raster and vector image . iii. Interpixel redundancy and Psychovisual redundancy	(12 marks)

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الامتحان النهائي للفصل الدراسي الثاني للعام الجامعي ٢٠١٧/٢٠١٨ م
 للفرقة : الثالثة : الشعبة : الرياضيات التاريخ : ٢٠١٨/٥/٢٤ م

الزمن : ساعتان

الدرجة الكلية : ٥٠ درجة
 درجة كل سؤال : ١٧ درجة

أسم المقرر : الطرق الرياضية
 رقم المقرر ورمزه : ٣٣٤ ر

أجب عن ثلاثة أسئلة فقط مما يأتي :-
 السؤال الأول :-

أوجد تحويل لابلاس للمشتقة التفاضلية للدالة $F(t)$ عند نقط الاتصال والانفصال للدالة .

$$\lim_{t \rightarrow 0} F(t) = \lim_{s \rightarrow \infty} s f(s)$$

أبرهن علي أن

$$\lim_{s \rightarrow \infty} F(t) = \lim_{s \rightarrow 0} s f(s)$$

$$\Gamma\left(\frac{1}{2}\right) = \sqrt{\pi}, \quad \int_0^{\infty} \delta(t) dt = 1, \quad L \sin \sqrt{t} = \frac{\sqrt{\pi}}{3} e^{-\frac{1}{4s}} s^{\frac{3}{2}}$$

السؤال الثاني :-

حل المعادلات الآتية :

$$t Y''(t) + Y'(t) + 4t Y(t) = 0, \quad y(0) = 3, y'(0) = 0$$

$$\frac{\partial U}{\partial x} = 2 \frac{\partial U}{\partial t} + U, \quad x > 0, t > 0 \quad U(x, 0) = 6 e^{-3x}$$

$$\int_0^t Y(u) Y(t-u) du = 16 \sin 4t$$

السؤال الثالث :-

(أ) فك الدالة $f(x) = x^2$, $0 < x < 2\pi$ بدلالة متسلسلة فوريير ثم أحسب المجموع

$$1 + \frac{1}{2^2} + \frac{1}{3^2} + \frac{1}{4^2} + \dots$$

(ب) صفيحة علي شكل دائري نصف قطرها الوحدة ووجهيها معزولين ونصف محيطها محفوظ عند درجة حرارة u_1

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من فضلك أنظر بقية الأسئلة خلف الورقة ،،،،،



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السؤال الرابع :-

أ) يعرف الطي للدالتين $f(x)$, $g(x)$ كالآتي

$$f * g = \int_{-\infty}^{\infty} f(u) g(x-u) du$$

برهن علي أن تحويل فوريير للطرف الأيمن هو حاصل ضرب تحويل فوريير للدالتين $f(x)$, $g(x)$

ب) أوجد تحويل فوريير للدالة $f(x) = \begin{cases} 1 & |x| < a \\ 0 & |x| > a \end{cases}$ وأرسم $f(x)$ كذلك تحويلها عند $a = 3$ وأوجد

$$\int_{-\infty}^{\infty} \frac{\sin u}{u} du \quad \text{كذلك} \quad \int_{-\infty}^{\infty} \frac{\sin \alpha a \cos \alpha x}{\alpha} d\alpha$$

ج) ترك خيط لانهائي من السكون وكانت أزاحته الابتدائية عن محور x هي $f(x)$ أوجد الإزاحه عند أي زمن .

انتهت الأسئلة مع تمنياتنا بالتوفيق ،،،،

لجنة الممتحنين :- أ. د/ نجاه عبد الرحمن حسين ، أ. د/ فاروق علي السيد



الامتحان النهائي للفصل الدراسي الثاني للعام الجامعي ٢٠١٧/٢٠١٨ م
 للفرقة : الثالثة شعبة : الرياضيات التاريخ : ٢٠١٨/٥/٢٤ م

الزمن : ساعتان

الدرجة الكلية : ٥٠ درجة

أسم المقرر : الطرق الرياضية
 رقم المقرر ورمزه : ٣٣٤ ر

درجة كل سؤال : ١٧ درجة

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امتحان الفرقة الثالثة شعبة الرياضيات

الزمن : ثلاث ساعات

رقم المقرر ورمزه : ١٣٤٦

المقرر : عمليات عشوائية وتطبيقاتها

أجب عن خمسة أسئلة فقط مما يأتي :- درجة جزء كل سؤال (خمس درجات)

١- (أ) لمجموعة المتغيرات العشوائية المستقلة $X_1, X_2, X_3, \dots$ بفرض أن التوقع الرياضي $E(X_i) = m$ والتباين $V(X_i)$ لكل منها محدود عرف كل من التقارب عن طريق الإحتمال وقانون الأعداد الكبرى (الضعيف).
(ب) بفرض أن $f f s s f s f f s s s f f s f f s$ هي إحدى النتائج الممكنة في محاولات برنولي العشوائية المستقلة بحيث أن $P(s) = p, P(f) = q, p + q = 1$ عرف عملية عشوائية في الفراغ R^2 موضحا ذلك بيانيا .

٢- (أ) في عملية برنولي العشوائية $\{X_n; n > 0\}$ بالإحتمال $p = 0.6$ إذا كان $X = X_1 + X_2$ ، $Y = X_1 + X_3$ احسب الإحتمالات الآتية : $P(X < 2, Y \leq 1)$ ، $P(2X < 3Y)$ ، $P(Y = X)$.
(ب) في السؤال (٢-أ) أوجد العزم الارتباطي بين X ، Y موضحا العلاقة بينهما .

٣- (أ) وضح العلاقة بين عملية برنولي العشوائية $\{X_n; n > 0\}$ و العملية العشوائية $\{Y_n; n \geq 0\}$ حيث أن المتغير Y_n يخضع لتوزيع ذي الحدين واذكر صفات كل منهما ثم عبر مع الاستنتاج عن إحتمال الحادث $(Y_{n+1} = k)$ من خلال إحتمالات الحوادث : $(Y_n = k)$ ، $(Y_n = k - 1)$ لأي عدد صحيح $k > 0$.
(ب) في العملية العشوائية $\{Y_n; n \geq 0\}$ أوجد كل من $E(Y_5)$ ، $E(Y_4^2)$ ، $P(Y_5 = 3, Y_7 = 4, Y_{14} = 9)$.

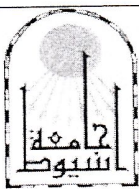
٤- (أ) عرف أزمنة النجاح T_k كعملية عشوائية موضحا العلاقة بينها وبين العملية العشوائية $\{Y_n; n \geq 0\}$ ثم اذكر فقط توزيع المتغير العشوائي T_k .
(ب) - في عملية بواسون العشوائية $\{N_t; t \geq 0\}$ بالمعدل $\lambda = 4$ احسب كل من الإحتمالات الآتية :
 $P(N_{1.5} = 2, N_4 = 5, N_{6.8} = 9)$ ، $P(N_3 = 5, N_7 = 9)$

٥- (أ) في عملية بواسون أو عملية الوصول المعودة $\{N_t; t \geq 0\}$ بالمعدل λ إثبت أن الإحتمال المشروط لعدد الوصول N_t بالنسبة إلى عدد الوصول N_{t+s} لكل $t > 0, s > 0$ يمثل توزيع ذي الحدين .
(ب) عرف العمليات العشوائية المستقلة ثم اثبت أن أي عمليتين مستقلتين لبواسون هو أيضا عملية بواسون .

٦- (أ) في عملية التجديد العشوائية $R = \{R_n; n \in N\}$ حيث N هي فئة الأعداد الصحيحة غير السالبة عرف دالة التجديد ثم عبر عنها من خلال توزيع المتغير R_n مع الاستنتاج .

(ب) في سلسلة ماركوف العشوائية المتقطعة $\{X_n; n \geq 0\}$ عرف مصفوفة الإحتمالات الإنتقالية بصفاتها المعروفة ثم احسب الإحتمال : $P(X_0 = 1, X_1 = 1, X_2 = 0, X_3 = 1, X_4 = 0, X_6 = 0)$ بفرض أن حالات الفراغ $(0, 1)$ والمصفوفة العشوائية

$$P = \begin{pmatrix} 1/2 & 1/2 \\ 1/3 & 2/3 \end{pmatrix} , \text{ ومنتجه الإحتمالات الابتدائية } \pi_0 = (2/5 \quad 3/5)$$

	المقرر: تحليل عددي (٣٢٣) الفرقة: المستوى الثالث الدرجة: ٥٠ درجة التاريخ: ٢٠١٨/٥/٢٩ الزمن: ثلاث ساعات	جامعة أسيوط كلية العلوم - قسم الرياضيات امتحان نهائي الفصل الدراسي الثاني للعام الجامعي ٢٠١٧/٢٠١٨
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Answer five questions only :- (10 marks for every question)

1-a) If the function $g \in C[a, b]$ and $g(x) \in [a, b] \forall x \in [a, b]$ and $g'(x)$ exist with $|g'(x)| \leq k < 1 \forall x \in [a, b]$ prove that the sequence defined by $P_n = g(P_{n-1}), n \geq 1$ will converge to the unique fixed point P and also $|P_{n+1} - P_n| \leq k^n |P_1 - P_0|$.

1-b) Verify that when Newton's method is used to compute $\sqrt{A}, A > 0$ (By solving the equation : $f(x) = x^2 - A$). The sequence of iterates is defined by : $x_{n+1} = (x_n + \frac{A}{x_n})/2$, and show that if the sequence $\{x_n\}$ is defined as the previous problem, then this method is quadratically convergence.

2-a) Derive Lagrange interpolation formula of degree n and write the error of the method.

2-b) For the given function $f(x) = \cos \pi x$ let $x_0 = -1, x_1 = 0, x_2 = 1$ construct the suitable interpolation polynomial and find the actual error.

3) Derive the formula of the Newton's interpolatory divided difference method and use this formula to obtain a polynomial of least degree that fits the values shown:

x	0	1	2	4	6
$f(x)$	1	9	23	93	259

من فضلك انظر خلف الورقة

السؤال الرابع :-

أ) يعرف الطي للدالتين $f(x)$, $g(x)$ كالآتي

$$f * g = \int_{-\infty}^{\infty} f(u) g(x-u) du$$

برهن علي أن تحويل فوريير للطرف الأيمن هو حاصل ضرب تحويلي فوريير للدالتين $f(x)$, $g(x)$

ب) أوجد تحويل فوريير للدالة $f(x) = \begin{cases} 1 & |x| < a \\ 0 & |x| > a \end{cases}$ وأرسم $f(x)$ كذلك تحويلها عند $a = 3$ وأوجد

$$\int_{-\infty}^{\infty} \frac{\sin u}{u} du \quad \text{كذلك} \quad \int_{-\infty}^{\infty} \frac{\sin \alpha a \cos \alpha x}{\alpha} d\alpha$$

ج) ترك خيط لانهائي من السكون وكانت أزاحته الابتدائية عن محور x هي $f(x)$ أوجد الإزاحه عند أي زمن .

انتهت الأسئلة مع تمنياتنا بالتوفيق ،،،،

لجنة الممتحنين :- أ. د/ نجاه عبد الرحمن حسين ، أ. د/ فاروق علي السيد



الامتحان النهائي للفصل الدراسي الثاني للعام الجامعي ٢٠١٧/٢٠١٨ م
 للفرقة : الثالثة : الشعبة : الرياضيات التاريخ : ٢٠١٨/٥/٢٤ م

الزمن : ساعتان

الدرجة الكلية : ٥٠ درجة

درجة كل سؤال : ١٧ درجة

أسم المقرر : الطرق الرياضية
 رقم المقرر ورمزه : ٣٣٤ ر

أجب عن ثلاثة أسئلة فقط مما يأتي :-

السؤال الأول :-

أوجد تحويل لابلاس للمشتقة التفاضلية للدالة $F(t)$ عند نقط الاتصال والانفصال للدالة .

أبرهن علي أن

$$\lim_{t \rightarrow 0} F(t) = \lim_{s \rightarrow \infty} s f(s)$$

$$\lim_{t \rightarrow \infty} F(t) = \lim_{s \rightarrow 0} s f(s)$$

$$\Gamma\left(\frac{1}{2}\right) = \sqrt{\pi}, \quad \int_0^{\infty} \delta(t) dt = 1, \quad L \sin \sqrt{t} = \frac{\sqrt{\pi}}{3} e^{-\frac{1}{4s}} s^{\frac{3}{2}}$$

السؤال الثاني :-

حل المعادلات الآتية :

$$t Y''(t) + Y'(t) + 4t Y(t) = 0, \quad y(0) = 3, y'(0) = 0$$

$$\frac{\partial U}{\partial x} = 2 \frac{\partial U}{\partial t} + U, \quad x > 0, t > 0 \quad U(x, 0) = 6 e^{-3x}$$

$$\int_0^t Y(u) Y(t-u) du = 16 \sin 4t$$

السؤال الثالث :-

(أ) فك الدالة $f(x) = x^2$, $0 < x < 2\pi$ بدلالة متسلسلة فوريير ثم أحسب المجموع

$$1 + \frac{1}{2^2} + \frac{1}{3^2} + \frac{1}{4^2} + \dots$$

(ب) صفيحة علي شكل دائري نصف قطرها الوحدة ووجهيها معزولين ونصف محيطها محفوظ عند درجة حرارة u_1

والآخر عند u_2 أوجد حالة الأتزان الحراري .

من فضلك أنظر بقية الأسئلة خلف الورقة ،،،،،



Answer the following questions (50 marks)

Q1.	Complete the following: (1)..... is a representation of a two-dimensional image as a finite set of digital values, called picture elements or pixels - Common image formats include.....(2).... ,(3)..... ,(4)..... (5)..... creates a Distance tool a draggable, resizable line that measures the distance between its endpoints. (6)..... These are the result of objects that are self-luminous, such as stars and light bulbs. (7).....the resulting output pixel is computed as a sum of products of the pixel values and mask coefficients in the pixel's neighborhood in the original image. - The Sobel operators used to compute edges are(8)..... ,(9)..... - Edge detector should have:(10)..... ,(11)..... - Types of noise are(12)..... ,(13)....	(13 marks)
Q2.	a) Compute Z from the following matlab script (6 marks) <pre> x = [150 10 90;80 50 60;121 160 20] y = [-1 0 1;-2 0 2;-1 0 1] z = imfilter(x,y,'corr') </pre> b) What is the Delta compression and compute the compressed data of the data (6 marks) 220 321 335 211 250 200 233 214 232 212	(12 marks)
Q3.	a) Write the MATLAB code used to: (4 marks) - Read any image then use affine transformation matrix for each of the operations below: - Flip the image right to left - Translation by [25, 15] pixels b) What are the main differences between: (8 marks) - Global thresholding and optimal thresholding. - Raster and vector image . - Interpixel redundancy and Psychovisual redundancy	(12 marks)

(Q5) (i) Assume that U, V are open intervals and let $f : U \rightarrow \mathbb{R}$ and $g : V \rightarrow \mathbb{R}$ be two differentiable functions such that $f(U) \subset V$. Prove that $g \circ f$ is differentiable on U and that $(g \circ f)' = (g' \circ f) \cdot f'$ [5 marks]

(ii) Prove that the function $f(x) := \frac{1}{x}$ is differentiable on $]0, \infty[$ but not uniformly continuous therein. [5 marks]

(Q6) (i) State and prove Rolle's theorem then use it to prove the mean value theorem. [6 marks]

(ii) Let I be an open interval. Apply the mean value theorem to prove that a function differentiable on I is

1. increasing if and only if $f' \geq 0$ on I ,

2. decreasing if and only if $f' \leq 0$ on I .

[4 marks]

With the best of luck,

Prof. Rashwan A. Rashwan,

Dr. Ahmed A. Abdelhakim



Time: 3 hours

Total mark: 50

Answer *only five* of the following questions:

(Q1) (i) Suppose that O_i , $i \geq 1$, are open subsets of $\mathbb{R}$. Prove that $\cup_{i \geq 1} O_i$ is also open in $\mathbb{R}$. [5 marks]

(ii) Let $S \subset \mathbb{R}$. Show that S is closed if and only if S contains the limit point of every convergent sequence of elements of S . [5 marks]

(Q2) (i) Prove that a sequence of real numbers converges if and only if it is a Cauchy sequence. [6 marks]

(ii) Show that if $(x_n)_{n \geq 1} \subset \mathbb{R}$ is a monotonically increasing sequence that is bounded above, then $x_n \rightarrow \sup_{n \geq 1} x_n$, as $n \rightarrow \infty$. [4 marks]

(Q3) (i) Show that $f : D \subset \mathbb{R} \rightarrow \mathbb{R}$ is continuous at $x_0 \in D$ if and only if the sequence $(f(x_n))_{n \geq 1}$ converges to $f(x_0)$ whenever $(x_n)_{n \geq 1}$ is a sequence in D that converges to x_0 . [6 marks]

(ii) Use the characterization given in (i) to prove the discontinuity at the origin of the function $f(x) = \begin{cases} \cos \frac{1}{x}, & x \neq 0; \\ 0, & x = 0. \end{cases}$ [4 marks]

(Q4) (i) Assume that D is a closed bounded subset of $\mathbb{R}$. Prove that if $f : D \rightarrow \mathbb{R}$ is continuous then f is bounded on D , and there exist $\alpha, \beta \in D$ such that $f(\alpha) = \max_{x \in D} f(x)$ and $f(\beta) = \min_{x \in D} f(x)$. [5 marks]

(ii) Argue by contradiction to demonstrate that if $f : [a, b] \rightarrow \mathbb{R}$ is continuous then it is uniformly continuous on $[a, b]$. [5 marks]

Please Turn over the page

جامعة أسيوط	مايو 2018	كود المقرر: 356 رك
كلية العلوم		المقرر : مقدمة فى الحسابات العلمية
قسم الرياضيات		الزمن : ساعتان

Answer the following questions by using MATLAB language: (50 marks)

1- Using Newton's forward difference formula, find $y(0.1)$ using the table below:

x	0.0	0.2	0.4	0.6	0.8
y	1.000	1.22140	1.49182	1.82212	2.22554

2- Solve the differential equation by Adams method (without using nested for loops) at $x=0.2$:

$$\frac{dy}{dt} = t^2 - y, \quad y(0) = 1, \quad h = 0.05.$$

and compare it with the analytic solution $y = -e^{-t} + t^2 - 2t + 2$.

3- Solve the following initial value problem:

$$\frac{d^2u}{dt^2} + 4\frac{du}{dt} + 3u = 0, \quad u(0) = 1, \quad \frac{du}{dt}(0) = 0.$$

4- Let $f(x) = \cos 2x$ and $x_0 = 0$. Determine

- The third Taylor polynomial for f about x_0 .
- Find error bound at $x = 0.2$ and compare it to the actual error.

5- For the well-known Chua's circuit equation in chaotic studies that

$$\dot{x} = \alpha[y - x - f(x)], \quad \dot{y} = x - y + z, \quad \dot{z} = -\beta y - \gamma z, \quad t \in (0, 10),$$

where the nonlinear function $f(x)$ is described by

$$f(x) = bx + 0.5(a-b)(|x+1| - |x-1|) \text{ and } a < b < 0.$$

Write an M-function to describe the equation, and draw the phase trajectory for the parameters $\alpha = 9$, $\beta = 100/7$, $\gamma = 0$, $a = -8/7$, $b = -5/7$, and initial conditions

$$x(0) = -2.121304, \quad y(0) = -0.066170, \quad z(0) = 2.881090.$$

Good Luck

Dr. Tarek Aboelenen



امتحان الفرقة الثالثة شعبة الرياضيات

الزمن : ثلاث ساعات

رقم المقرر ورمزه : ١٣٤٦

المقرر : عمليات عشوائية وتطبيقاتها

أجب عن خمسة أسئلة فقط مما يأتي :- درجة جزء كل سؤال (خمس درجات)

١- (أ) لمجموعة المتغيرات العشوائية المستقلة $X_1, X_2, X_3, \dots$ بفرض أن التوقع الرياضي $E(X_i) = m$ والتباين $V(X_i)$ لكل منها محدود عرف كل من التقارب عن طريق الإحتمال وقانون الأعداد الكبرى (الضعيف).
(ب) بفرض أن $f f s s f s f f s s s f f s f f s$ هي إحدى النتائج الممكنة في محاولات برنولي العشوائية المستقلة بحيث أن $P(s) = p, P(f) = q, p + q = 1$ عرف عملية عشوائية في الفراغ R^2 موضحا ذلك بيانيا .

٢- (أ) في عملية برنولي العشوائية $\{X_n; n > 0\}$ بالإحتمال $p = 0.6$ إذا كان $X = X_1 + X_2$ ، $Y = X_1 + X_3$ احسب الإحتمالات الآتية : $P(X < 2, Y \leq 1)$ ، $P(2X < 3Y)$ ، $P(Y = X)$.
(ب) في السؤال (٢-أ) أوجد العزم الارتباطي بين X ، Y موضحا العلاقة بينهما .

٣- (أ) وضح العلاقة بين عملية برنولي العشوائية $\{X_n; n > 0\}$ و العملية العشوائية $\{Y_n; n \geq 0\}$ حيث أن المتغير Y_n يخضع لتوزيع ذي الحدين واذكر صفات كل منهما ثم عبر مع الاستنتاج عن إحتمال الحادث $(Y_{n+1} = k)$ من خلال إحتمالات الحوادث : $(Y_n = k)$ ، $(Y_n = k - 1)$ لأي عدد صحيح $k > 0$.
(ب) في العملية العشوائية $\{Y_n; n \geq 0\}$ أوجد كل من $E(Y_5)$ ، $E(Y_4^2)$ ، $P(Y_5 = 3, Y_7 = 4, Y_{14} = 9)$.

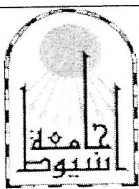
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	المقرر: تحليل عددي (٣٢٣) الفرقة: المستوى الثالث الدرجة: ٥٠ درجة التاريخ: ٢٠١٨/٥/٢٩ الزمن: ثلاث ساعات	جامعة أسيوط كلية العلوم - قسم الرياضيات امتحان نهائي الفصل الدراسي الثاني للعام الجامعي ٢٠١٧/٢٠١٨
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من فضلك انظر خلف الورقة

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لجنة الممتحنين :- أ.د/ نجاه عبد الرحمن حسين ، أ.د/ فاروق علي السيد



الامتحان النهائي للفصل الدراسي الثاني للعام الجامعي ٢٠١٧/٢٠١٨ م
 للفرقة : الثالثة
 الشعبة : الرياضيات
 التاريخ : ٢٠١٨/٥/٢٤ م

الزمن : ساعتان

الدرجة الكلية : ٥٠ درجة

درجة كل سؤال : ١٧ درجة

أسم المقرر : الطرق الرياضية
 رقم المقرر ورمزه : ٣٣٤ ر

أجب عن ثلاثة أسئلة فقط مما يأتي :-

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والآخر عند u_2 أوجد حالة الأتزان الحراري .

من فضلك أنظر بقية الأسئلة خلف الورقة ،،،،،



Answer the following questions (50 marks)

Q1.	Complete the following: (1)..... is a representation of a two-dimensional image as a finite set of digital values, called picture elements or pixels - Common image formats include.....(2).... ,(3)..... ,(4)..... (5)..... creates a Distance tool a draggable, resizable line that measures the distance between its endpoints. (6)..... These are the result of objects that are self-luminous, such as stars and light bulbs. (7).....the resulting output pixel is computed as a sum of products of the pixel values and mask coefficients in the pixel's neighborhood in the original image. - The Sobel operators used to compute edges are(8)..... ,(9)..... - Edge detector should have:(10)..... ,(11)..... - Types of noise are(12)..... ,(13)....	(13 marks)
Q2.	a) Compute Z from the following matlab script (6 marks) <pre> x = [150 10 90;80 50 60;121 160 20] y = [-1 0 1;-2 0 2;-1 0 1] z = imfilter(x,y,'corr') </pre> b) What is the Delta compression and compute the compressed data of the data (6 marks) 220 321 335 211 250 200 233 214 232 212	(12 marks)
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(Q6) (i) State and prove Rolle's theorem then use it to prove the mean value theorem. [6 marks]

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1. increasing if and only if $f' \geq 0$ on I ,

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With the best of luck,

Prof. Rashwan A. Rashwan,

Dr. Ahmed A. Abdelhakim



Time: 3 hours

Total mark: 50

Answer *only five* of the following questions:

(Q1) (i) Suppose that O_i , $i \geq 1$, are open subsets of $\mathbb{R}$. Prove that $\cup_{i \geq 1} O_i$ is also open in $\mathbb{R}$. [5 marks]

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(Q2) (i) Prove that a sequence of real numbers converges if and only if it is a Cauchy sequence. [6 marks]

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Please Turn over the page

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- 1- Explain the internet "nuts and bolts"?
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جامعة أسيوط	مايو 2018	كود المقرر: 356 رك
كلية العلوم		المقرر : مقدمة فى الحسابات العلمية
قسم الرياضيات		الزمن : ساعتان

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1- Using Newton's forward difference formula, find $y(0.1)$ using the table below:

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Good Luck

Dr. Tarek Aboelenen



امتحان الفرقة الثالثة شعبة الرياضيات

الزمن : ثلاث ساعات

رقم المقرر ورمزه : ١٣٤٦

المقرر : عمليات عشوائية وتطبيقاتها

أجب عن خمسة أسئلة فقط مما يأتي :- درجة جزء كل سؤال (خمس درجات)

١- (أ) لمجموعة المتغيرات العشوائية المستقلة $X_1, X_2, X_3, \dots$ بفرض أن التوقع الرياضي $E(X_i) = m$ والتباين $V(X_i)$ لكل منها محدود عرف كل من التقارب عن طريق الإحتمال وقانون الأعداد الكبرى (الضعيف).
(ب) بفرض أن $f f s s f s f f s s s f f s f f s$ هي إحدى النتائج الممكنة في محاولات برنولي العشوائية المستقلة بحيث أن $P(s) = p, P(f) = q, p + q = 1$ عرف عملية عشوائية في الفراغ R^2 موضحا ذلك بيانيا .

٢- (أ) في عملية برنولي العشوائية $\{X_n; n > 0\}$ بالإحتمال $p = 0.6$ إذا كان $X = X_1 + X_2$ ، $Y = X_1 + X_3$ احسب الإحتمالات الآتية : $P(X < 2, Y \leq 1)$ ، $P(2X < 3Y)$ ، $P(Y = X)$.
(ب) في السؤال (٢-أ) أوجد العزم الارتباطي بين X ، Y موضحا العلاقة بينهما .

٣- (أ) وضح العلاقة بين عملية برنولي العشوائية $\{X_n; n > 0\}$ و العملية العشوائية $\{Y_n; n \geq 0\}$ حيث أن المتغير Y_n يخضع لتوزيع ذي الحدين واذكر صفات كل منهما ثم عبر مع الاستنتاج عن إحتمال الحادث $(Y_{n+1} = k)$ من خلال إحتمالات الحوادث : $(Y_n = k)$ ، $(Y_n = k - 1)$ لأي عدد صحيح $k > 0$.
(ب) في العملية العشوائية $\{Y_n; n \geq 0\}$ أوجد كل من $E(Y_5)$ ، $E(Y_4^2)$ ، $P(Y_5 = 3, Y_7 = 4, Y_{14} = 9)$.

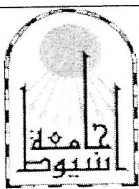
٤- (أ) عرف أزمنة النجاح T_k كعملية عشوائية موضحا العلاقة بينها وبين العملية العشوائية $\{Y_n; n \geq 0\}$ ثم اذكر فقط توزيع المتغير العشوائي T_k .
(ب) - في عملية بواسون العشوائية $\{N_t; t \geq 0\}$ بالمعدل $\lambda = 4$ احسب كل من الإحتمالات الآتية :
 $P(N_{1.5} = 2, N_4 = 5, N_{6.8} = 9)$ ، $P(N_3 = 5, N_7 = 9)$

٥- (أ) في عملية بواسون أو عملية الوصول المعودة $\{N_t; t \geq 0\}$ بالمعدل λ إثبت أن الإحتمال المشروط لعدد الوصول N_t بالنسبة إلى عدد الوصول N_{t+s} لكل $t > 0, s > 0$ يمثل توزيع ذي الحدين .
(ب) عرف العمليات العشوائية المستقلة ثم اثبت أن أي عمليتين مستقلتين لبواسون هو أيضا عملية بواسون .

٦- (أ) في عملية التجديد العشوائية $R = \{R_n; n \in N\}$ حيث N هي فئة الأعداد الصحيحة غير السالبة عرف دالة التجديد ثم عبر عنها من خلال توزيع المتغير R_n مع الاستنتاج .

(ب) في سلسلة ماركوف العشوائية المتقطعة $\{X_n; n \geq 0\}$ عرف مصفوفة الإحتمالات الإنتقالية بصفاتها المعروفة ثم احسب الإحتمال : $P(X_0 = 1, X_1 = 1, X_2 = 0, X_3 = 1, X_4 = 0, X_6 = 0)$ بفرض أن حالات الفراغ $(0, 1)$ والمصفوفة العشوائية

$$P = \begin{pmatrix} 1/2 & 1/2 \\ 1/3 & 2/3 \end{pmatrix} , \text{ ومنتجه الإحتمالات الابتدائية } \pi_0 = (2/5 \quad 3/5)$$

	المقرر: تحليل عددي (٣٢٣) الفرقة: المستوى الثالث الدرجة: ٥٠ درجة التاريخ: ٢٠١٨/٥/٢٩ الزمن: ثلاث ساعات	جامعة أسيوط كلية العلوم - قسم الرياضيات امتحان نهائي الفصل الدراسي الثاني للعام الجامعي ٢٠١٧/٢٠١٨
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Answer five questions only :- (10 marks for every question)

1-a) If the function $g \in C[a, b]$ and $g(x) \in [a, b] \forall x \in [a, b]$ and $g'(x)$ exist with $|g'(x)| \leq k < 1 \forall x \in [a, b]$ prove that the sequence defined by $P_n = g(P_{n-1}), n \geq 1$ will converge to the unique fixed point P and also $|P_{n+1} - P_n| \leq k^n |P_1 - P_0|$.

1-b) Verify that when Newton's method is used to compute $\sqrt{A}, A > 0$ (By solving the equation : $f(x) = x^2 - A$). The sequence of iterates is defined by : $x_{n+1} = (x_n + \frac{A}{x_n})/2$, and show that if the sequence $\{x_n\}$ is defined as the previous problem, then this method is quadratically convergence.

2-a) Derive Lagrange interpolation formula of degree n and write the error of the method .

2-b) For the given function $f(x) = \cos \pi x$ let $x_0 = -1, x_1 = 0, x_2 = 1$ construct the suitable interpolation polynomial and find the actual error.

3) Derive the formula of the Newton's interpolatory divided difference method and use this formula to obtain a polynomial of least degree that fits the values shown:

x	0	1	2	4	6
$f(x)$	1	9	23	93	259

من فضلك انظر خلف الورقة

السؤال الرابع :-

أ) يعرف الطي للدالتين $f(x)$, $g(x)$ كالآتي

$$f * g = \int_{-\infty}^{\infty} f(u) g(x-u) du$$

برهن علي أن تحويل فوريير للطرف الأيمن هو حاصل ضرب تحويلي فوريير للدالتين $f(x)$, $g(x)$

ب) أوجد تحويل فوريير للدالة $f(x) = \begin{cases} 1 & |x| < a \\ 0 & |x| > a \end{cases}$ وأرسم $f(x)$ كذلك تحويلها عند $a = 3$ وأوجد

$$\int_{-\infty}^{\infty} \frac{\sin u}{u} du \quad \text{كذلك} \quad \int_{-\infty}^{\infty} \frac{\sin \alpha a \cos \alpha x}{\alpha} d\alpha$$

ج) ترك خيط لانهائي من السكون وكانت أزاحته الابتدائية عن محور x هي $f(x)$ أوجد الإزاحه عند أي زمن .

انتهت الأسئلة مع تمنياتنا بالتوفيق ،،،،

لجنة الممتحنين :- أ.د/ نجاه عبد الرحمن حسين ، أ.د/ فاروق علي السيد



الامتحان النهائي للفصل الدراسي الثاني للعام الجامعي ٢٠١٧/٢٠١٨ م
 للفرقة : الثالثة شعبة : الرياضيات التاريخ : ٢٠١٨/٥/٢٤ م

الزمن : ساعتان

الدرجة الكلية : ٥٠ درجة

أسم المقرر : الطرق الرياضية
 رقم المقرر ورمزه : ٣٣٤ ر

درجة كل سؤال : ١٧ درجة

أجب عن ثلاثة أسئلة فقط مما يأتي :-

السؤال الأول :-

أوجد تحويل لابلاس للمشتقة التفاضلية للدالة $F(t)$ عند نقط الاتصال والانفصال للدالة .

أبرهن علي أن

$$\lim_{t \rightarrow 0} F(t) = \lim_{s \rightarrow \infty} s f(s)$$

$$\lim_{t \rightarrow \infty} F(t) = \lim_{s \rightarrow 0} s f(s)$$

$$\Gamma\left(\frac{1}{2}\right) = \sqrt{\pi}, \quad \int_0^{\infty} \delta(t) dt = 1, \quad L \sin \sqrt{t} = \frac{\sqrt{\pi}}{3} e^{-\frac{1}{4s}} s^{\frac{3}{2}}$$

السؤال الثاني :-

حل المعادلات الآتية :

$$t Y''(t) + Y'(t) + 4t Y(t) = 0, \quad y(0) = 3, y'(0) = 0$$

$$\frac{\partial U}{\partial x} = 2 \frac{\partial U}{\partial t} + U, \quad x > 0, t > 0 \quad U(x, 0) = 6 e^{-3x}$$

$$\int_0^t Y(u) Y(t-u) du = 16 \sin 4t$$

السؤال الثالث :-

(أ) فك الدالة $f(x) = x^2$, $0 < x < 2\pi$ بدلالة متسلسلة فوريير ثم أحسب المجموع

$$1 + \frac{1}{2^2} + \frac{1}{3^2} + \frac{1}{4^2} + \dots$$

(ب) صفيحة علي شكل دائري نصف قطرها الوحدة ووجهيها معزولين ونصف محيطها محفوظ عند درجة حرارة u_1

والآخر عند u_2 أوجد حالة الأتزان الحراري .

من فضلك أنظر بقية الأسئلة خلف الورقة ،،،،،



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Dr. Tarek Aboelenen



امتحان الفرقة الثالثة شعبة الرياضيات

الزمن : ثلاث ساعات

رقم المقرر ورمزه : ١٣٤٦

المقرر : عمليات عشوائية وتطبيقاتها

أجب عن خمسة أسئلة فقط مما يأتي :- درجة جزء كل سؤال (خمس درجات)

١- (أ) لمجموعة المتغيرات العشوائية المستقلة $X_1, X_2, X_3, \dots$ بفرض أن التوقع الرياضي $E(X_i) = m$ والتباين $V(X_i)$ لكل منها محدود عرف كل من التقارب عن طريق الإحتمال وقانون الأعداد الكبرى (الضعيف).
(ب) بفرض أن $f f s s f s f f s s s f f s f f s$ هي إحدى النتائج الممكنة في محاولات برنولي العشوائية المستقلة بحيث أن $P(s) = p, P(f) = q, p + q = 1$ عرف عملية عشوائية في الفراغ R^2 موضحا ذلك بيانيا .

٢- (أ) في عملية برنولي العشوائية $\{X_n; n > 0\}$ بالإحتمال $p = 0.6$ إذا كان $X = X_1 + X_2$ ، $Y = X_1 + X_3$ احسب الإحتمالات الآتية : $P(X < 2, Y \leq 1)$ ، $P(2X < 3Y)$ ، $P(Y = X)$.
(ب) في السؤال (٢-أ) أوجد العزم الارتباطي بين X ، Y موضحا العلاقة بينهما .

٣- (أ) وضح العلاقة بين عملية برنولي العشوائية $\{X_n; n > 0\}$ و العملية العشوائية $\{Y_n; n \geq 0\}$ حيث أن المتغير Y_n يخضع لتوزيع ذي الحدين واذكر صفات كل منهما ثم عبر مع الاستنتاج عن إحتمال الحادث $(Y_{n+1} = k)$ من خلال إحتمالات الحوادث : $(Y_n = k)$ ، $(Y_n = k - 1)$ لأي عدد صحيح $k > 0$.
(ب) في العملية العشوائية $\{Y_n; n \geq 0\}$ أوجد كل من $E(Y_5)$ ، $E(Y_4^2)$ ، $P(Y_5 = 3, Y_7 = 4, Y_{14} = 9)$.

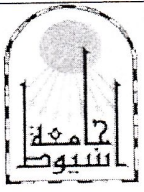
٤- (أ) عرف أزمنة النجاح T_k كعملية عشوائية موضحا العلاقة بينها وبين العملية العشوائية $\{Y_n; n \geq 0\}$ ثم اذكر فقط توزيع المتغير العشوائي T_k .
(ب) - في عملية بواسون العشوائية $\{N_t; t \geq 0\}$ بالمعدل $\lambda = 4$ احسب كل من الإحتمالات الآتية :
 $P(N_{1.5} = 2, N_4 = 5, N_{6.8} = 9)$ ، $P(N_3 = 5, N_7 = 9)$

٥- (أ) في عملية بواسون أو عملية الوصول المعودة $\{N_t; t \geq 0\}$ بالمعدل λ إثبت أن الإحتمال المشروط لعدد الوصول N_t بالنسبة إلى عدد الوصول N_{t+s} لكل $t > 0, s > 0$ يمثل توزيع ذي الحدين .
(ب) عرف العمليات العشوائية المستقلة ثم اثبت أن أي عمليتين مستقلتين لبواسون هو أيضا عملية بواسون .

٦- (أ) في عملية التجديد العشوائية $R = \{R_n; n \in N\}$ حيث N هي فئة الأعداد الصحيحة غير السالبة عرف دالة التجديد ثم عبر عنها من خلال توزيع المتغير R_n مع الاستنتاج .

(ب) في سلسلة ماركوف العشوائية المتقطعة $\{X_n; n \geq 0\}$ عرف مصفوفة الإحتمالات الإنتقالية بصفاتها المعروفة ثم احسب الإحتمال : $P(X_0 = 1, X_1 = 1, X_2 = 0, X_3 = 1, X_4 = 0, X_6 = 0)$ بفرض أن حالات الفراغ $(0, 1)$ والمصفوفة العشوائية

$$P = \begin{pmatrix} 1/2 & 1/2 \\ 1/3 & 2/3 \end{pmatrix} , \text{ ومنتجه الإحتمالات الابتدائية } \pi_0 = (2/5 \quad 3/5)$$

	المقرر: تحليل عددي (٣٢٣) الفرقة: المستوى الثالث الدرجة: ٥٠ درجة التاريخ: ٢٠١٨/٥/٢٩ الزمن: ثلاث ساعات	جامعة أسيوط كلية العلوم - قسم الرياضيات امتحان نهائي الفصل الدراسي الثاني للعام الجامعي ٢٠١٧/٢٠١٨
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Answer five questions only :- (10 marks for every question)

1-a) If the function $g \in C[a, b]$ and $g(x) \in [a, b] \forall x \in [a, b]$ and $g'(x)$ exist with $|g'(x)| \leq k < 1 \forall x \in [a, b]$ prove that the sequence defined by $P_n = g(P_{n-1}), n \geq 1$ will converge to the unique fixed point P and also $|P_{n+1} - P_n| \leq k^n |P_1 - P_0|$.

1-b) Verify that when Newton's method is used to compute $\sqrt{A}, A > 0$ (By solving the equation : $f(x) = x^2 - A$). The sequence of iterates is defined by : $x_{n+1} = (x_n + \frac{A}{x_n})/2$, and show that if the sequence $\{x_n\}$ is defined as the previous problem, then this method is quadratically convergence.

2-a) Derive Lagrange interpolation formula of degree n and write the error of the method.

2-b) For the given function $f(x) = \cos \pi x$ let $x_0 = -1, x_1 = 0, x_2 = 1$ construct the suitable interpolation polynomial and find the actual error.

3) Derive the formula of the Newton's interpolatory divided difference method and use this formula to obtain a polynomial of least degree that fits the values shown:

x	0	1	2	4	6
$f(x)$	1	9	23	93	259

من فضلك انظر خلف الورقة

السؤال الرابع :-

أ) يعرف الطي للدالتين $f(x)$, $g(x)$ كالآتي

$$f * g = \int_{-\infty}^{\infty} f(u) g(x-u) du$$

برهن علي أن تحويل فوريير للطرف الأيمن هو حاصل ضرب تحويلي فوريير للدالتين $f(x)$, $g(x)$

ب) أوجد تحويل فوريير للدالة $f(x) = \begin{cases} 1 & |x| < a \\ 0 & |x| > a \end{cases}$ وأرسم $f(x)$ كذلك تحويلها عند $a = 3$ وأوجد

$$\int_{-\infty}^{\infty} \frac{\sin u}{u} du \quad \text{كذلك} \quad \int_{-\infty}^{\infty} \frac{\sin \alpha a \cos \alpha x}{\alpha} d\alpha$$

ج) ترك خيط لانهائي من السكون وكانت أزاحته الابتدائية عن محور x هي $f(x)$ أوجد الإزاحه عند أي زمن .

انتهت الأسئلة مع تمنياتنا بالتوفيق ،،،،

لجنة الممتحنين :- أ.د/ نجاه عبد الرحمن حسين ، أ.د/ فاروق علي السيد



الامتحان النهائي للفصل الدراسي الثاني للعام الجامعي ٢٠١٧/٢٠١٨ م
 للفرقة : الثالثة : الشعبة : الرياضيات التاريخ : ٢٠١٨/٥/٢٤ م

الزمن : ساعتان

الدرجة الكلية : ٥٠ درجة

أسم المقرر : الطرق الرياضية
 رقم المقرر ورمزه : ٣٣٤ ر

درجة كل سؤال : ١٧ درجة

أجب عن ثلاثة أسئلة فقط مما يأتي :-

السؤال الأول :-

أوجد تحويل لابلاس للمشتقة التفاضلية للدالة $F(t)$ عند نقط الاتصال والانفصال للدالة .

أبرهن علي أن

$$\lim_{t \rightarrow 0} F(t) = \lim_{s \rightarrow \infty} s f(s)$$

$$\lim_{t \rightarrow \infty} F(t) = \lim_{s \rightarrow 0} s f(s)$$

$$\Gamma\left(\frac{1}{2}\right) = \sqrt{\pi}, \quad \int_0^{\infty} \delta(t) dt = 1, \quad L \sin \sqrt{t} = \frac{\sqrt{\pi}}{3} e^{-\frac{1}{4s}} s^{\frac{3}{2}}$$

السؤال الثاني :-

حل المعادلات الآتية :

$$t Y''(t) + Y'(t) + 4t Y(t) = 0, \quad y(0) = 3, y'(0) = 0$$

$$\frac{\partial U}{\partial x} = 2 \frac{\partial U}{\partial t} + U, \quad x > 0, t > 0 \quad U(x, 0) = 6 e^{-3x}$$

$$\int_0^t Y(u) Y(t-u) du = 16 \sin 4t$$

السؤال الثالث :-

(أ) فك الدالة $f(x) = x^2$, $0 < x < 2\pi$ بدلالة متسلسلة فوريير ثم أحسب المجموع

$$1 + \frac{1}{2^2} + \frac{1}{3^2} + \frac{1}{4^2} + \dots$$

(ب) صفيحة علي شكل دائري نصف قطرها الوحدة ووجهيها معزولين ونصف محيطها محفوظ عند درجة حرارة u_1

والآخر عند u_2 أوجد حالة الأتزان الحراري .

من فضلك أنظر بقية الأسئلة خلف الورقة ،،،،،



Answer the following questions (50 marks)

Q1.	Complete the following: (1)..... is a representation of a two-dimensional image as a finite set of digital values, called picture elements or pixels - Common image formats include.....(2).... ,(3)..... ,(4)..... (5)..... creates a Distance tool a draggable, resizable line that measures the distance between its endpoints. (6)..... These are the result of objects that are self-luminous, such as stars and light bulbs. (7).....the resulting output pixel is computed as a sum of products of the pixel values and mask coefficients in the pixel's neighborhood in the original image. - The Sobel operators used to compute edges are(8)..... ,(9)..... - Edge detector should have:(10)..... ,(11)..... - Types of noise are(12)..... ,(13)....	(13 marks)
Q2.	a) Compute Z from the following matlab script (6 marks) <pre> x = [150 10 90;80 50 60;121 160 20] y = [-1 0 1;-2 0 2;-1 0 1] z = imfilter(x,y,'corr') </pre> b) What is the Delta compression and compute the compressed data of the data (6 marks) 220 321 335 211 250 200 233 214 232 212	(12 marks)
Q3.	a) Write the MATLAB code used to: (4 marks) - Read any image then use affine transformation matrix for each of the operations below: - Flip the image right to left - Translation by [25, 15] pixels b) What are the main differences between: (8 marks) - Global thresholding and optimal thresholding. - Raster and vector image . - Interpixel redundancy and Psychovisual redundancy	(12 marks)

(Q5) (i) Assume that U, V are open intervals and let $f : U \rightarrow \mathbb{R}$ and $g : V \rightarrow \mathbb{R}$ be two differentiable functions such that $f(U) \subset V$. Prove that $g \circ f$ is differentiable on U and that $(g \circ f)' = (g' \circ f) \cdot f'$ [5 marks]

(ii) Prove that the function $f(x) := \frac{1}{x}$ is differentiable on $]0, \infty[$ but not uniformly continuous therein. [5 marks]

(Q6) (i) State and prove Rolle's theorem then use it to prove the mean value theorem. [6 marks]

(ii) Let I be an open interval. Apply the mean value theorem to prove that a function differentiable on I is

1. increasing if and only if $f' \geq 0$ on I ,

2. decreasing if and only if $f' \leq 0$ on I .

[4 marks]

With the best of luck,

Prof. Rashwan A. Rashwan,

Dr. Ahmed A. Abdelhakim



Time: 3 hours

Total mark: 50

Answer *only five* of the following questions:

(Q1) (i) Suppose that O_i , $i \geq 1$, are open subsets of $\mathbb{R}$. Prove that $\bigcup_{i \geq 1} O_i$ is also open in $\mathbb{R}$. [5 marks]

(ii) Let $S \subset \mathbb{R}$. Show that S is closed if and only if S contains the limit point of every convergent sequence of elements of S . [5 marks]

(Q2) (i) Prove that a sequence of real numbers converges if and only if it is a Cauchy sequence. [6 marks]

(ii) Show that if $(x_n)_{n \geq 1} \subset \mathbb{R}$ is a monotonically increasing sequence that is bounded above, then $x_n \rightarrow \sup_{n \geq 1} x_n$, as $n \rightarrow \infty$. [4 marks]

(Q3) (i) Show that $f : D \subset \mathbb{R} \rightarrow \mathbb{R}$ is continuous at $x_0 \in D$ if and only if the sequence $(f(x_n))_{n \geq 1}$ converges to $f(x_0)$ whenever $(x_n)_{n \geq 1}$ is a sequence in D that converges to x_0 . [6 marks]

(ii) Use the characterization given in (i) to prove the discontinuity at the origin of the function $f(x) = \begin{cases} \cos \frac{1}{x}, & x \neq 0; \\ 0, & x = 0. \end{cases}$ [4 marks]

(Q4) (i) Assume that D is a closed bounded subset of $\mathbb{R}$. Prove that if $f : D \rightarrow \mathbb{R}$ is continuous then f is bounded on D , and there exist $\alpha, \beta \in D$ such that $f(\alpha) = \max_{x \in D} f(x)$ and $f(\beta) = \min_{x \in D} f(x)$. [5 marks]

(ii) Argue by contradiction to demonstrate that if $f : [a, b] \rightarrow \mathbb{R}$ is continuous then it is uniformly continuous on $[a, b]$. [5 marks]

Please Turn over the page

Q2.

- a. Maintain two different Algorithm of crossover process with mention the probability of crossover (5 marks)
- b. Maintain two different Algorithm of mutation process with mention the probability of mutation. (5 marks)

Q3. a. Maintain tree type representation of solutions in genetic algorithm. (3 marks)

b. Using genetic algorithm to find the maximum value of the function $(15x - x^2)$ where parameter x varies between 0 and 15. For simplicity, we may assume that x takes only integer values. Using the genetic algorithm procedure in one step and begin with four solutions in initial solutions. (10 marks)

Q4. Discuss the internal structure of Taxi driver Robot. (7 marks)

Q5. Discuss the Tabu search method and maintain the type of memory using in this method and maintain the Tabu search algorithm. (10 marks)

==best wishes==

Dr. Alaa F. Mohamed

Answer the following questions: (50 Marks)

Question 1: Answer the following points (10 Marks)

- 1- Explain the internet "nuts and bolts"?
- 2- Explain the sources of packet delay?
- 3- What are protocols?
- 4- Explain Access network: digital subscriber line (DSL)?

Question 2: Answer the following points (10 Marks)

- 1- What is the network core?
- 2- Explain Packet Switching: queueing delay, loss?
- 3- Define throughput?
- 4- Define and explain traffic intensity?

Question 3: Answer the following points (10 Marks)

- 1- Explain the Internet protocol stack?
- 2- Mention some network applications?
- 3- Explain the application client-server architecture?
- 4- Explain P2P architecture?

Question 4: Answer the following points (10 Marks)

- 1- HTTP is "stateless". What does that mean?
- 2- Compare between persistent HTTP and non-persistent HTTP?
- 3- Give examples of HTTP response status codes?
- 4- Explain the term (web caches) and how it is useful?

Question 5: Answer the following points (10 Marks)

- 1- Give a DNS name resolution example?
- 2- Compare between multiplexing and demultiplexing? Support your answer with a diagram?
- 3- Define and explain the use of ACKs and NAKs?
- 4- Define and explain HOL? Support your answer with a diagram?

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قسم الرياضيات		الزمن : ساعتان

Answer the following questions by using MATLAB language: (50 marks)

1- Using Newton's forward difference formula, find $y(0.1)$ using the table below:

x	0.0	0.2	0.4	0.6	0.8
y	1.000	1.22140	1.49182	1.82212	2.22554

2- Solve the differential equation by Adams method (without using nested for loops) at $x=0.2$:

$$\frac{dy}{dt} = t^2 - y, \quad y(0) = 1, \quad h = 0.05.$$

and compare it with the analytic solution $y = -e^{-t} + t^2 - 2t + 2$.

3- Solve the following initial value problem:

$$\frac{d^2u}{dt^2} + 4\frac{du}{dt} + 3u = 0, \quad u(0) = 1, \quad \frac{du}{dt}(0) = 0.$$

4- Let $f(x) = \cos 2x$ and $x_0 = 0$. Determine

a) The third Taylor polynomial for f about x_0 .

b) Find error bound at $x = 0.2$ and compare it to the actual error.

5- For the well-known Chua's circuit equation in chaotic studies that

$$\dot{x} = \alpha[y - x - f(x)], \quad \dot{y} = x - y + z, \quad \dot{z} = -\beta y - \gamma z, \quad t \in (0, 10),$$

where the nonlinear function $f(x)$ is described by

$$f(x) = bx + 0.5(a-b)(|x+1| - |x-1|) \text{ and } a < b < 0.$$

Write an M-function to describe the equation, and draw the phase trajectory for the parameters $\alpha = 9$, $\beta = 100/7$, $\gamma = 0$, $a = -8/7$, $b = -5/7$, and initial conditions

$$x(0) = -2.121304, \quad y(0) = -0.066170, \quad z(0) = 2.881090.$$

Good Luck

Dr. Tarek Aboelenen



امتحان الفرقة الثالثة شعبة الرياضيات

الزمن : ثلاث ساعات

رقم المقرر ورمزه : ١٣٤٦

المقرر : عمليات عشوائية وتطبيقاتها

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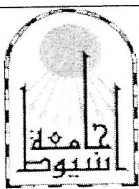
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من فضلك انظر خلف الورقة

السؤال الرابع :-

أ) يعرف الطي للدالتين $f(x)$, $g(x)$ كالآتي

$$f * g = \int_{-\infty}^{\infty} f(u) g(x-u) du$$

برهن علي أن تحويل فوريير للطرف الأيمن هو حاصل ضرب تحويل فوريير للدالتين $f(x)$, $g(x)$

ب) أوجد تحويل فوريير للدالة $f(x) = \begin{cases} 1 & |x| < a \\ 0 & |x| > a \end{cases}$ وأرسم $f(x)$ كذلك تحويلها عند $a = 3$ وأوجد

$$\int_{-\infty}^{\infty} \frac{\sin u}{u} du \quad \text{كذلك} \quad \int_{-\infty}^{\infty} \frac{\sin \alpha a \cos \alpha x}{\alpha} d\alpha$$

ج) ترك خيط لانهائي من السكون وكانت أزاحته الابتدائية عن محور x هي $f(x)$ أوجد الإزاحه عند أي زمن .

انتهت الأسئلة مع تمنياتنا بالتوفيق ،،،،

لجنة الممتحنين :- أ.د/ نجاه عبد الرحمن حسين ، أ.د/ فاروق علي السيد



الامتحان النهائي للفصل الدراسي الثاني للعام الجامعي ٢٠١٧/٢٠١٨ م
 للفرقة : الثالثة
 الشعبة : الرياضيات
 التاريخ : ٢٠١٨/٥/٢٤ م

الزمن : ساعتان

الدرجة الكلية : ٥٠ درجة

أسم المقرر : الطرق الرياضية
 رقم المقرر ورمزه : ٣٣٤ ر

درجة كل سؤال : ١٧ درجة

أجب عن ثلاثة أسئلة فقط مما يأتي :-

السؤال الأول :-

أوجد تحويل لابلاس للمشتقة التفاضلية للدالة $F(t)$ عند نقط الاتصال والانفصال للدالة .

أبرهن علي أن

$$\lim_{t \rightarrow 0} F(t) = \lim_{s \rightarrow \infty} s f(s)$$

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$$\Gamma\left(\frac{1}{2}\right) = \sqrt{\pi}, \quad \int_0^{\infty} \delta(t) dt = 1, \quad L \sin \sqrt{t} = \frac{\sqrt{\pi}}{3} e^{-\frac{1}{4s}} s^{\frac{3}{2}}$$

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$$t Y''(t) + Y'(t) + 4t Y(t) = 0, \quad y(0) = 3, y'(0) = 0$$

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$$\int_0^t Y(u) Y(t-u) du = 16 \sin 4t$$

السؤال الثالث :-

أ) فك الدالة $f(x) = x^2$, $0 < x < 2\pi$ بدلالة متسلسلة فوريير ثم أحسب المجموع

$$1 + \frac{1}{2^2} + \frac{1}{3^2} + \frac{1}{4^2} + \dots$$

ب) صفيحة علي شكل دائري نصف قطرها الوحدة ووجهيها معزولين ونصف محيطها محفوظ عند درجة حرارة u_1

والآخر عند u_2 أوجد حالة الأتزان الحراري .

من فضلك أنظر بقية الأسئلة خلف الورقة ،،،،،



Answer the following questions (50 marks)

Q1.	Complete the following: (1)..... is a representation of a two-dimensional image as a finite set of digital values, called picture elements or pixels - Common image formats include.....(2).... ,(3)..... ,(4)..... (5)..... creates a Distance tool a draggable, resizable line that measures the distance between its endpoints. (6)..... These are the result of objects that are self-luminous, such as stars and light bulbs. (7).....the resulting output pixel is computed as a sum of products of the pixel values and mask coefficients in the pixel's neighborhood in the original image. - The Sobel operators used to compute edges are(8)..... ,(9)..... - Edge detector should have:(10)..... ,(11)..... - Types of noise are(12)..... ,(13)....	(13 marks)
Q2.	a) Compute Z from the following matlab script (6 marks) <pre> x = [150 10 90;80 50 60;121 160 20] y = [-1 0 1;-2 0 2;-1 0 1] z = imfilter(x,y,'corr') </pre> b) What is the Delta compression and compute the compressed data of the data (6 marks) 220 321 335 211 250 200 233 214 232 212	(12 marks)
Q3.	a) Write the MATLAB code used to: (4 marks) - Read any image then use affine transformation matrix for each of the operations below: - Flip the image right to left - Translation by [25, 15] pixels b) What are the main differences between: (8 marks) - Global thresholding and optimal thresholding. - Raster and vector image . - Interpixel redundancy and Psychovisual redundancy	(12 marks)

(Q5) (i) Assume that U, V are open intervals and let $f : U \rightarrow \mathbb{R}$ and $g : V \rightarrow \mathbb{R}$ be two differentiable functions such that $f(U) \subset V$. Prove that $g \circ f$ is differentiable on U and that $(g \circ f)' = (g' \circ f) \cdot f'$ [5 marks]

(ii) Prove that the function $f(x) := \frac{1}{x}$ is differentiable on $]0, \infty[$ but not uniformly continuous therein. [5 marks]

(Q6) (i) State and prove Rolle's theorem then use it to prove the mean value theorem. [6 marks]

(ii) Let I be an open interval. Apply the mean value theorem to prove that a function differentiable on I is

1. increasing if and only if $f' \geq 0$ on I ,

2. decreasing if and only if $f' \leq 0$ on I .

[4 marks]

With the best of luck,

Prof. Rashwan A. Rashwan,

Dr. Ahmed A. Abdelhakim



Time: 3 hours

Total mark: 50

Answer *only five* of the following questions:

(Q1) (i) Suppose that O_i , $i \geq 1$, are open subsets of $\mathbb{R}$. Prove that $\cup_{i \geq 1} O_i$ is also open in $\mathbb{R}$. [5 marks]

(ii) Let $S \subset \mathbb{R}$. Show that S is closed if and only if S contains the limit point of every convergent sequence of elements of S . [5 marks]

(Q2) (i) Prove that a sequence of real numbers converges if and only if it is a Cauchy sequence. [6 marks]

(ii) Show that if $(x_n)_{n \geq 1} \subset \mathbb{R}$ is a monotonically increasing sequence that is bounded above, then $x_n \rightarrow \sup_{n \geq 1} x_n$, as $n \rightarrow \infty$. [4 marks]

(Q3) (i) Show that $f : D \subset \mathbb{R} \rightarrow \mathbb{R}$ is continuous at $x_0 \in D$ if and only if the sequence $(f(x_n))_{n \geq 1}$ converges to $f(x_0)$ whenever $(x_n)_{n \geq 1}$ is a sequence in D that converges to x_0 . [6 marks]

(ii) Use the characterization given in (i) to prove the discontinuity at the origin of the function $f(x) = \begin{cases} \cos \frac{1}{x}, & x \neq 0; \\ 0, & x = 0. \end{cases}$ [4 marks]

(Q4) (i) Assume that D is a closed bounded subset of $\mathbb{R}$. Prove that if $f : D \rightarrow \mathbb{R}$ is continuous then f is bounded on D , and there exist $\alpha, \beta \in D$ such that $f(\alpha) = \max_{x \in D} f(x)$ and $f(\beta) = \min_{x \in D} f(x)$. [5 marks]

(ii) Argue by contradiction to demonstrate that if $f : [a, b] \rightarrow \mathbb{R}$ is continuous then it is uniformly continuous on $[a, b]$. [5 marks]

Please Turn over the page

Q2.

- a. Maintain two different Algorithm of crossover process with mention the probability of crossover (5 marks)
- b. Maintain two different Algorithm of mutation process with mention the probability of mutation. (5 marks)

Q3. a. Maintain tree type representation of solutions in genetic algorithm. (3 marks)

b. Using genetic algorithm to find the maximum value of the function $(15x - x^2)$ where parameter x varies between 0 and 15. For simplicity, we may assume that x takes only integer values. Using the genetic algorithm procedure in one step and begin with four solutions in initial solutions. (10 marks)

Q4. Discuss the internal structure of Taxi driver Robot. (7 marks)

Q5. Discuss the Tabu search method and maintain the type of memory using in this method and maintain the Tabu search algorithm. (10 marks)

==best wishes==

Dr. Alaa F. Mohamed

Answer the following questions: (50 Marks)

Question 1: Answer the following points (10 Marks)

- 1- Explain the internet "nuts and bolts"?
- 2- Explain the sources of packet delay?
- 3- What are protocols?
- 4- Explain Access network: digital subscriber line (DSL)?

Question 2: Answer the following points (10 Marks)

- 1- What is the network core?
- 2- Explain Packet Switching: queueing delay, loss?
- 3- Define throughput?
- 4- Define and explain traffic intensity?

Question 3: Answer the following points (10 Marks)

- 1- Explain the Internet protocol stack?
- 2- Mention some network applications?
- 3- Explain the application client-server architecture?
- 4- Explain P2P architecture?

Question 4: Answer the following points (10 Marks)

- 1- HTTP is "stateless". What does that mean?
- 2- Compare between persistent HTTP and non-persistent HTTP?
- 3- Give examples of HTTP response status codes?
- 4- Explain the term (web caches) and how it is useful?

Question 5: Answer the following points (10 Marks)

- 1- Give a DNS name resolution example?
- 2- Compare between multiplexing and demultiplexing? Support your answer with a diagram?
- 3- Define and explain the use of ACKs and NAKs?
- 4- Define and explain HOL? Support your answer with a diagram?

جامعة أسيوط	مايو 2018	كود المقرر: 356 رك
كلية العلوم		المقرر : مقدمة فى الحسابات العلمية
قسم الرياضيات		الزمن : ساعتان

Answer the following questions by using MATLAB language: (50 marks)

1- Using Newton's forward difference formula, find $y(0.1)$ using the table below:

x	0.0	0.2	0.4	0.6	0.8
y	1.000	1.22140	1.49182	1.82212	2.22554

2- Solve the differential equation by Adams method (without using nested for loops) at $x=0.2$:

$$\frac{dy}{dt} = t^2 - y, \quad y(0) = 1, \quad h = 0.05.$$

and compare it with the analytic solution $y = -e^{-t} + t^2 - 2t + 2$.

3- Solve the following initial value problem:

$$\frac{d^2u}{dt^2} + 4\frac{du}{dt} + 3u = 0, \quad u(0) = 1, \quad \frac{du}{dt}(0) = 0.$$

4- Let $f(x) = \cos 2x$ and $x_0 = 0$. Determine

- The third Taylor polynomial for f about x_0 .
- Find error bound at $x = 0.2$ and compare it to the actual error.

5- For the well-known Chua's circuit equation in chaotic studies that

$$\dot{x} = \alpha[y - x - f(x)], \quad \dot{y} = x - y + z, \quad \dot{z} = -\beta y - \gamma z, \quad t \in (0, 10),$$

where the nonlinear function $f(x)$ is described by

$$f(x) = bx + 0.5(a-b)(|x+1| - |x-1|) \text{ and } a < b < 0.$$

Write an M-function to describe the equation, and draw the phase trajectory for the parameters $\alpha = 9$, $\beta = 100/7$, $\gamma = 0$, $a = -8/7$, $b = -5/7$, and initial conditions

$$x(0) = -2.121304, \quad y(0) = -0.066170, \quad z(0) = 2.881090.$$

Good Luck

Dr. Tarek Aboelenen



امتحان الفرقة الثالثة شعبة الرياضيات

الزمن : ثلاث ساعات

رقم المقرر ورمزه : ١٣٤٦

المقرر : عمليات عشوائية وتطبيقاتها

أجب عن خمسة أسئلة فقط مما يأتي :- درجة جزء كل سؤال (خمس درجات)

١- (أ) لمجموعة المتغيرات العشوائية المستقلة $X_1, X_2, X_3, \dots$ بفرض أن التوقع الرياضي $E(X_i) = m$ والتباين $V(X_i)$ لكل منها محدود عرف كل من التقارب عن طريق الإحتمال وقانون الأعداد الكبرى (الضعيف).
(ب) بفرض أن $f f s s f s f f s s s f f s f f s$ هي إحدى النتائج الممكنة في محاولات برنولي العشوائية المستقلة بحيث أن $P(s) = p, P(f) = q, p + q = 1$ عرف عملية عشوائية في الفراغ R^2 موضحا ذلك بيانيا .

٢- (أ) في عملية برنولي العشوائية $\{X_n; n > 0\}$ بالإحتمال $p = 0.6$ إذا كان $X = X_1 + X_2$ ، $Y = X_1 + X_3$ احسب الإحتمالات الآتية : $P(X < 2, Y \leq 1)$ ، $P(2X < 3Y)$ ، $P(Y = X)$.
(ب) في السؤال (٢-أ) أوجد العزم الارتباطي بين X ، Y موضحا العلاقة بينهما .

٣- (أ) وضح العلاقة بين عملية برنولي العشوائية $\{X_n; n > 0\}$ و العملية العشوائية $\{Y_n; n \geq 0\}$ حيث أن المتغير Y_n يخضع لتوزيع ذي الحدين واذكر صفات كل منهما ثم عبر مع الإستنتاج عن إحتمال الحادث $(Y_{n+1} = k)$ من خلال إحتمالات الحوادث : $(Y_n = k)$ ، $(Y_n = k - 1)$ لأي عدد صحيح $k > 0$.
(ب) في العملية العشوائية $\{Y_n; n \geq 0\}$ أوجد كل من $E(Y_5)$ ، $E(Y_4^2)$ ، $P(Y_5 = 3, Y_7 = 4, Y_{14} = 9)$.

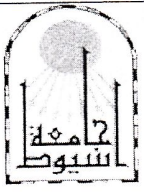
٤- (أ) عرف أزمنة النجاح T_k كعملية عشوائية موضحا العلاقة بينها وبين العملية العشوائية $\{Y_n; n \geq 0\}$ ثم اذكر فقط توزيع المتغير العشوائي T_k .
(ب) - في عملية بواسون العشوائية $\{N_t; t \geq 0\}$ بالمعدل $\lambda = 4$ احسب كل من الإحتمالات الآتية :
 $P(N_{1.5} = 2, N_4 = 5, N_{6.8} = 9)$ ، $P(N_3 = 5, N_7 = 9)$

٥- (أ) في عملية بواسون أو عملية الوصول المعودة $\{N_t; t \geq 0\}$ بالمعدل λ إثبت أن الإحتمال المشروط لعدد الوصول N_t بالنسبة إلى عدد الوصول N_{t+s} لكل $t > 0, s > 0$ يمثل توزيع ذي الحدين .
(ب) عرف العمليات العشوائية المستقلة ثم اثبت أن أي عمليتين مستقلتين لبواسون هو أيضا عملية بواسون .

٦- (أ) في عملية التجديد العشوائية $R = \{R_n; n \in N\}$ حيث N هي فئة الأعداد الصحيحة غير السالبة عرف دالة التجديد ثم عبر عنها من خلال توزيع المتغير R_n مع الإستنتاج .

(ب) في سلسلة ماركوف العشوائية المتقطعة $\{X_n; n \geq 0\}$ عرف مصفوفة الإحتمالات الإنتقالية بصفاتها المعروفة ثم احسب الإحتمال : $P(X_0 = 1, X_1 = 1, X_2 = 0, X_3 = 1, X_4 = 0, X_6 = 0)$ بفرض أن حالات الفراغ $(0, 1)$ والمصفوفة العشوائية

$$P = \begin{pmatrix} 1/2 & 1/2 \\ 1/3 & 2/3 \end{pmatrix} , \text{ ومنتجه الإحتمالات الابتدائية } \pi_0 = (2/5 \quad 3/5)$$

	المقرر: تحليل عددي (٣٢٣) الفرقة: المستوى الثالث الدرجة: ٥٠ درجة التاريخ: ٢٠١٨/٥/٢٩ الزمن: ثلاث ساعات	جامعة أسيوط كلية العلوم - قسم الرياضيات امتحان نهائي الفصل الدراسي الثاني للعام الجامعي ٢٠١٧/٢٠١٨
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Answer five questions only :- (10 marks for every question)

1-a) If the function $g \in C[a, b]$ and $g(x) \in [a, b] \forall x \in [a, b]$ and $g'(x)$ exist with $|g'(x)| \leq k < 1 \forall x \in [a, b]$ prove that the sequence defined by $P_n = g(P_{n-1}), n \geq 1$ will converge to the unique fixed point P and also $|P_{n+1} - P_n| \leq k^n |P_1 - P_0|$.

1-b) Verify that when Newton's method is used to compute $\sqrt{A}, A > 0$ (By solving the equation : $f(x) = x^2 - A$). The sequence of iterates is defined by : $x_{n+1} = (x_n + \frac{A}{x_n})/2$, and show that if the sequence $\{x_n\}$ is defined as the previous problem, then this method is quadratically convergence.

2-a) Derive Lagrange interpolation formula of degree n and write the error of the method.

2-b) For the given function $f(x) = \cos \pi x$ let $x_0 = -1, x_1 = 0, x_2 = 1$ construct the suitable interpolation polynomial and find the actual error.

3) Derive the formula of the Newton's interpolatory divided difference method and use this formula to obtain a polynomial of least degree that fits the values shown:

x	0	1	2	4	6
$f(x)$	1	9	23	93	259

من فضلك انظر خلف الورقة

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لجنة الممتحنين :- أ. د/ نجاه عبد الرحمن حسين ، أ. د/ فاروق علي السيد



الامتحان النهائي للفصل الدراسي الثاني للعام الجامعي ٢٠١٧/٢٠١٨ م
 للفرقة : الثالثة : الشعبة : الرياضيات التاريخ : ٢٠١٨/٥/٢٤ م

الزمن : ساعتان

الدرجة الكلية : ٥٠ درجة

أسم المقرر : الطرق الرياضية
 رقم المقرر ورمزه : ٣٣٤ ر

درجة كل سؤال : ١٧ درجة

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Prof. Rashwan A. Rashwan,

Dr. Ahmed A. Abdelhakim



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(Q3) (i) Show that $f : D \subset \mathbb{R} \rightarrow \mathbb{R}$ is continuous at $x_0 \in D$ if and only if the sequence $(f(x_n))_{n \geq 1}$ converges to $f(x_0)$ whenever $(x_n)_{n \geq 1}$ is a sequence in D that converges to x_0 . [6 marks]

(ii) Use the characterization given in (i) to prove the discontinuity at the origin of the function $f(x) = \begin{cases} \cos \frac{1}{x}, & x \neq 0; \\ 0, & x = 0. \end{cases}$ [4 marks]

(Q4) (i) Assume that D is a closed bounded subset of $\mathbb{R}$. Prove that if $f : D \rightarrow \mathbb{R}$ is continuous then f is bounded on D , and there exist $\alpha, \beta \in D$ such that $f(\alpha) = \max_{x \in D} f(x)$ and $f(\beta) = \min_{x \in D} f(x)$. [5 marks]

(ii) Argue by contradiction to demonstrate that if $f : [a, b] \rightarrow \mathbb{R}$ is continuous then it is uniformly continuous on $[a, b]$. [5 marks]

Please Turn over the page

Question 3: (10 marks)

1. What are the difference between Data View, Variable View and Output View in SPSS?
2. Some significance tests are very restrictive about the form of data they can accept. What are the different types of measurement?
3. Describe how to test the degree of association between variables by SPSS.
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Q2.

- a. Maintain two different Algorithm of crossover process with mention the probability of crossover (5 marks)
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b. Using genetic algorithm to find the maximum value of the function $(15x - x^2)$ where parameter x varies between 0 and 15. For simplicity, we may assume that x takes only integer values. Using the genetic algorithm procedure in one step and begin with four solutions in initial solutions. (10 marks)

Q4. Discuss the internal structure of Taxi driver Robot. (7 marks)

Q5. Discuss the Tabu search method and maintain the type of memory using in this method and maintain the Tabu search algorithm. (10 marks)

==best wishes==

Dr. Alaa F. Mohamed

Answer the following questions: (50 Marks)

Question 1: Answer the following points (10 Marks)

- 1- Explain the internet "nuts and bolts"?
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جامعة أسيوط	مايو 2018	كود المقرر: 356 رك
كلية العلوم		المقرر : مقدمة فى الحسابات العلمية
قسم الرياضيات		الزمن : ساعتان

Answer the following questions by using MATLAB language: (50 marks)

1- Using Newton's forward difference formula, find $y(0.1)$ using the table below:

x	0.0	0.2	0.4	0.6	0.8
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Write an M-function to describe the equation, and draw the phase trajectory for the parameters $\alpha = 9$, $\beta = 100/7$, $\gamma = 0$, $a = -8/7$, $b = -5/7$, and initial conditions

$$x(0) = -2.121304, \quad y(0) = -0.066170, \quad z(0) = 2.881090.$$

Good Luck

Dr. Tarek Aboelenen



امتحان الفرقة الثالثة شعبة الرياضيات

الزمن : ثلاث ساعات

رقم المقرر ورمزه : ١٣٤٦

المقرر : عمليات عشوائية وتطبيقاتها

أجب عن خمسة أسئلة فقط مما يأتي :- درجة جزء كل سؤال (خمس درجات)

١- (أ) لمجموعة المتغيرات العشوائية المستقلة $X_1, X_2, X_3, \dots$ بفرض أن التوقع الرياضي $E(X_i) = m$ والتباين $V(X_i)$ لكل منها محدود عرف كل من التقارب عن طريق الإحتمال وقانون الأعداد الكبرى (الضعيف).
(ب) بفرض أن $f f s s f s f f s s s f f s f f s$ هي إحدى النتائج الممكنة في محاولات برنولي العشوائية المستقلة بحيث أن $P(s) = p, P(f) = q, p + q = 1$ عرف عملية عشوائية في الفراغ R^2 موضحا ذلك بيانيا .

٢- (أ) في عملية برنولي العشوائية $\{X_n; n > 0\}$ بالإحتمال $p = 0.6$ إذا كان $X = X_1 + X_2$ ، $Y = X_1 + X_3$ احسب الإحتمالات الآتية : $P(X < 2, Y \leq 1)$ ، $P(2X < 3Y)$ ، $P(Y = X)$.
(ب) في السؤال (٢-أ) أوجد العزم الارتباطي بين X ، Y موضحا العلاقة بينهما .

٣- (أ) وضح العلاقة بين عملية برنولي العشوائية $\{X_n; n > 0\}$ و العملية العشوائية $\{Y_n; n \geq 0\}$ حيث أن المتغير Y_n يخضع لتوزيع ذي الحدين واذكر صفات كل منهما ثم عبر مع الاستنتاج عن إحتمال الحادث $(Y_{n+1} = k)$ من خلال إحتمالات الحوادث : $(Y_n = k)$ ، $(Y_n = k - 1)$ لأي عدد صحيح $k > 0$.
(ب) في العملية العشوائية $\{Y_n; n \geq 0\}$ أوجد كل من $E(Y_5)$ ، $E(Y_4^2)$ ، $P(Y_5 = 3, Y_7 = 4, Y_{14} = 9)$.

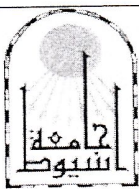
٤- (أ) عرف أزمنة النجاح T_k كعملية عشوائية موضحا العلاقة بينها وبين العملية العشوائية $\{Y_n; n \geq 0\}$ ثم اذكر فقط توزيع المتغير العشوائي T_k .
(ب) - في عملية بواسون العشوائية $\{N_t; t \geq 0\}$ بالمعدل $\lambda = 4$ احسب كل من الإحتمالات الآتية :
 $P(N_{1.5} = 2, N_4 = 5, N_{6.8} = 9)$ ، $P(N_3 = 5, N_7 = 9)$

٥- (أ) في عملية بواسون أو عملية الوصول المعودة $\{N_t; t \geq 0\}$ بالمعدل λ إثبت أن الإحتمال المشروط لعدد الوصول N_t بالنسبة إلى عدد الوصول N_{t+s} لكل $t > 0, s > 0$ يمثل توزيع ذي الحدين.
(ب) عرف العمليات العشوائية المستقلة ثم اثبت أن أي عمليتين مستقلتين لبواسون هو أيضا عملية بواسون .

٦- (أ) في عملية التجديد العشوائية $R = \{R_n; n \in N\}$ حيث N هي فئة الأعداد الصحيحة غير السالبة عرف دالة التجديد ثم عبر عنها من خلال توزيع المتغير R_n مع الاستنتاج .

(ب) في سلسلة ماركوف العشوائية المتقطعة $\{X_n; n \geq 0\}$ عرف مصفوفة الإحتمالات الإنتقالية بصفاتها المعروفة ثم احسب الإحتمال : $P(X_0 = 1, X_1 = 1, X_2 = 0, X_3 = 1, X_4 = 0, X_6 = 0)$ بفرض أن حالات الفراغ $(0, 1)$ والمصفوفة العشوائية

$$P = \begin{pmatrix} 1/2 & 1/2 \\ 1/3 & 2/3 \end{pmatrix} , \text{ ومنتجه الإحتمالات الابتدائية } \pi_0 = (2/5 \quad 3/5)$$

	المقرر: تحليل عددي (٣٢٣) الفرقة: المستوى الثالث الدرجة: ٥٠ درجة التاريخ: ٢٠١٨/٥/٢٩ الزمن: ثلاث ساعات	جامعة أسيوط كلية العلوم - قسم الرياضيات امتحان نهائي الفصل الدراسي الثاني للعام الجامعي ٢٠١٧/٢٠١٨
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Answer five questions only :- (10 marks for every question)

1-a) If the function $g \in C[a, b]$ and $g(x) \in [a, b] \forall x \in [a, b]$ and $g'(x)$ exist with $|g'(x)| \leq k < 1 \forall x \in [a, b]$ prove that the sequence defined by $P_n = g(P_{n-1}), n \geq 1$ will converge to the unique fixed point P and also $|P_{n+1} - P_n| \leq k^n |P_1 - P_0|$.

1-b) Verify that when Newton's method is used to compute $\sqrt{A}, A > 0$ (By solving the equation : $f(x) = x^2 - A$). The sequence of iterates is defined by : $x_{n+1} = (x_n + \frac{A}{x_n})/2$, and show that if the sequence $\{x_n\}$ is defined as the previous problem, then this method is quadratically convergence.

2-a) Derive Lagrange interpolation formula of degree n and write the error of the method.

2-b) For the given function $f(x) = \cos \pi x$ let $x_0 = -1, x_1 = 0, x_2 = 1$ construct the suitable interpolation polynomial and find the actual error.

3) Derive the formula of the Newton's interpolatory divided difference method and use this formula to obtain a polynomial of least degree that fits the values shown:

x	0	1	2	4	6
$f(x)$	1	9	23	93	259

من فضلك انظر خلف الورقة

السؤال الرابع :-

أ) يعرف الطي للدالتين $f(x)$, $g(x)$ كالآتي

$$f * g = \int_{-\infty}^{\infty} f(u) g(x-u) du$$

برهن علي أن تحويل فوريير للطرف الأيمن هو حاصل ضرب تحويل فوريير للدالتين $f(x)$, $g(x)$

ب) أوجد تحويل فوريير للدالة $f(x) = \begin{cases} 1 & |x| < a \\ 0 & |x| > a \end{cases}$ وأرسم $f(x)$ كذلك تحويلها عند $a = 3$ وأوجد

$$\int_{-\infty}^{\infty} \frac{\sin u}{u} du \quad \text{كذلك} \quad \int_{-\infty}^{\infty} \frac{\sin \alpha a \cos \alpha x}{\alpha} d\alpha$$

ج) ترك خيط لانهائي من السكون وكانت أزاحته الابتدائية عن محور x هي $f(x)$ أوجد الإزاحه عند أي زمن .

انتهت الأسئلة مع تمنياتنا بالتوفيق ،،،،

لجنة الممتحنين :- أ.د/ نجاه عبد الرحمن حسين ، أ.د/ فاروق علي السيد



الامتحان النهائي للفصل الدراسي الثاني للعام الجامعي ٢٠١٧/٢٠١٨ م
 للفرقة : الثالثة
 الشعبة : الرياضيات
 التاريخ : ٢٠١٨/٥/٢٤ م

الزمن : ساعتان

الدرجة الكلية : ٥٠ درجة

درجة كل سؤال : ١٧ درجة

أسم المقرر : الطرق الرياضية
 رقم المقرر ورمزه : ٣٣٤ ر

أجب عن ثلاثة أسئلة فقط مما يأتي :-

السؤال الأول :-

أوجد تحويل لابلاس للمشتقة التفاضلية للدالة $F(t)$ عند نقط الاتصال والانفصال للدالة .

أبرهن علي أن

$$\lim_{t \rightarrow 0} F(t) = \lim_{s \rightarrow \infty} s f(s)$$

$$\lim_{t \rightarrow \infty} F(t) = \lim_{s \rightarrow 0} s f(s)$$

$$\Gamma\left(\frac{1}{2}\right) = \sqrt{\pi}, \quad \int_0^{\infty} \delta(t) dt = 1, \quad L \sin \sqrt{t} = \frac{\sqrt{\pi}}{3} e^{-\frac{1}{4s}} s^{\frac{3}{2}}$$

السؤال الثاني :-

حل المعادلات الآتية :

$$t Y''(t) + Y'(t) + 4t Y(t) = 0, \quad y(0) = 3, y'(0) = 0$$

$$\frac{\partial U}{\partial x} = 2 \frac{\partial U}{\partial t} + U, \quad x > 0, t > 0 \quad U(x, 0) = 6 e^{-3x}$$

$$\int_0^t Y(u) Y(t-u) du = 16 \sin 4t$$

السؤال الثالث :-

(أ) فك الدالة $f(x) = x^2$, $0 < x < 2\pi$ بدلالة متسلسلة فوريير ثم أحسب المجموع

$$1 + \frac{1}{2^2} + \frac{1}{3^2} + \frac{1}{4^2} + \dots$$

(ب) صفيحة علي شكل دائري نصف قطرها الوحدة ووجهيها معزولين ونصف محيطها محفوظ عند درجة حرارة u_1

والآخر عند u_2 أوجد حالة الأتزان الحراري .

من فضلك أنظر بقية الأسئلة خلف الورقة ،،،،،



Answer the following questions (50 marks)

Q1.	Complete the following: (1)..... is a representation of a two-dimensional image as a finite set of digital values, called picture elements or pixels - Common image formats include.....(2).... ,(3)..... ,(4)..... (5)..... creates a Distance tool a draggable, resizable line that measures the distance between its endpoints. (6)..... These are the result of objects that are self-luminous, such as stars and light bulbs. (7).....the resulting output pixel is computed as a sum of products of the pixel values and mask coefficients in the pixel's neighborhood in the original image. - The Sobel operators used to compute edges are(8)..... ,(9)..... - Edge detector should have:(10)..... ,(11)..... - Types of noise are(12)..... ,(13)....	(13 marks)
Q2.	a) Compute Z from the following matlab script (6 marks) <pre> x = [150 10 90;80 50 60;121 160 20] y = [-1 0 1;-2 0 2;-1 0 1] z = imfilter(x,y,'corr') </pre> b) What is the Delta compression and compute the compressed data of the data (6 marks) 220 321 335 211 250 200 233 214 232 212	(12 marks)
Q3.	a) Write the MATLAB code used to: (4 marks) - Read any image then use affine transformation matrix for each of the operations below: - Flip the image right to left - Translation by [25, 15] pixels b) What are the main differences between: (8 marks) - Global thresholding and optimal thresholding. - Raster and vector image . - Interpixel redundancy and Psychovisual redundancy	(12 marks)

(Q5) (i) Assume that U, V are open intervals and let $f : U \rightarrow \mathbb{R}$ and $g : V \rightarrow \mathbb{R}$ be two differentiable functions such that $f(U) \subset V$. Prove that $g \circ f$ is differentiable on U and that $(g \circ f)' = (g' \circ f) \cdot f'$ [5 marks]

(ii) Prove that the function $f(x) := \frac{1}{x}$ is differentiable on $]0, \infty[$ but not uniformly continuous therein. [5 marks]

(Q6) (i) State and prove Rolle's theorem then use it to prove the mean value theorem. [6 marks]

(ii) Let I be an open interval. Apply the mean value theorem to prove that a function differentiable on I is

1. increasing if and only if $f' \geq 0$ on I ,

2. decreasing if and only if $f' \leq 0$ on I .

[4 marks]

With the best of luck,

Prof. Rashwan A. Rashwan,

Dr. Ahmed A. Abdelhakim



Time: 3 hours

Total mark: 50

Answer *only five* of the following questions:

(Q1) (i) Suppose that O_i , $i \geq 1$, are open subsets of $\mathbb{R}$. Prove that $\cup_{i \geq 1} O_i$ is also open in $\mathbb{R}$. [5 marks]

(ii) Let $S \subset \mathbb{R}$. Show that S is closed if and only if S contains the limit point of every convergent sequence of elements of S . [5 marks]

(Q2) (i) Prove that a sequence of real numbers converges if and only if it is a Cauchy sequence. [6 marks]

(ii) Show that if $(x_n)_{n \geq 1} \subset \mathbb{R}$ is a monotonically increasing sequence that is bounded above, then $x_n \rightarrow \sup_{n \geq 1} x_n$, as $n \rightarrow \infty$. [4 marks]

(Q3) (i) Show that $f : D \subset \mathbb{R} \rightarrow \mathbb{R}$ is continuous at $x_0 \in D$ if and only if the sequence $(f(x_n))_{n \geq 1}$ converges to $f(x_0)$ whenever $(x_n)_{n \geq 1}$ is a sequence in D that converges to x_0 . [6 marks]

(ii) Use the characterization given in (i) to prove the discontinuity at the origin of the function $f(x) = \begin{cases} \cos \frac{1}{x}, & x \neq 0; \\ 0, & x = 0. \end{cases}$ [4 marks]

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(ii) Argue by contradiction to demonstrate that if $f : [a, b] \rightarrow \mathbb{R}$ is continuous then it is uniformly continuous on $[a, b]$. [5 marks]

Please Turn over the page

Question 2: (10 marks)

	A	B	C	D	E	F	G
1		MT1	MT2	Final	Total	Honors	Passed
2	Possible points	100	100	200	400		320
3							
4	Blue	79	89	169	337	FALSE	TRUE
5	Jones	85	65	195	345	FALSE	TRUE
6	Grey	60	97	187	344	TRUE	TRUE
7	Mary	10	30	50	90	TRUE	FALSE
8							

Write the following Boolean functions

1. Blue's total and Jones' total are greater than Grey's:
2. Grey's total is not the maximum grade:
3. None of the students passed the course
4. Blue is not an Honors student
5. Blue didn't get a passing grade (320)

Question 3: (10 marks)

1. What are the difference between Data View, Variable View and Output View in SPSS?
2. Some significance tests are very restrictive about the form of data they can accept. What are the different types of measurement?
3. Describe how to test the degree of association between variables by SPSS.
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b. Using genetic algorithm to find the maximum value of the function $(15x - x^2)$ where parameter x varies between 0 and 15. For simplicity, we may assume that x takes only integer values. Using the genetic algorithm procedure in one step and begin with four solutions in initial solutions. (10 marks)

Q4. Discuss the internal structure of Taxi driver Robot. (7 marks)

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==best wishes==

Dr. Alaa F. Mohamed

Answer the following questions: (50 Marks)

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جامعة أسيوط	مايو 2018	كود المقرر: 356 رك
كلية العلوم		المقرر : مقدمة فى الحسابات العلمية
قسم الرياضيات		الزمن : ساعتان

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Good Luck

Dr. Tarek Aboelenen



امتحان الفرقة الثالثة شعبة الرياضيات

الزمن : ثلاث ساعات

رقم المقرر ورمزه : ١٣٤٦

المقرر : عمليات عشوائية وتطبيقاتها

أجب عن خمسة أسئلة فقط مما يأتي :- درجة جزء كل سؤال (خمس درجات)

١- (أ) لمجموعة المتغيرات العشوائية المستقلة $X_1, X_2, X_3, \dots$ بفرض أن التوقع الرياضي $E(X_i) = m$ والتباين $V(X_i)$ لكل منها محدود عرف كل من التقارب عن طريق الإحتمال وقانون الأعداد الكبرى (الضعيف).
(ب) - بفرض أن $f f s s f s f f s s s f f s f f s$ هي إحدى النتائج الممكنة في محاولات برنولي العشوائية المستقلة بحيث أن $P(s) = p, P(f) = q, p + q = 1$ عرف عملية عشوائية في الفراغ R^2 موضحا ذلك بيانيا .

٢- (أ) في عملية برنولي العشوائية $\{X_n; n > 0\}$ بالإحتمال $p = 0.6$ إذا كان $X = X_1 + X_2$ ، $Y = X_1 + X_3$ احسب الإحتمالات الآتية : $P(X < 2, Y \leq 1)$ ، $P(2X < 3Y)$ ، $P(Y = X)$.
(ب) في السؤال (٢-أ) أوجد العزم الارتباطي بين X ، Y موضحا العلاقة بينهما .

٣- (أ) وضح العلاقة بين عملية برنولي العشوائية $\{X_n; n > 0\}$ و العملية العشوائية $\{Y_n; n \geq 0\}$ حيث أن المتغير Y_n يخضع لتوزيع ذي الحدين واذكر صفات كل منهما ثم عبر مع الإستنتاج عن إحتمال الحادث $(Y_{n+1} = k)$ من خلال إحتمالات الحوادث : $(Y_n = k)$ ، $(Y_n = k - 1)$ لأي عدد صحيح $k > 0$.
(ب) - في العملية العشوائية $\{Y_n; n \geq 0\}$ أوجد كل من $E(Y_5)$ ، $E(Y_4^2)$ ، $P(Y_5 = 3, Y_7 = 4, Y_{14} = 9)$.

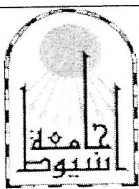
٤- (أ) عرف أزمنة النجاح T_k كعملية عشوائية موضحا العلاقة بينها وبين العملية العشوائية $\{Y_n; n \geq 0\}$ ثم اذكر فقط توزيع المتغير العشوائي T_k .
(ب) - في عملية بواسون العشوائية $\{N_t; t \geq 0\}$ بالمعدل $\lambda = 4$ احسب كل من الإحتمالات الآتية :
 $P(N_{1.5} = 2, N_4 = 5, N_{6.8} = 9)$ ، $P(N_3 = 5, N_7 = 9)$

٥- (أ) في عملية بواسون أو عملية الوصول المعودة $\{N_t; t \geq 0\}$ بالمعدل λ إثبت أن الإحتمال المشروط لعدد الوصول N_t بالنسبة إلى عدد الوصول N_{t+s} لكل $t > 0, s > 0$ يمثل توزيع ذي الحدين .
(ب) - عرف العمليات العشوائية المستقلة ثم اثبت أن أي عمليتين مستقلتين لبواسون هو أيضا عملية بواسون .

٦- (أ) في عملية التجديد العشوائية $R = \{R_n; n \in N\}$ حيث N هي فئة الأعداد الصحيحة غير السالبة عرف دالة التجديد ثم عبر عنها من خلال توزيع المتغير R_n مع الإستنتاج .

(ب) في سلسلة ماركوف العشوائية المتقطعة $\{X_n; n \geq 0\}$ عرف مصفوفة الإحتمالات الإنتقالية بصفاتها المعروفة ثم احسب الإحتمال : $P(X_0 = 1, X_1 = 1, X_2 = 0, X_3 = 1, X_4 = 0, X_6 = 0)$ بفرض أن حالات الفراغ $(0, 1)$ والمصفوفة العشوائية

$$P = \begin{pmatrix} 1/2 & 1/2 \\ 1/3 & 2/3 \end{pmatrix} , \text{ ومنتجه الإحتمالات الابتدائية } \pi_0 = (2/5 \quad 3/5)$$

	المقرر: تحليل عددي (٣٢٣) الفرقة: المستوى الثالث الدرجة: ٥٠ درجة التاريخ: ٢٠١٨/٥/٢٩ الزمن: ثلاث ساعات	جامعة أسيوط كلية العلوم - قسم الرياضيات امتحان نهائي الفصل الدراسي الثاني للعام الجامعي ٢٠١٧/٢٠١٨
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Answer five questions only :- (10 marks for every question)

1-a) If the function $g \in C[a, b]$ and $g(x) \in [a, b] \forall x \in [a, b]$ and $g'(x)$ exist with $|g'(x)| \leq k < 1 \forall x \in [a, b]$ prove that the sequence defined by $P_n = g(P_{n-1}), n \geq 1$ will converge to the unique fixed point P and also $|P_{n+1} - P_n| \leq k^n |P_1 - P_0|$.

1-b) Verify that when Newton's method is used to compute $\sqrt{A}, A > 0$ (By solving the equation : $f(x) = x^2 - A$). The sequence of iterates is defined by : $x_{n+1} = (x_n + \frac{A}{x_n})/2$, and show that if the sequence $\{x_n\}$ is defined as the previous problem, then this method is quadratically convergence.

2-a) Derive Lagrange interpolation formula of degree n and write the error of the method.

2-b) For the given function $f(x) = \cos \pi x$ let $x_0 = -1, x_1 = 0, x_2 = 1$ construct the suitable interpolation polynomial and find the actual error.

3) Derive the formula of the Newton's interpolatory divided difference method and use this formula to obtain a polynomial of least degree that fits the values shown:

x	0	1	2	4	6
$f(x)$	1	9	23	93	259

من فضلك انظر خلف الورقة

السؤال الرابع :-

أ) يعرف الطي للدالتين $f(x)$, $g(x)$ كالآتي

$$f * g = \int_{-\infty}^{\infty} f(u) g(x-u) du$$

برهن علي أن تحويل فوريير للطرف الأيمن هو حاصل ضرب تحويلي فوريير للدالتين $f(x)$, $g(x)$

ب) أوجد تحويل فوريير للدالة $f(x) = \begin{cases} 1 & |x| < a \\ 0 & |x| > a \end{cases}$ وأرسم $f(x)$ كذلك تحويلها عند $a = 3$ وأوجد

$$\int_{-\infty}^{\infty} \frac{\sin u}{u} du \quad \text{كذلك} \quad \int_{-\infty}^{\infty} \frac{\sin \alpha a \cos \alpha x}{\alpha} d\alpha$$

ج) ترك خيط لانهائي من السكون وكانت أزاحته الابتدائية عن محور x هي $f(x)$ أوجد الإزاحه عند أي زمن .

انتهت الأسئلة مع تمنياتنا بالتوفيق ،،،،

لجنة الممتحنين :- أ.د/ نجاه عبد الرحمن حسين ، أ.د/ فاروق علي السيد



الامتحان النهائي للفصل الدراسي الثاني للعام الجامعي ٢٠١٧/٢٠١٨ م
 للفرقة : الثالثة شعبة : الرياضيات التاريخ : ٢٠١٨/٥/٢٤ م

الزمن : ساعتان

الدرجة الكلية : ٥٠ درجة

أسم المقرر : الطرق الرياضية
 رقم المقرر ورمزه : ٣٣٤ ر

درجة كل سؤال : ١٧ درجة

أجب عن ثلاثة أسئلة فقط مما يأتي :-

السؤال الأول :-

أوجد تحويل لابلاس للمشتقة التفاضلية للدالة $F(t)$ عند نقط الاتصال والانفصال للدالة .

أبرهن علي أن

$$\lim_{t \rightarrow 0} F(t) = \lim_{s \rightarrow \infty} s f(s)$$

$$\lim_{t \rightarrow \infty} F(t) = \lim_{s \rightarrow 0} s f(s)$$

$$\Gamma\left(\frac{1}{2}\right) = \sqrt{\pi}, \quad \int_0^{\infty} \delta(t) dt = 1, \quad L \sin \sqrt{t} = \frac{\sqrt{\pi}}{3} e^{-\frac{1}{4s}} s^{\frac{3}{2}}$$

السؤال الثاني :-

حل المعادلات الآتية :

$$t Y''(t) + Y'(t) + 4t Y(t) = 0, \quad y(0) = 3, y'(0) = 0$$

$$\frac{\partial U}{\partial x} = 2 \frac{\partial U}{\partial t} + U, \quad x > 0, t > 0 \quad U(x, 0) = 6 e^{-3x}$$

$$\int_0^t Y(u) Y(t-u) du = 16 \sin 4t$$

السؤال الثالث :-

(أ) فك الدالة $f(x) = x^2$, $0 < x < 2\pi$ بدلالة متسلسلة فوريير ثم أحسب المجموع

$$1 + \frac{1}{2^2} + \frac{1}{3^2} + \frac{1}{4^2} + \dots$$

(ب) صفيحة علي شكل دائري نصف قطرها الوحدة ووجهيها معزولين ونصف محيطها محفوظ عند درجة حرارة u_1

والآخر عند u_2 أوجد حالة الأتزان الحراري .

من فضلك أنظر بقية الأسئلة خلف الورقة ،،،،،



Answer the following questions (50 marks)

Q1.	Complete the following: (1)..... is a representation of a two-dimensional image as a finite set of digital values, called picture elements or pixels - Common image formats include.....(2).... ,(3)..... ,(4)..... (5)..... creates a Distance tool a draggable, resizable line that measures the distance between its endpoints. (6)..... These are the result of objects that are self-luminous, such as stars and light bulbs. (7).....the resulting output pixel is computed as a sum of products of the pixel values and mask coefficients in the pixel's neighborhood in the original image. - The Sobel operators used to compute edges are(8)..... ,(9)..... - Edge detector should have:(10)..... ,(11)..... - Types of noise are(12)..... ,(13)....	(13 marks)
Q2.	a) Compute Z from the following matlab script (6 marks) <pre> x = [150 10 90;80 50 60;121 160 20] y = [-1 0 1;-2 0 2;-1 0 1] z = imfilter(x,y,'corr') </pre> b) What is the Delta compression and compute the compressed data of the data (6 marks) 220 321 335 211 250 200 233 214 232 212	(12 marks)
Q3.	a) Write the MATLAB code used to: (4 marks) - Read any image then use affine transformation matrix for each of the operations below: - Flip the image right to left - Translation by [25, 15] pixels b) What are the main differences between: (8 marks) - Global thresholding and optimal thresholding. - Raster and vector image . - Interpixel redundancy and Psychovisual redundancy	(12 marks)

(Q5) (i) Assume that U, V are open intervals and let $f : U \rightarrow \mathbb{R}$ and $g : V \rightarrow \mathbb{R}$ be two differentiable functions such that $f(U) \subset V$. Prove that $g \circ f$ is differentiable on U and that $(g \circ f)' = (g' \circ f) \cdot f'$ [5 marks]

(ii) Prove that the function $f(x) := \frac{1}{x}$ is differentiable on $]0, \infty[$ but not uniformly continuous therein. [5 marks]

(Q6) (i) State and prove Rolle's theorem then use it to prove the mean value theorem. [6 marks]

(ii) Let I be an open interval. Apply the mean value theorem to prove that a function differentiable on I is

1. increasing if and only if $f' \geq 0$ on I ,

2. decreasing if and only if $f' \leq 0$ on I .

[4 marks]

With the best of luck,

Prof. Rashwan A. Rashwan,

Dr. Ahmed A. Abdelhakim



Time: 3 hours

Total mark: 50

Answer *only five* of the following questions:

(Q1) (i) Suppose that O_i , $i \geq 1$, are open subsets of $\mathbb{R}$. Prove that $\cup_{i \geq 1} O_i$ is also open in $\mathbb{R}$. [5 marks]

(ii) Let $S \subset \mathbb{R}$. Show that S is closed if and only if S contains the limit point of every convergent sequence of elements of S . [5 marks]

(Q2) (i) Prove that a sequence of real numbers converges if and only if it is a Cauchy sequence. [6 marks]

(ii) Show that if $(x_n)_{n \geq 1} \subset \mathbb{R}$ is a monotonically increasing sequence that is bounded above, then $x_n \rightarrow \sup_{n \geq 1} x_n$, as $n \rightarrow \infty$. [4 marks]

(Q3) (i) Show that $f : D \subset \mathbb{R} \rightarrow \mathbb{R}$ is continuous at $x_0 \in D$ if and only if the sequence $(f(x_n))_{n \geq 1}$ converges to $f(x_0)$ whenever $(x_n)_{n \geq 1}$ is a sequence in D that converges to x_0 . [6 marks]

(ii) Use the characterization given in (i) to prove the discontinuity at the origin of the function $f(x) = \begin{cases} \cos \frac{1}{x}, & x \neq 0; \\ 0, & x = 0. \end{cases}$ [4 marks]

(Q4) (i) Assume that D is a closed bounded subset of $\mathbb{R}$. Prove that if $f : D \rightarrow \mathbb{R}$ is continuous then f is bounded on D , and there exist $\alpha, \beta \in D$ such that $f(\alpha) = \max_{x \in D} f(x)$ and $f(\beta) = \min_{x \in D} f(x)$. [5 marks]

(ii) Argue by contradiction to demonstrate that if $f : [a, b] \rightarrow \mathbb{R}$ is continuous then it is uniformly continuous on $[a, b]$. [5 marks]

Please Turn over the page

CS12	CS11	CS10	Description
0	0	0	No clock source (Timer/Counter stopped).
0	0	1	clk _{IO} /1 (No prescaling)
0	1	0	clk _{IO} /8 (From prescaler)
0	1	1	clk _{IO} /64 (From prescaler)
1	0	0	clk _{IO} /256 (From prescaler)
1	0	1	clk _{IO} /1024 (From prescaler)
1	1	0	External clock source on T1 pin. Clock on falling edge.
1	1	1	External clock source on T1 pin. Clock on rising edge.

Timer/Counter1 – TCNT1H and TCNT1L

Bit	7	6	5	4	3	2	1	0	
	TCNT1[15:8]								TCNT1H
	TCNT1[7:0]								TCNT1L
Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

Output Compare Register 1 B – OCR1BH and OCR1BL

Bit	7	6	5	4	3	2	1	0	
	OCR1B[15:8]								OCR1BH
	OCR1B[7:0]								OCR1BL
Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

Input Capture Register 1 – ICR1H and ICR1L

Bit	7	6	5	4	3	2	1	0	
	ICR1[15:8]								ICR1H
	ICR1[7:0]								ICR1L
Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

Timer/Counter Interrupt Mask Register – TIMSK⁽¹⁾

Bit	7	6	5	4	3	2	1	0	
	OCIE2	OCIE1	OCIE1A	OCIE1B	TOIE1	OCIE0	TOIE0		TIMSK
Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

- Bit 5 – OCIE1: Timer/Counter1, Input Capture Interrupt Enable
 Bit 4 – OCIE1A: Timer/Counter1, Output Compare A Match Interrupt Enable
 Bit 3 – OCIE1B: Timer/Counter1, Output Compare B Match Interrupt Enable
 Bit 2 – TOIE1: Timer/Counter1, Overflow Interrupt Enable

Timer/Counter Interrupt Flag Register – TIFR

Bit	7	6	5	4	3	2	1	0	
	OCF2	TOV2	ICF1	OCF1A	OCF1B	TOV1	OCF0	TOV0	TIFR
Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

- Bit 5 – ICF1: Timer/Counter1, Input Capture Flag
 Bit 4 – OCF1A: Timer/Counter1, Output Compare A Match Flag
 Bit 3 – OCF1B: Timer/Counter1, Output Compare B Match Flag
 Bit 2 – TOV1: Timer/Counter1, Overflow Flag

USART

Operating Mode	Equation for Calculating Baud Rate ⁽¹⁾	Equation for Calculating UBRR Value
Asynchronous Normal Mode (U2X = 0)	$BAUD = \frac{f_{osc}}{16(UBRR + 1)}$	$UBRR = \frac{f_{osc}}{16BAUD} - 1$
Asynchronous Double Speed Mode (U2X = 1)	$BAUD = \frac{f_{osc}}{8(UBRR + 1)}$	$UBRR = \frac{f_{osc}}{8BAUD} - 1$
Synchronous Master Mode	$BAUD = \frac{f_{osc}}{2(UBRR + 1)}$	$UBRR = \frac{f_{osc}}{2BAUD} - 1$

USART I/O Data Register – UDR

Bit	7	6	5	4	3	2	1	0	
	RXB[7:0]								UDR (Read)
	TXB[7:0]								UDR (Write)
Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

Timer/Counter
Interrupt Mask
Register – TIMSK

Bit	7	6	5	4	3	2	1	0	
	OCIE2	TOIE2	OCIE1	OCIE1A	OCIE1B	TOIE1	OCIE0	TOIE0	TIMSK
Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

Bit 1 – OCIE0: Timer/Counter0 Output Compare Match Interrupt Enable
Bit 0 – TOIE0: Timer/Counter0 Overflow Interrupt Enable

Timer/Counter
Interrupt Flag Register
– TIFR

Bit	7	6	5	4	3	2	1	0	
	OCF2	TOV2	ICF1	OCF1A	OCF1B	TOV1	OCF0	TOV0	TIFR
Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

Bit 1 – OCF0: Output Compare Flag 0
Bit 0 – TOV0: Timer/Counter0 Overflow Flag

Timer/Counter1
Control Register A –
TCCR1A

Bit	7	6	5	4	3	2	1	0	
	COM1A1	COM1A0	COM1B1	COM1B0	FOC1A	FOC1B	WGM11	WGM10	TCCR1A
Read/Write	R/W	R/W	R/W	R/W	W	W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

Bit 7:6 – COM1A1:0: Compare Output Mode for Compare unit A
Bit 5:4 – COM1B1:0: Compare Output Mode for Compare unit B
Bit 3 – FOC1A: Force Output Compare for Compare unit A
Bit 2 – FOC1B: Force Output Compare for Compare unit B
Bit 1:0 – WGM11:0: Waveform Generation Mode

CS02	CS01	CS00	Description
0	0	0	No clock source (Timer/Counter stopped).
0	0	1	$clk_{IO}/1$ (No prescaling)
0	1	0	$clk_{IO}/8$ (From prescaler)
0	1	1	$clk_{IO}/64$ (From prescaler)
1	0	0	$clk_{IO}/256$ (From prescaler)
1	0	1	$clk_{IO}/1024$ (From prescaler)
1	1	0	External clock source on T0 pin, Clock on falling edge.
1	1	1	External clock source on T0 pin, Clock on rising edge.

COM1A1/COM1B1	COM1A0/COM1B0	Description
0	0	Normal port operation, OC1A/OC1B disconnected.
0	1	Toggle OC1A/OC1B on compare match
1	0	Clear OC1A/OC1B on compare match (Set output to low level)
1	1	Set OC1A/OC1B on compare match (Set output to high level)

Mode	WGM13	WGM12 (CTC1)	WGM11 (PWM11)	WGM10 (PWM10)	Timer/Counter Mode of Operation	TOP	Update of OCR1x	TOV1 Flag Set on
0	0	0	0	0	Normal	0xFFFF	Immediate	MAX
1	0	0	0	1	PWM, Phase Correct, 8-bit	0x00FF	TOP	BOTTOM
2	0	0	1	0	PWM, Phase Correct, 9-bit	0x01FF	TOP	BOTTOM
3	0	0	1	1	PWM, Phase Correct, 10-bit	0x03FF	TOP	BOTTOM
4	0	1	0	0	CTC	OCR1A	Immediate	MAX
5	0	1	0	1	Fast PWM, 8-bit	0x00FF	BOTTOM	TOP
6	0	1	1	0	Fast PWM, 9-bit	0x01FF	BOTTOM	TOP
7	0	1	1	1	Fast PWM, 10-bit	0x03FF	BOTTOM	TOP
8	1	0	0	0	PWM, Phase and Frequency Correct	ICR1	BOTTOM	BOTTOM
9	1	0	0	1	PWM, Phase and Frequency Correct	OCR1A	BOTTOM	BOTTOM
10	1	0	1	0	PWM, Phase Correct	ICR1	TOP	BOTTOM
11	1	0	1	1	PWM, Phase Correct	OCR1A	TOP	BOTTOM
12	1	1	0	0	CTC	ICR1	Immediate	MAX
13	1	1	0	1	Reserved	–	–	–
14	1	1	1	0	Fast PWM	ICR1	BOTTOM	TOP
15	1	1	1	1	Fast PWM	OCR1A	BOTTOM	TOP

Timer/Counter1
Control Register B –
TCCR1B

Bit	7	6	5	4	3	2	1	0	
	ICNC1	ICES1	–	WGM13	WGM12	CS12	CS11	CS10	TCCR1B
Read/Write	R/W	R/W	R	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

Bit 7 – ICNC1: Input Capture Noise Canceler
Bit 6 – ICES1: Input Capture Edge Select
Bit 5 – Reserved Bit
Bit 4:3 – WGM13:2: Waveform Generation Mode
Bit 2:0 – CS12:0: Clock Select

CS12	CS11	CS10	Description
0	0	0	No clock source (Timer/Counter stopped).
0	0	1	$clk_{IO}/1$ (No prescaling)
0	1	0	$clk_{IO}/8$ (From prescaler)
0	1	1	$clk_{IO}/64$ (From prescaler)
1	0	0	$clk_{IO}/256$ (From prescaler)
1	0	1	$clk_{IO}/1024$ (From prescaler)
1	1	0	External clock source on T1 pin. Clock on falling edge.
1	1	1	External clock source on T1 pin. Clock on rising edge.

Timer/Counter1 – TCNT1H and TCNT1L

Bit	7	6	5	4	3	2	1	0	
	TCNT1[15:8]								TCNT1H
	TCNT1[7:0]								TCNT1L
Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

Output Compare Register 1 B – OCR1BH and OCR1BL

Bit	7	6	5	4	3	2	1	0	
	OCR1B[15:8]								OCR1BH
	OCR1B[7:0]								OCR1BL
Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

Input Capture Register 1 – ICR1H and ICR1L

Bit	7	6	5	4	3	2	1	0	
	ICR1[15:8]								ICR1H
	ICR1[7:0]								ICR1L
Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

Timer/Counter Interrupt Mask Register – TIMSK⁽¹⁾

Bit	7	6	5	4	3	2	1	0	
	OCIE2	TOIE2	TICIE1	OCIE1A	OCIE1B	TOIE1	OCIE0	TOIE0	TIMSK
Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

- Bit 5 – TICIE1: Timer/Counter1, Input Capture Interrupt Enable
 Bit 4 – OCIE1A: Timer/Counter1, Output Compare A Match Interrupt Enable
 Bit 3 – OCIE1B: Timer/Counter1, Output Compare B Match Interrupt Enable
 Bit 2 – TOIE1: Timer/Counter1, Overflow Interrupt Enable

Timer/Counter Interrupt Flag Register – TIFR

Bit	7	6	5	4	3	2	1	0	
	OCF2	TOV2	ICF1	OCF1A	OCF1B	TOV1	OCF0	TOV0	TIFR
Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

- Bit 5 – ICF1: Timer/Counter1, Input Capture Flag
 Bit 4 – OCF1A: Timer/Counter1, Output Compare A Match Flag
 Bit 3 – OCF1B: Timer/Counter1, Output Compare B Match Flag
 Bit 2 – TOV1: Timer/Counter1, Overflow Flag

USART

Operating Mode	Equation for Calculating Baud Rate ⁽¹⁾	Equation for Calculating UBRR Value
Asynchronous Normal Mode (U2X = 0)	$BAUD = \frac{f_{osc}}{16(UBRR + 1)}$	$UBRR = \frac{f_{osc}}{16BAUD} - 1$
Asynchronous Double Speed Mode (U2X = 1)	$BAUD = \frac{f_{osc}}{8(UBRR + 1)}$	$UBRR = \frac{f_{osc}}{8BAUD} - 1$
Synchronous Master Mode	$BAUD = \frac{f_{osc}}{2(UBRR + 1)}$	$UBRR = \frac{f_{osc}}{2BAUD} - 1$

USART I/O Data Register – UDR

Bit	7	6	5	4	3	2	1	0	
	RXB[7:0]								UDR (Read)
	TXB[7:0]								UDR (Write)
Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

USART Control and Status Register A – UCSRA

Bit	7	6	5	4	3	2	1	0	
	RXC	TXC	UDRE	FE	DOR	PE	U2X	MPCM	UCSRA
Read/Write	R	R/W	R	R	R	R	R/W	R/W	
Initial Value	0	0	1	0	0	0	0	0	

- Bit 7 – RXC: USART Receive Complete
- Bit 6 – TXC: USART Transmit Complete
- Bit 5 – UDRE: USART Data Register Empty
- Bit 4 – FE: Frame Error
- Bit 3 – DOR: Data OverRun
- Bit 2 – PE: Parity Error
- Bit 1 – U2X: Double the USART Transmission Speed
- Bit 0 – MPCM: Multi-processor Communication Mode

USART Control and Status Register B – UCSRB

Bit	7	6	5	4	3	2	1	0	
	RXCIE	TXCIE	UDRIE	RXEN	TXEN	UCSZ2	RXB8	TXB8	UCSRB
Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R	R/W	
Initial Value	0	0	0	0	0	0	0	0	

- Bit 7 – RXCIE: RX Complete Interrupt Enable
- Bit 6 – TXCIE: TX Complete Interrupt Enable
- Bit 5 – UDRIE: USART Data Register Empty Interrupt Enable
- Bit 4 – RXEN: Receiver Enable
- Bit 3 – TXEN: Transmitter Enable
- Bit 2 – UCSZ2: Character Size
- Bit 1 – RXB8: Receive Data Bit 8
- Bit 0 – TXB8: Transmit Data Bit 8

USART Control and Status Register C – UCSRC

Bit	7	6	5	4	3	2	1	0	
	URSEL	UMSEL	UPM1	UPM0	USBS	UCSZ1	UCSZ0	UCPOL	UCSRC
Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	
Initial Value	1	0	0	0	0	1	1	0	

- Bit 7 – URSEL: Register Select
- Bit 6 – UMSEL: USART Mode Select
- Bit 5:4 – UPM1:0: Parity Mode
- Bit 3 – USBS: Stop Bit Select
- Bit 2:1 – UCSZ1:0: Character Size
- Bit 0 – UCPOL: Clock Polarity

UMSEL	Mode
0	Asynchronous Operation
1	Synchronous Operation

USBS	Stop Bit(s)
0	1-bit
1	2-bit

UPM1	UPM0	Parity Mode
0	0	Disabled
0	1	Reserved
1	0	Enabled, Even Parity
1	1	Enabled, Odd Parity

UCPOL	Transmitted Data Changed (Output of Tx D Pin)	Received Data Sampled (Input on Rx D Pin)
0	Rising XCK Edge	Falling XCK Edge
1	Falling XCK Edge	Rising XCK Edge

Table 66. UCSZ Bits Settings

UCSZ2	UCSZ1	UCSZ0	Character Size
0	0	0	5-bit
0	0	1	6-bit
0	1	0	7-bit
0	1	1	8-bit
1	0	0	Reserved
1	0	1	Reserved
1	1	0	Reserved
1	1	1	9-bit

USART Baud Rate Registers – UBRRL and UBRRH

Bit	15	14	13	12	11	10	9	8	
	URSEL	-	-	-	-	UBRR[11:9]	-	-	UBRRH
	-	-	-	-	-	UBRR[7:0]	-	-	UBRRL
Read/Write	R/W	R	R	R	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	



Operation Research326 R

11-5-2018

Third Level: Computer Science Section

Time: 3 hours

Total Degree (50 marks)

Science Faculty

Mathematical Department

Answer the following Questions:

1-Use the Simplex method to solve the following linear programming

Maximize $Z = 10x_1 + 11x_2$

Subject to $x_1 + 2x_2 \leq 150$, $3x_1 + 4x_2 \leq 200$, $6x_1 + x_2 \leq 175$

and $x_1, x_2 \geq 0$

(10 marks)

2) Use the graphical and the algebraic method to solve the problem

Max $f(\underline{x}) = 5x_1 + 7x_2$ Subject to $5x_1 + 8x_2 \leq 24$, $x_1 + x_2 \leq 4$,

$10x_1 + 7x_2 \leq 35$ and $x_1, x_2 \geq 0$

(12.5marks)

3) Use the Lagrange multiplier method to find the extreme points of the problem

Minimize $f(\underline{x}) = x_1^2 + x_2^2 - 3x_1x_2$

Subject to $g(\underline{x}) = x_1^2 + x_2^2 - 8 = 0$.

(12.5marks)

4) Use the Hessian Matrix to find the local points of the problem

$f(\underline{x}) = f(x_1, x_2) = x_1^3 + x_2^3 + 2x_1^2 + 4x_2^2 + 6$

(10marks)

5) Find the local Points

$f(x) = 3x^4 - 20x^3 + 36x^2 + 16$ (5marks)

Best Wishes

Dr. Alaa Fahim



Operation Research326 R

11-5-2018

Third Level: Computer Science Section

Time: 3 hours

Total Degree (50 marks)

Science Faculty

Mathematical Department

Answer the following Questions:

1-Use the Simplex method to solve the following linear programming

Maximize $Z = 10x_1 + 11x_2$

Subject to $x_1 + 2x_2 \leq 150$, $3x_1 + 4x_2 \leq 200$, $6x_1 + x_2 \leq 175$

and $x_1, x_2 \geq 0$

(10 marks)

2) Use the graphical and the algebraic method to solve the problem

Max $f(\underline{x}) = 5x_1 + 7x_2$ Subject to $5x_1 + 8x_2 \leq 24$, $x_1 + x_2 \leq 4$,

$10x_1 + 7x_2 \leq 35$ and $x_1, x_2 \geq 0$

(12.5marks)

3) Use the Lagrange multiplier method to find the extreme points of the problem

Minimize $f(\underline{x}) = x_1^2 + x_2^2 - 3x_1x_2$

Subject to $g(\underline{x}) = x_1^2 + x_2^2 - 8 = 0$.

(12.5marks)

4) Use the Hessian Matrix to find the local points of the problem

$f(\underline{x}) = f(x_1, x_2) = x_1^3 + x_2^3 + 2x_1^2 + 4x_2^2 + 6$

(10marks)

5) Find the local Points

$f(x) = 3x^4 - 20x^3 + 36x^2 + 16$ (5marks)

Best Wishes

Dr. Alaa Fahim

اجب عن خمسة فقط من الاسئلة الاتية :- (10 درجات لكل سؤال : بواقع 5 درجات لكل فقرة)

(1) (i) اوجد الحل العام للمعادلة : $p_1 + 3p_2 + 2p_3(1 + \sqrt{x_1 + x_2 + x_3 - u}) = 6$
(ii) اوجد الحل الخاص للمعادلة : $(y - z)[2xyp + (x^2 - y^2)q] + z(x^2 - y^2) = 0$
الذي يمر خلال المنحنى $y = 0, x^3 = z^2$

(2) اوجد الحل العام لكل من المعادلتين التفاضليتين الجزئيتين الاتيتين :-
(i) $(D_1^3 - D_1^2 D_2 - D_1 D_2^2 + D_2^3)z = \log(x + y)$
(ii) $(D_1^2 - a^2 D_2^2)z = x^2 + y^2$, ثابت مطلق a

(3) اوجد الحل العام لكل من المعادلتين التفاضليتين الجزئيتين الاتيتين :-
(i) $(D_1^2 D_2 + D_2^2 - 2)z = e^{2y} \sin 3x - e^x \cos 2y$
(ii) $(D_1^2 - D_2^2 - D_1 - 3D_2 - 2)z = e^{2x-3y} + x + y + 1$

(4) (i) احسب التكاملات الاتية :-
(a) $\int_0^{\infty} x^{-\frac{1}{3}}(1 + 2x)^{-3} dx$ (b) $\int_0^1 \sqrt{\log \frac{1}{x}} dx$

(ii) اثبت ان :-
(a) $\tan^{-1} x = x {}_2F_1(1, \frac{1}{2}; \frac{3}{2}; -x^2)$
(b) $(a - b) {}_2F_1(a, b; c; x) = a {}_2F_1(a + 1, b; c; x) - b {}_2F_1(a, b + 1; c; x)$

(5) اثبت ان دوال بسل من النوع الاول $J_n(x)$ تحقق الاتي :-
(i) $J_{-\frac{1}{2}}(x) = \sqrt{\frac{2}{\pi x}} \cos x$, (ii) $\int x^n J_{n-1}(x) dx = x^n J_n(x) + c$

(6) (i) اثبت ان كثيرات حدود لجندر $P_n(x)$ تحقق :-
(ii) احسب التكاملات الاتية :-
(a) $\int_{-1}^1 x P_n(x) P_{n+1}(x) dx$, (b) $\int_{-1}^1 x^2 P_n(x) P_{n+1}(x) dx$, (c) $\int_{-1}^1 x^2 P_n(x) dx$



أجب عن أسئلة الآتية :- (كل سؤال ١٠ درجات)

(١) (أ) أثبت قاعدة التضعيف لدالة جاما $\sqrt{\pi} \Gamma(2x) = 2^{2x-1} \Gamma(x) \Gamma\left(x + \frac{1}{2}\right), x > 0$

ثم استخدمها فى إثبات أن: $\Gamma\left(\frac{5}{6}\right) \left[\Gamma\left(\frac{1}{3}\right)\right]^2 = 2 \sqrt[3]{2} \sqrt{\frac{\pi^3}{3}}$

(ب) باستخدام دوال جاما و بيتا أوجد التكاملات الآتية: (i) $\int_0^{\frac{\pi}{2}} \sqrt{\tan \theta} d\theta$ (ii) $\int_0^{\infty} \frac{\sqrt{x}}{e^{x^3}} dx$

(٢) (أ) أثبت أن: $\Gamma(x) \Gamma(1-x) = \frac{\pi}{\sin \pi x}, 0 < x < 1$ ومن ثم أثبت أن

$\Gamma\left(x + \frac{1}{2}\right) \Gamma\left(\frac{1}{2} - x\right) = \frac{\pi}{\cos \pi x}$

(ب) أثبت أن:

(i) $\sqrt{1-x^2} T_n(x) = U_{n+1}(x) - x U_n(x),$

(ii) $(1-x^2) U'_n(x) = -n x U_n(x) + n U_{n-1}(x)$

(٣) أثبت أن:

(i) ${}_2F_1(\alpha, \beta; \gamma, x) = (1-x)^{-\beta} {}_2F_1\left(\gamma - \alpha, \beta; \gamma, \frac{x}{x-1}\right)$

(ii) ${}_1F_1\left(\frac{1}{2}; \frac{3}{2}, -x^2\right) = \frac{\sqrt{\pi}}{2x} \operatorname{erf}(x)$ حيث أن: $\operatorname{erf}(x) = \frac{2}{\sqrt{\pi}} \int_0^x e^{-t^2} dt$ هى دالة الخطأ

(iii) ${}_1F_1(\alpha + 1; \gamma, x) - {}_1F_1(\alpha; \gamma, x) - \frac{x}{\gamma} {}_1F_1(\alpha + 1; \gamma + 1, x) = 0$

(٤) (أ) أوجد مفكوك ليجندر للدالة: $f(x) = x^3$

(ب) أثبت أن: $H_n(x) = (-1)^n e^{x^2} \frac{d^n}{dx^n} (e^{-x^2})$ حيث $H_n(x)$ كثيرة حدود هيرميت.

(ج) أثبت أن: $J_{\frac{1}{2}}(x) = \sqrt{\frac{2}{\pi}} \frac{\sin x}{\sqrt{x}}$

(٥) (أ) باستخدام الصيغة التكاملية لدوال بسل أثبت أن: $\int_0^{\infty} e^{-3x} J_0(4x) dx = \frac{1}{5}$

(ب) أوجد الحل العام لمعادلة بسل التفاضلية:

$x^2 \frac{d^2 y}{dx^2} + x \frac{dy}{dx} + (x^2 - n^2)y = 0$

	Assiut University Faculty of Science Mathematics Dept.	Final Exam 2017-2018 Course: Mathematical and Statistical Packages Course code: MC300	Date: 14/5/2018 Level: Three Time: 2 Hours	
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Question 1: Put True or False for each of the following items (30 marks)

1. To enter a formula into a cell, begin by typing an equal sign.
2. Functions are pre-defined worksheet formulas.
3. Formulas in Excel must be written in a very specific format, referred to as syntax.
4. The second order of precedence is for exponentiation.
5. When the formula in cell **B7 =B4+B5+B6** is copied into cell **C7** the formula will be changed to **= C4+C5+C6**.
6. The error "#####" means Data being referenced is not available.
7. The range **B2:B7** is a range down a column.
8. To keep things clear and simple only add an absolute (\$) cell reference if absolutely necessary.
9. The formula **=ROUND(78.686788,-1)** results in the value 80 .
10. Placing an absolute sign in front of a ranged name (**\$budget**) is incorrect syntax.
11. The columns of the worksheet are named with Numbers.
12. Cells may contain only Labels and Values.
13. The cell address first lists the row name and then the column name.
14. This selected cell is referred to as the **active cell**.
15. The contents of the active cell will also be displayed on the **formula bar**.
16. A cell that is on sheet 3, in the second column third row would be referred to as **Sheet3@B3**.
17. Formatted Display is the number of decimal places that appear in a cell.
18. Formulas can be copied to perform different operations on a corresponding set of data.
19. The function **COUNT(value1,[value2],...)** counts non-blank cells.
20. The Average function ignore the blank cells.
21. TRUE and FALSE are called Boolean Values.
22. SPSS stands for Statistical Package for the Social Sciences.
23. SPSS is capable of handling large amounts of data.
24. SPSS has only two windows Data view and Output view.
25. **Transform** menu includes several options to change current variables.
26. In SPSS, Each column typically represents the data from 1 case.
27. In SPSS, The first column of variable view is Name.
28. In SPSS, you can sort data from **Transform** menu then **Sort Cases**.
29. Descriptive statistics are calculated using the **Analyze** menu.
30. Correlation is used to test the degree of association between variables.

Answer Sheet		
	True	False
1		
2		
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26		
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28		
29		
30		

Question 2: (10 marks)

	A	B	C	D	E	F	G
1		MT1	MT2	Final	Total	Honors	Passed
2	Possible points	100	100	200	400		320
3							
4	Blue	79	89	169	337	FALSE	TRUE
5	Jones	85	65	195	345	FALSE	TRUE
6	Grey	60	97	187	344	TRUE	TRUE
7	Mary	10	30	50	90	TRUE	FALSE
8							

Write the following Boolean functions

1. Blue's total and Jones' total are greater than Grey's:
2. Grey's total is not the maximum grade:
3. None of the students passed the course
4. Blue is not an Honors student
5. Blue didn't get a passing grade (320)

Question 3: (10 marks)

1. What are the difference between Data View, Variable View and Output View in SPSS?
2. Some significance tests are very restrictive about the form of data they can accept. What are the different types of measurement?
3. Describe how to test the degree of association between variables by SPSS.
4. Explain how to use SPSS to calculate the frequency and percent of females and males who did and did not have social problems.

Q2.

- a. Maintain two different Algorithm of crossover process with mention the probability of crossover (5 marks)
- b. Maintain two different Algorithm of mutation process with mention the probability of mutation. (5 marks)

Q3. a. Maintain tree type representation of solutions in genetic algorithm. (3 marks)

b. Using genetic algorithm to find the maximum value of the function $(15x - x^2)$ where parameter x varies between 0 and 15. For simplicity, we may assume that x takes only integer values. Using the genetic algorithm procedure in one step and begin with four solutions in initial solutions. (10 marks)

Q4. Discuss the internal structure of Taxi driver Robot. (7 marks)

Q5. Discuss the Tabu search method and maintain the type of memory using in this method and maintain the Tabu search algorithm. (10 marks)

==best wishes==

Dr. Alaa F. Mohamed



2017-2018
18-5-2018

Final Exam for Level 3
Subject: Artificial Intelligent
MC352
Time: 2 Hours

Mathematics Dept.
Faculty of Science
Assiut University

Q1. Choose the correct answer. (10 marks)

1.is the right action is the one that will cause the agent to be most successful
a) rationality b) Omniscience c) Perfection
2. Motors, files and body parts are considered as
a) effector b) sensor c) agents
3. Speaker, monitor and body part are considered as.....
a) effector b) sensor c) agents
4. The environment of part parking rebort is.....
a) Dynamics b) statistic c) semi
5. The environment of cross puzzle is considered as
a) squential b) eposidic c) mixed
6. The environment of backgammon game is considered as.....
a) Stochastic b) deterministic c) mixed
7. The accessibility of cross-word puzzle
a) partially b) fully c) statistic
8. Simulated annealing is considered as
a) informed search b) blind search c) agents
9. The is a metaheuristic begin with some of solution and make some operators
a) A* search b) Tabu search c) genetic algorithm
10. Theis a metaheuristic using memory that guides a local search procedure to explore the solution space.
a) A* search b) Tabu search c) genetic algorithm

Answer the following questions: (50 Marks)

Question 1: Answer the following points (10 Marks)

- 1- Explain the internet "nuts and bolts"?
- 2- Explain the sources of packet delay?
- 3- What are protocols?
- 4- Explain Access network: digital subscriber line (DSL)?

Question 2: Answer the following points (10 Marks)

- 1- What is the network core?
- 2- Explain Packet Switching: queueing delay, loss?
- 3- Define throughput?
- 4- Define and explain traffic intensity?

Question 3: Answer the following points (10 Marks)

- 1- Explain the Internet protocol stack?
- 2- Mention some network applications?
- 3- Explain the application client-server architecture?
- 4- Explain P2P architecture?

Question 4: Answer the following points (10 Marks)

- 1- HTTP is "stateless". What does that mean?
- 2- Compare between persistent HTTP and non-persistent HTTP?
- 3- Give examples of HTTP response status codes?
- 4- Explain the term (web caches) and how it is useful?

Question 5: Answer the following points (10 Marks)

- 1- Give a DNS name resolution example?
- 2- Compare between multiplexing and demultiplexing? Support your answer with a diagram?
- 3- Define and explain the use of ACKs and NAKs?
- 4- Define and explain HOL? Support your answer with a diagram?

جامعة أسيوط	مايو 2018	كود المقرر: 356 رك
كلية العلوم		المقرر : مقدمة فى الحسابات العلمية
قسم الرياضيات		الزمن : ساعتان

Answer the following questions by using MATLAB language: (50 marks)

1- Using Newton's forward difference formula, find $y(0.1)$ using the table below:

x	0.0	0.2	0.4	0.6	0.8
y	1.000	1.22140	1.49182	1.82212	2.22554

2- Solve the differential equation by Adams method (without using nested for loops) at $x=0.2$:

$$\frac{dy}{dt} = t^2 - y, \quad y(0) = 1, \quad h = 0.05.$$

and compare it with the analytic solution $y = -e^{-t} + t^2 - 2t + 2$.

3- Solve the following initial value problem:

$$\frac{d^2u}{dt^2} + 4\frac{du}{dt} + 3u = 0, \quad u(0) = 1, \quad \frac{du}{dt}(0) = 0.$$

4- Let $f(x) = \cos 2x$ and $x_0 = 0$. Determine

- The third Taylor polynomial for f about x_0 .
- Find error bound at $x = 0.2$ and compare it to the actual error.

5- For the well-known Chua's circuit equation in chaotic studies that

$$\dot{x} = \alpha[y - x - f(x)], \quad \dot{y} = x - y + z, \quad \dot{z} = -\beta y - \gamma z, \quad t \in (0, 10),$$

where the nonlinear function $f(x)$ is described by

$$f(x) = bx + 0.5(a-b)(|x+1| - |x-1|) \text{ and } a < b < 0.$$

Write an M-function to describe the equation, and draw the phase trajectory for the parameters $\alpha = 9$, $\beta = 100/7$, $\gamma = 0$, $a = -8/7$, $b = -5/7$, and initial conditions

$$x(0) = -2.121304, \quad y(0) = -0.066170, \quad z(0) = 2.881090.$$

Good Luck

Dr. Tarek Aboelenen



امتحان الفرقة الثالثة شعبة الرياضيات

المقرر : عمليات عشوائية وتطبيقاتها
رقم المقرر ورمزه : ١٣٤٦
الزمن : ثلاث ساعات

أجب عن خمسة أسئلة فقط مما يأتي :- درجة جزء كل سؤال (خمس درجات)

١- (أ) لمجموعة المتغيرات العشوائية المستقلة $X_1, X_2, X_3, \dots$ بفرض أن التوقع الرياضي $E(X_i) = m$ والتباين $V(X_i)$ لكل منها محدود عرف كل من التقارب عن طريق الإحتمال وقانون الأعداد الكبرى (الضعيف).
(ب) - بفرض أن $f f s s f s f f s s s f f s f f s$ هي إحدى النتائج الممكنة في محاولات برنولي العشوائية المستقلة بحيث أن $P(s) = p, P(f) = q, p + q = 1$ عرف عملية عشوائية في الفراغ R^2 موضحا ذلك بيانيا .

٢- (أ) في عملية برنولي العشوائية $\{X_n; n > 0\}$ بالإحتمال $p = 0.6$ إذا كان $X = X_1 + X_2$ ، $Y = X_1 + X_3$ احسب الإحتمالات الآتية : $P(X < 2, Y \leq 1)$ ، $P(2X < 3Y)$ ، $P(Y = X)$.
(ب) في السؤال (٢-أ) أوجد العزم الارتباطي بين X ، Y موضحا العلاقة بينهما .

٣- (أ) وضح العلاقة بين عملية برنولي العشوائية $\{X_n; n > 0\}$ و العملية العشوائية $\{Y_n; n \geq 0\}$ حيث أن المتغير Y_n يخضع لتوزيع ذي الحدين واذكر صفات كل منهما ثم عبر مع الإستنتاج عن إحتمال الحادث $(Y_{n+1} = k)$ من خلال إحتمالات الحوادث : $(Y_n = k)$ ، $(Y_n = k - 1)$ لأي عدد صحيح $k > 0$.
(ب) - في العملية العشوائية $\{Y_n; n \geq 0\}$ أوجد كل من $E(Y_5)$ ، $E(Y_4^2)$ ، $P(Y_5 = 3, Y_7 = 4, Y_{14} = 9)$.

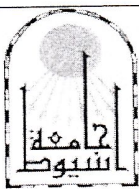
٤- (أ) عرف أزمنة النجاح T_k كعملية عشوائية موضحا العلاقة بينها وبين العملية العشوائية $\{Y_n; n \geq 0\}$ ثم اذكر فقط توزيع المتغير العشوائي T_k .
(ب) - في عملية بواسون العشوائية $\{N_t; t \geq 0\}$ بالمعدل $\lambda = 4$ احسب كل من الإحتمالات الآتية :
 $P(N_{1.5} = 2, N_4 = 5, N_{6.8} = 9)$ ، $P(N_3 = 5, N_7 = 9)$

٥- (أ) في عملية بواسون أو عملية الوصول المعودة $\{N_t; t \geq 0\}$ بالمعدل λ إثبت أن الإحتمال المشروط لعدد الوصول N_t بالنسبة إلى عدد الوصول N_{t+s} لكل $t > 0, s > 0$ يمثل توزيع ذي الحدين.
(ب) - عرف العمليات العشوائية المستقلة ثم اثبت أن أي عمليتين مستقلتين لبواسون هو أيضا عملية بواسون .

٦- (أ) في عملية التجديد العشوائية $R = \{R_n; n \in N\}$ حيث N هي فئة الأعداد الصحيحة غير السالبة عرف دالة التجديد ثم عبر عنها من خلال توزيع المتغير R_n مع الإستنتاج .

(ب) في سلسلة ماركوف العشوائية المتقطعة $\{X_n; n \geq 0\}$ عرف مصفوفة الإحتمالات الإنتقالية بصفاتها المعروفة ثم احسب الإحتمال : $P(X_0 = 1, X_1 = 1, X_2 = 0, X_3 = 1, X_4 = 0, X_6 = 0)$ بفرض أن حالات الفراغ $(0, 1)$ والمصفوفة العشوائية

$$P = \begin{pmatrix} 1/2 & 1/2 \\ 1/3 & 2/3 \end{pmatrix} , \text{ ومنتجه الإحتمالات الابتدائية } \pi_0 = (2/5 \quad 3/5)$$

	المقرر: تحليل عددي (٣٢٣) الفرقة: المستوى الثالث الدرجة: ٥٠ درجة التاريخ: ٢٠١٨/٥/٢٩ الزمن: ثلاث ساعات	جامعة أسيوط كلية العلوم - قسم الرياضيات امتحان نهائي الفصل الدراسي الثاني للعام الجامعي ٢٠١٧/٢٠١٨
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Answer five questions only :- (10 marks for every question)

1-a) If the function $g \in C[a, b]$ and $g(x) \in [a, b] \forall x \in [a, b]$ and $g'(x)$ exist with $|g'(x)| \leq k < 1 \forall x \in [a, b]$ prove that the sequence defined by $P_n = g(P_{n-1}), n \geq 1$ will converge to the unique fixed point P and also $|P_{n+1} - P_n| \leq k^n |P_1 - P_0|$.

1-b) Verify that when Newton's method is used to compute $\sqrt{A}, A > 0$ (By solving the equation : $f(x) = x^2 - A$). The sequence of iterates is defined by : $x_{n+1} = (x_n + \frac{A}{x_n})/2$, and show that if the sequence $\{x_n\}$ is defined as the previous problem, then this method is quadratically convergence.

2-a) Derive Lagrange interpolation formula of degree n and write the error of the method.

2-b) For the given function $f(x) = \cos \pi x$ let $x_0 = -1, x_1 = 0, x_2 = 1$ construct the suitable interpolation polynomial and find the actual error.

3) Derive the formula of the Newton's interpolatory divided difference method and use this formula to obtain a polynomial of least degree that fits the values shown:

x	0	1	2	4	6
$f(x)$	1	9	23	93	259

من فضلك انظر خلف الورقة

السؤال الرابع :-

أ) يعرف الطي للدالتين $f(x)$, $g(x)$ كالآتي

$$f * g = \int_{-\infty}^{\infty} f(u) g(x-u) du$$

برهن علي أن تحويل فوريير للطرف الأيمن هو حاصل ضرب تحويلي فوريير للدالتين $f(x)$, $g(x)$

ب) أوجد تحويل فوريير للدالة $f(x) = \begin{cases} 1 & |x| < a \\ 0 & |x| > a \end{cases}$ وأرسم $f(x)$ كذلك تحويلها عند $a = 3$ وأوجد

$$\int_{-\infty}^{\infty} \frac{\sin u}{u} du \quad \text{كذلك} \quad \int_{-\infty}^{\infty} \frac{\sin \alpha a \cos \alpha x}{\alpha} d\alpha$$

ج) ترك خيط لانهائي من السكون وكانت أزاحته الابتدائية عن محور x هي $f(x)$ أوجد الإزاحه عند أي زمن .

انتهت الأسئلة مع تمنياتنا بالتوفيق ،،،،

لجنة الممتحنين :- أ.د/ نجاه عبد الرحمن حسين ، أ.د/ فاروق علي السيد



الامتحان النهائي للفصل الدراسي الثاني للعام الجامعي ٢٠١٧/٢٠١٨ م
 للفرقة : الثالثة
 الشعبة : الرياضيات
 التاريخ : ٢٠١٨/٥/٢٤ م

الزمن : ساعتان

الدرجة الكلية : ٥٠ درجة

درجة كل سؤال : ١٧ درجة

أسم المقرر : الطرق الرياضية
 رقم المقرر ورمزه : ٣٣٤ ر

أجب عن ثلاثة أسئلة فقط مما يأتي :-

السؤال الأول :-

أوجد تحويل لابلاس للمشتقة التفاضلية للدالة $F(t)$ عند نقط الاتصال والانفصال للدالة .

أبرهن علي أن

$$\lim_{t \rightarrow 0} F(t) = \lim_{s \rightarrow \infty} s f(s)$$

$$\lim_{t \rightarrow \infty} F(t) = \lim_{s \rightarrow 0} s f(s)$$

$$\Gamma\left(\frac{1}{2}\right) = \sqrt{\pi}, \quad \int_0^{\infty} \delta(t) dt = 1, \quad L \sin \sqrt{t} = \frac{\sqrt{\pi}}{3} e^{-\frac{1}{4s}} s^{\frac{3}{2}}$$

السؤال الثاني :-

حل المعادلات الآتية :

$$t Y''(t) + Y'(t) + 4t Y(t) = 0, \quad y(0) = 3, y'(0) = 0$$

$$\frac{\partial U}{\partial x} = 2 \frac{\partial U}{\partial t} + U, \quad x > 0, t > 0 \quad U(x, 0) = 6 e^{-3x}$$

$$\int_0^t Y(u) Y(t-u) du = 16 \sin 4t$$

السؤال الثالث :-

(أ) فك الدالة $f(x) = x^2$, $0 < x < 2\pi$ بدلالة متسلسلة فوريير ثم أحسب المجموع

$$1 + \frac{1}{2^2} + \frac{1}{3^2} + \frac{1}{4^2} + \dots$$

(ب) صفيحة علي شكل دائري نصف قطرها الوحدة ووجهيها معزولين ونصف محيطها محفوظ عند درجة حرارة u_1

والآخر عند u_2 أوجد حالة الأتزان الحراري .

من فضلك أنظر بقية الأسئلة خلف الورقة ،،،،،



Answer the following questions (50 marks)

Q1.	Complete the following: (1)..... is a representation of a two-dimensional image as a finite set of digital values, called picture elements or pixels - Common image formats include.....(2).... ,(3)..... ,(4)..... (5)..... creates a Distance tool a draggable, resizable line that measures the distance between its endpoints. (6)..... These are the result of objects that are self-luminous, such as stars and light bulbs. (7).....the resulting output pixel is computed as a sum of products of the pixel values and mask coefficients in the pixel's neighborhood in the original image. - The Sobel operators used to compute edges are(8)..... ,(9)..... - Edge detector should have:(10)..... ,(11)..... - Types of noise are(12)..... ,(13)....	(13 marks)
Q2.	a) Compute Z from the following matlab script (6 marks) <pre> x = [150 10 90;80 50 60;121 160 20] y = [-1 0 1;-2 0 2;-1 0 1] z = imfilter(x,y,'corr') </pre> b) What is the Delta compression and compute the compressed data of the data (6 marks) 220 321 335 211 250 200 233 214 232 212	(12 marks)
Q3.	a) Write the MATLAB code used to: (4 marks) - Read any image then use affine transformation matrix for each of the operations below: - Flip the image right to left - Translation by [25, 15] pixels b) What are the main differences between: (8 marks) - Global thresholding and optimal thresholding. - Raster and vector image . - Interpixel redundancy and Psychovisual redundancy	(12 marks)

(Q5) (i) Assume that U, V are open intervals and let $f : U \rightarrow \mathbb{R}$ and $g : V \rightarrow \mathbb{R}$ be two differentiable functions such that $f(U) \subset V$. Prove that $g \circ f$ is differentiable on U and that $(g \circ f)' = (g' \circ f) \cdot f'$ [5 marks]

(ii) Prove that the function $f(x) := \frac{1}{x}$ is differentiable on $]0, \infty[$ but not uniformly continuous therein. [5 marks]

(Q6) (i) State and prove Rolle's theorem then use it to prove the mean value theorem. [6 marks]

(ii) Let I be an open interval. Apply the mean value theorem to prove that a function differentiable on I is

1. increasing if and only if $f' \geq 0$ on I ,

2. decreasing if and only if $f' \leq 0$ on I .

[4 marks]

With the best of luck,

Prof. Rashwan A. Rashwan,

Dr. Ahmed A. Abdelhakim



Time: 3 hours

Total mark: 50

Answer *only five* of the following questions:

(Q1) (i) Suppose that O_i , $i \geq 1$, are open subsets of $\mathbb{R}$. Prove that $\cup_{i \geq 1} O_i$ is also open in $\mathbb{R}$. [5 marks]

(ii) Let $S \subset \mathbb{R}$. Show that S is closed if and only if S contains the limit point of every convergent sequence of elements of S . [5 marks]

(Q2) (i) Prove that a sequence of real numbers converges if and only if it is a Cauchy sequence. [6 marks]

(ii) Show that if $(x_n)_{n \geq 1} \subset \mathbb{R}$ is a monotonically increasing sequence that is bounded above, then $x_n \rightarrow \sup_{n \geq 1} x_n$, as $n \rightarrow \infty$. [4 marks]

(Q3) (i) Show that $f : D \subset \mathbb{R} \rightarrow \mathbb{R}$ is continuous at $x_0 \in D$ if and only if the sequence $(f(x_n))_{n \geq 1}$ converges to $f(x_0)$ whenever $(x_n)_{n \geq 1}$ is a sequence in D that converges to x_0 . [6 marks]

(ii) Use the characterization given in (i) to prove the discontinuity at the origin of the function $f(x) = \begin{cases} \cos \frac{1}{x}, & x \neq 0; \\ 0, & x = 0. \end{cases}$ [4 marks]

(Q4) (i) Assume that D is a closed bounded subset of $\mathbb{R}$. Prove that if $f : D \rightarrow \mathbb{R}$ is continuous then f is bounded on D , and there exist $\alpha, \beta \in D$ such that $f(\alpha) = \max_{x \in D} f(x)$ and $f(\beta) = \min_{x \in D} f(x)$. [5 marks]

(ii) Argue by contradiction to demonstrate that if $f : [a, b] \rightarrow \mathbb{R}$ is continuous then it is uniformly continuous on $[a, b]$. [5 marks]

Please Turn over the page

Answer Sheet		
	True	False
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Question 2: (10 marks)

	A	B	C	D	E	F	G
1		MT1	MT2	Final	Total	Honors	Passed
2	Possible points	100	100	200	400		320
3							
4	Blue	79	89	169	337	FALSE	TRUE
5	Jones	85	65	195	345	FALSE	TRUE
6	Grey	60	97	187	344	TRUE	TRUE
7	Mary	10	30	50	90	TRUE	FALSE
8							

Write the following Boolean functions

1. Blue's total and Jones' total are greater than Grey's:
2. Grey's total is not the maximum grade:
3. None of the students passed the course
4. Blue is not an Honors student
5. Blue didn't get a passing grade (320)

Question 3: (10 marks)

1. What are the difference between Data View, Variable View and Output View in SPSS?
2. Some significance tests are very restrictive about the form of data they can accept. What are the different types of measurement?
3. Describe how to test the degree of association between variables by SPSS.
4. Explain how to use SPSS to calculate the frequency and percent of females and males who did and did not have social problems.

Q2.

- a. Maintain two different Algorithm of crossover process with mention the probability of crossover (5 marks)
- b. Maintain two different Algorithm of mutation process with mention the probability of mutation. (5 marks)

Q3. a. Maintain tree type representation of solutions in genetic algorithm. (3 marks)

b. Using genetic algorithm to find the maximum value of the function $(15x - x^2)$ where parameter x varies between 0 and 15. For simplicity, we may assume that x takes only integer values. Using the genetic algorithm procedure in one step and begin with four solutions in initial solutions. (10 marks)

Q4. Discuss the internal structure of Taxi driver Robot. (7 marks)

Q5. Discuss the Tabu search method and maintain the type of memory using in this method and maintain the Tabu search algorithm. (10 marks)

==best wishes==

Dr. Alaa F. Mohamed

Answer the following questions: (50 Marks)

Question 1: Answer the following points (10 Marks)

- 1- Explain the internet "nuts and bolts"?
- 2- Explain the sources of packet delay?
- 3- What are protocols?
- 4- Explain Access network: digital subscriber line (DSL)?

Question 2: Answer the following points (10 Marks)

- 1- What is the network core?
- 2- Explain Packet Switching: queueing delay, loss?
- 3- Define throughput?
- 4- Define and explain traffic intensity?

Question 3: Answer the following points (10 Marks)

- 1- Explain the Internet protocol stack?
- 2- Mention some network applications?
- 3- Explain the application client-server architecture?
- 4- Explain P2P architecture?

Question 4: Answer the following points (10 Marks)

- 1- HTTP is "stateless". What does that mean?
- 2- Compare between persistent HTTP and non-persistent HTTP?
- 3- Give examples of HTTP response status codes?
- 4- Explain the term (web caches) and how it is useful?

Question 5: Answer the following points (10 Marks)

- 1- Give a DNS name resolution example?
- 2- Compare between multiplexing and demultiplexing? Support your answer with a diagram?
- 3- Define and explain the use of ACKs and NAKs?
- 4- Define and explain HOL? Support your answer with a diagram?

جامعة أسيوط	مايو 2018	كود المقرر: 356 رك
كلية العلوم		المقرر : مقدمة فى الحسابات العلمية
قسم الرياضيات		الزمن : ساعتان

Answer the following questions by using MATLAB language: (50 marks)

1- Using Newton's forward difference formula, find $y(0.1)$ using the table below:

x	0.0	0.2	0.4	0.6	0.8
y	1.000	1.22140	1.49182	1.82212	2.22554

2- Solve the differential equation by Adams method (without using nested for loops) at $x=0.2$:

$$\frac{dy}{dt} = t^2 - y, \quad y(0) = 1, \quad h = 0.05.$$

and compare it with the analytic solution $y = -e^{-t} + t^2 - 2t + 2$.

3- Solve the following initial value problem:

$$\frac{d^2u}{dt^2} + 4\frac{du}{dt} + 3u = 0, \quad u(0) = 1, \quad \frac{du}{dt}(0) = 0.$$

4- Let $f(x) = \cos 2x$ and $x_0 = 0$. Determine

- The third Taylor polynomial for f about x_0 .
- Find error bound at $x = 0.2$ and compare it to the actual error.

5- For the well-known Chua's circuit equation in chaotic studies that

$$\dot{x} = \alpha[y - x - f(x)], \quad \dot{y} = x - y + z, \quad \dot{z} = -\beta y - \gamma z, \quad t \in (0, 10),$$

where the nonlinear function $f(x)$ is described by

$$f(x) = bx + 0.5(a-b)(|x+1| - |x-1|) \text{ and } a < b < 0.$$

Write an M-function to describe the equation, and draw the phase trajectory for the parameters $\alpha = 9$, $\beta = 100/7$, $\gamma = 0$, $a = -8/7$, $b = -5/7$, and initial conditions

$$x(0) = -2.121304, \quad y(0) = -0.066170, \quad z(0) = 2.881090.$$

Good Luck

Dr. Tarek Aboelenen



امتحان الفرقة الثالثة شعبة الرياضيات

الزمن : ثلاث ساعات

رقم المقرر ورمزه : ١٣٤٦

المقرر : عمليات عشوائية وتطبيقاتها

أجب عن خمسة أسئلة فقط مما يأتي :- درجة جزء كل سؤال (خمس درجات)

١- (أ) لمجموعة المتغيرات العشوائية المستقلة $X_1, X_2, X_3, \dots$ بفرض أن التوقع الرياضي $E(X_i) = m$ والتباين $V(X_i)$ لكل منها محدود عرف كل من التقارب عن طريق الإحتمال وقانون الأعداد الكبرى (الضعيف).
(ب) بفرض أن $f f s s f s f f s s s f f s f f s$ هي إحدى النتائج الممكنة في محاولات برنولي العشوائية المستقلة بحيث أن $P(s) = p, P(f) = q, p + q = 1$ عرف عملية عشوائية في الفراغ R^2 موضحا ذلك بيانيا .

٢- (أ) في عملية برنولي العشوائية $\{X_n; n > 0\}$ بالإحتمال $p = 0.6$ إذا كان $X = X_1 + X_2$ ، $Y = X_1 + X_3$ احسب الإحتمالات الآتية : $P(X < 2, Y \leq 1)$ ، $P(2X < 3Y)$ ، $P(Y = X)$.
(ب) في السؤال (٢-أ) أوجد العزم الارتباطي بين X ، Y موضحا العلاقة بينهما .

٣- (أ) وضح العلاقة بين عملية برنولي العشوائية $\{X_n; n > 0\}$ و العملية العشوائية $\{Y_n; n \geq 0\}$ حيث أن المتغير Y_n يخضع لتوزيع ذي الحدين واذكر صفات كل منهما ثم عبر مع الاستنتاج عن إحتمال الحادث $(Y_{n+1} = k)$ من خلال إحتمالات الحوادث : $(Y_n = k)$ ، $(Y_n = k - 1)$ لأي عدد صحيح $k > 0$.
(ب) في العملية العشوائية $\{Y_n; n \geq 0\}$ أوجد كل من $E(Y_5)$ ، $E(Y_4^2)$ ، $P(Y_5 = 3, Y_7 = 4, Y_{14} = 9)$.

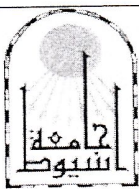
٤- (أ) عرف أزمنة النجاح T_k كعملية عشوائية موضحا العلاقة بينها وبين العملية العشوائية $\{Y_n; n \geq 0\}$ ثم اذكر فقط توزيع المتغير العشوائي T_k .
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 $P(N_{1.5} = 2, N_4 = 5, N_{6.8} = 9)$ ، $P(N_3 = 5, N_7 = 9)$

٥- (أ) في عملية بواسون أو عملية الوصول المعودة $\{N_t; t \geq 0\}$ بالمعدل λ إثبت أن الإحتمال المشروط لعدد الوصول N_t بالنسبة إلى عدد الوصول N_{t+s} لكل $t > 0, s > 0$ يمثل توزيع ذي الحدين .
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(ب) في سلسلة ماركوف العشوائية المتقطعة $\{X_n; n \geq 0\}$ عرف مصفوفة الإحتمالات الإنتقالية بصفاتها المعروفة ثم احسب الإحتمال : $P(X_0 = 1, X_1 = 1, X_2 = 0, X_3 = 1, X_4 = 0, X_6 = 0)$ بفرض أن حالات الفراغ $(0, 1)$ والمصفوفة العشوائية

$$P = \begin{pmatrix} 1/2 & 1/2 \\ 1/3 & 2/3 \end{pmatrix} , \text{ ومنتجه الإحتمالات الابتدائية } \pi_0 = (2/5 \quad 3/5)$$

	المقرر: تحليل عددي (٣٢٣) الفرقة: المستوى الثالث الدرجة: ٥٠ درجة التاريخ: ٢٠١٨/٥/٢٩ الزمن: ثلاث ساعات	جامعة أسيوط كلية العلوم - قسم الرياضيات امتحان نهائي الفصل الدراسي الثاني للعام الجامعي ٢٠١٧/٢٠١٨
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Answer five questions only :- (10 marks for every question)

1-a) If the function $g \in C[a, b]$ and $g(x) \in [a, b] \forall x \in [a, b]$ and $g'(x)$ exist with $|g'(x)| \leq k < 1 \forall x \in [a, b]$ prove that the sequence defined by $P_n = g(P_{n-1}), n \geq 1$ will converge to the unique fixed point P and also $|P_{n+1} - P_n| \leq k^n |P_1 - P_0|$.

1-b) Verify that when Newton's method is used to compute $\sqrt{A}, A > 0$ (By solving the equation : $f(x) = x^2 - A$). The sequence of iterates is defined by : $x_{n+1} = (x_n + \frac{A}{x_n})/2$, and show that if the sequence $\{x_n\}$ is defined as the previous problem, then this method is quadratically convergence.

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x	0	1	2	4	6
$f(x)$	1	9	23	93	259

من فضلك انظر خلف الورقة

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أ) يعرف الطي للدالتين $f(x)$, $g(x)$ كالآتي

$$f * g = \int_{-\infty}^{\infty} f(u) g(x-u) du$$

برهن علي أن تحويل فوريير للطرف الأيمن هو حاصل ضرب تحويلي فوريير للدالتين $f(x)$, $g(x)$

ب) أوجد تحويل فوريير للدالة $f(x) = \begin{cases} 1 & |x| < a \\ 0 & |x| > a \end{cases}$ وأرسم $f(x)$ كذلك تحويلها عند $a = 3$ وأوجد

$$\int_{-\infty}^{\infty} \frac{\sin u}{u} du \quad \text{كذلك} \quad \int_{-\infty}^{\infty} \frac{\sin \alpha a \cos \alpha x}{\alpha} d\alpha$$

ج) ترك خيط لانهائي من السكون وكانت أزاحته الابتدائية عن محور x هي $f(x)$ أوجد الإزاحه عند أي زمن .

انتهت الأسئلة مع تمنياتنا بالتوفيق ،،،،

لجنة الممتحنين :- أ.د/ نجاه عبد الرحمن حسين ، أ.د/ فاروق علي السيد



الامتحان النهائي للفصل الدراسي الثاني للعام الجامعي ٢٠١٧/٢٠١٨ م
 للفرقة : الثالثة شعبة : الرياضيات التاريخ : ٢٠١٨/٥/٢٤ م

الزمن : ساعتان

الدرجة الكلية : ٥٠ درجة

أسم المقرر : الطرق الرياضية
 رقم المقرر ورمزه : ٣٣٤ ر

درجة كل سؤال : ١٧ درجة

أجب عن ثلاثة أسئلة فقط مما يأتي :-

السؤال الأول :-

أوجد تحويل لابلاس للمشتقة التفاضلية للدالة $F(t)$ عند نقط الاتصال والانفصال للدالة .

أبرهن علي أن

$$\lim_{t \rightarrow 0} F(t) = \lim_{s \rightarrow \infty} s f(s)$$

$$\lim_{t \rightarrow \infty} F(t) = \lim_{s \rightarrow 0} s f(s)$$

$$\Gamma\left(\frac{1}{2}\right) = \sqrt{\pi}, \quad \int_0^{\infty} \delta(t) dt = 1, \quad L \sin \sqrt{t} = \frac{\sqrt{\pi}}{3} e^{-\frac{1}{4s}} s^{\frac{3}{2}}$$

السؤال الثاني :-

حل المعادلات الآتية :

$$t Y''(t) + Y'(t) + 4t Y(t) = 0, \quad y(0) = 3, y'(0) = 0$$

$$\frac{\partial U}{\partial x} = 2 \frac{\partial U}{\partial t} + U, \quad x > 0, t > 0 \quad U(x, 0) = 6 e^{-3x}$$

$$\int_0^t Y(u) Y(t-u) du = 16 \sin 4t$$

السؤال الثالث :-

أ) فك الدالة $f(x) = x^2$, $0 < x < 2\pi$ بدلالة متسلسلة فوريير ثم أحسب المجموع

$$1 + \frac{1}{2^2} + \frac{1}{3^2} + \frac{1}{4^2} + \dots$$

ب) صفيحة علي شكل دائري نصف قطرها الوحدة ووجهيها معزولين ونصف محيطها محفوظ عند درجة حرارة u_1

والآخر عند u_2 أوجد حالة الأتزان الحراري .

من فضلك أنظر بقية الأسئلة خلف الورقة ،،،،،



Answer the following questions (50 marks)

Q1.	Complete the following: (1)..... is a representation of a two-dimensional image as a finite set of digital values, called picture elements or pixels - Common image formats include.....(2).... ,(3)..... ,(4)..... (5)..... creates a Distance tool a draggable, resizable line that measures the distance between its endpoints. (6)..... These are the result of objects that are self-luminous, such as stars and light bulbs. (7).....the resulting output pixel is computed as a sum of products of the pixel values and mask coefficients in the pixel's neighborhood in the original image. - The Sobel operators used to compute edges are(8)..... ,(9)..... - Edge detector should have:(10)..... ,(11)..... - Types of noise are(12)..... ,(13)....	(13 marks)
Q2.	a) Compute Z from the following matlab script (6 marks) <pre> x = [150 10 90;80 50 60;121 160 20] y = [-1 0 1;-2 0 2;-1 0 1] z = imfilter(x,y,'corr') </pre> b) What is the Delta compression and compute the compressed data of the data (6 marks) 220 321 335 211 250 200 233 214 232 212	(12 marks)
Q3.	a) Write the MATLAB code used to: (4 marks) - Read any image then use affine transformation matrix for each of the operations below: - Flip the image right to left - Translation by [25, 15] pixels b) What are the main differences between: (8 marks) - Global thresholding and optimal thresholding. - Raster and vector image . - Interpixel redundancy and Psychovisual redundancy	(12 marks)

(Q5) (i) Assume that U, V are open intervals and let $f : U \rightarrow \mathbb{R}$ and $g : V \rightarrow \mathbb{R}$ be two differentiable functions such that $f(U) \subset V$. Prove that $g \circ f$ is differentiable on U and that $(g \circ f)' = (g' \circ f) \cdot f'$ [5 marks]

(ii) Prove that the function $f(x) := \frac{1}{x}$ is differentiable on $]0, \infty[$ but not uniformly continuous therein. [5 marks]

(Q6) (i) State and prove Rolle's theorem then use it to prove the mean value theorem. [6 marks]

(ii) Let I be an open interval. Apply the mean value theorem to prove that a function differentiable on I is

1. increasing if and only if $f' \geq 0$ on I ,

2. decreasing if and only if $f' \leq 0$ on I .

[4 marks]

With the best of luck,

Prof. Rashwan A. Rashwan,

Dr. Ahmed A. Abdelhakim



Time: 3 hours

Total mark: 50

Answer *only five* of the following questions:

(Q1) (i) Suppose that O_i , $i \geq 1$, are open subsets of $\mathbb{R}$. Prove that $\cup_{i \geq 1} O_i$ is also open in $\mathbb{R}$. [5 marks]

(ii) Let $S \subset \mathbb{R}$. Show that S is closed if and only if S contains the limit point of every convergent sequence of elements of S . [5 marks]

(Q2) (i) Prove that a sequence of real numbers converges if and only if it is a Cauchy sequence. [6 marks]

(ii) Show that if $(x_n)_{n \geq 1} \subset \mathbb{R}$ is a monotonically increasing sequence that is bounded above, then $x_n \rightarrow \sup_{n \geq 1} x_n$, as $n \rightarrow \infty$. [4 marks]

(Q3) (i) Show that $f : D \subset \mathbb{R} \rightarrow \mathbb{R}$ is continuous at $x_0 \in D$ if and only if the sequence $(f(x_n))_{n \geq 1}$ converges to $f(x_0)$ whenever $(x_n)_{n \geq 1}$ is a sequence in D that converges to x_0 . [6 marks]

(ii) Use the characterization given in (i) to prove the discontinuity at the origin of the function $f(x) = \begin{cases} \cos \frac{1}{x}, & x \neq 0; \\ 0, & x = 0. \end{cases}$ [4 marks]

(Q4) (i) Assume that D is a closed bounded subset of $\mathbb{R}$. Prove that if $f : D \rightarrow \mathbb{R}$ is continuous then f is bounded on D , and there exist $\alpha, \beta \in D$ such that $f(\alpha) = \max_{x \in D} f(x)$ and $f(\beta) = \min_{x \in D} f(x)$. [5 marks]

(ii) Argue by contradiction to demonstrate that if $f : [a, b] \rightarrow \mathbb{R}$ is continuous then it is uniformly continuous on $[a, b]$. [5 marks]

Please Turn over the page

	Assiut University Faculty of Science Mathematics Dept.	Final Exam 2017-2018 Course: Mathematical and Statistical Packages Course code: MC300	Date: 14/5/2018 Level: Three Time: 2 Hours	
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Question 1: Put True or False for each of the following items (30 marks)

1. To enter a formula into a cell, begin by typing an equal sign.
2. Functions are pre-defined worksheet formulas.
3. Formulas in Excel must be written in a very specific format, referred to as syntax.
4. The second order of precedence is for exponentiation.
5. When the formula in cell **B7 =B4+B5+B6** is copied into cell **C7** the formula will be changed to **= C4+C5+C6**.
6. The error "#####" means Data being referenced is not available.
7. The range **B2:B7** is a range down a column.
8. To keep things clear and simple only add an absolute (\$) cell reference if absolutely necessary.
9. The formula **=ROUND(78.686788,-1)** results in the value 80 .
10. Placing an absolute sign in front of a ranged name (**\$budget**) is incorrect syntax.
11. The columns of the worksheet are named with Numbers.
12. Cells may contain only Labels and Values.
13. The cell address first lists the row name and then the column name.
14. This selected cell is referred to as the **active cell**.
15. The contents of the active cell will also be displayed on the **formula bar**.
16. A cell that is on sheet 3, in the second column third row would be referred to as **Sheet3@B3**.
17. Formatted Display is the number of decimal places that appear in a cell.
18. Formulas can be copied to perform different operations on a corresponding set of data.
19. The function **COUNT(value1,[value2],...)** counts non-blank cells.
20. The Average function ignore the blank cells.
21. TRUE and FALSE are called Boolean Values.
22. SPSS stands for Statistical Package for the Social Sciences.
23. SPSS is capable of handling large amounts of data.
24. SPSS has only two windows Data view and Output view.
25. **Transform** menu includes several options to change current variables.
26. In SPSS, Each column typically represents the data from 1 case.
27. In SPSS, The first column of variable view is Name.
28. In SPSS, you can sort data from **Transform** menu then **Sort Cases**.
29. Descriptive statistics are calculated using the **Analyze** menu.
30. Correlation is used to test the degree of association between variables.

Answer Sheet		
	True	False
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30		

Question 2: (10 marks)

	A	B	C	D	E	F	G
1		MT1	MT2	Final	Total	Honors	Passed
2	Possible points	100	100	200	400		320
3							
4	Blue	79	89	169	337	FALSE	TRUE
5	Jones	85	65	195	345	FALSE	TRUE
6	Grey	60	97	187	344	TRUE	TRUE
7	Mary	10	30	50	90	TRUE	FALSE
8							

Write the following Boolean functions

1. Blue's total and Jones' total are greater than Grey's:
2. Grey's total is not the maximum grade:
3. None of the students passed the course
4. Blue is not an Honors student
5. Blue didn't get a passing grade (320)

Question 3: (10 marks)

1. What are the difference between Data View, Variable View and Output View in SPSS?
2. Some significance tests are very restrictive about the form of data they can accept. What are the different types of measurement?
3. Describe how to test the degree of association between variables by SPSS.
4. Explain how to use SPSS to calculate the frequency and percent of females and males who did and did not have social problems.

Q2.

- a. Maintain two different Algorithm of crossover process with mention the probability of crossover (5 marks)
- b. Maintain two different Algorithm of mutation process with mention the probability of mutation. (5 marks)

Q3. a. Maintain tree type representation of solutions in genetic algorithm. (3 marks)

b. Using genetic algorithm to find the maximum value of the function $(15x - x^2)$ where parameter x varies between 0 and 15. For simplicity, we may assume that x takes only integer values. Using the genetic algorithm procedure in one step and begin with four solutions in initial solutions. (10 marks)

Q4. Discuss the internal structure of Taxi driver Robot. (7 marks)

Q5. Discuss the Tabu search method and maintain the type of memory using in this method and maintain the Tabu search algorithm. (10 marks)

==best wishes==

Dr. Alaa F. Mohamed

Answer the following questions: (50 Marks)

Question 1: Answer the following points (10 Marks)

- 1- Explain the internet "nuts and bolts"?
- 2- Explain the sources of packet delay?
- 3- What are protocols?
- 4- Explain Access network: digital subscriber line (DSL)?

Question 2: Answer the following points (10 Marks)

- 1- What is the network core?
- 2- Explain Packet Switching: queueing delay, loss?
- 3- Define throughput?
- 4- Define and explain traffic intensity?

Question 3: Answer the following points (10 Marks)

- 1- Explain the Internet protocol stack?
- 2- Mention some network applications?
- 3- Explain the application client-server architecture?
- 4- Explain P2P architecture?

Question 4: Answer the following points (10 Marks)

- 1- HTTP is "stateless". What does that mean?
- 2- Compare between persistent HTTP and non-persistent HTTP?
- 3- Give examples of HTTP response status codes?
- 4- Explain the term (web caches) and how it is useful?

Question 5: Answer the following points (10 Marks)

- 1- Give a DNS name resolution example?
- 2- Compare between multiplexing and demultiplexing? Support your answer with a diagram?
- 3- Define and explain the use of ACKs and NAKs?
- 4- Define and explain HOL? Support your answer with a diagram?

جامعة أسيوط	مايو 2018	كود المقرر: 356 رك
كلية العلوم		المقرر : مقدمة فى الحسابات العلمية
قسم الرياضيات		الزمن : ساعتان

Answer the following questions by using MATLAB language: (50 marks)

1- Using Newton's forward difference formula, find $y(0.1)$ using the table below:

x	0.0	0.2	0.4	0.6	0.8
y	1.000	1.22140	1.49182	1.82212	2.22554

2- Solve the differential equation by Adams method (without using nested for loops) at $x=0.2$:

$$\frac{dy}{dt} = t^2 - y, \quad y(0) = 1, \quad h = 0.05.$$

and compare it with the analytic solution $y = -e^{-t} + t^2 - 2t + 2$.

3- Solve the following initial value problem:

$$\frac{d^2u}{dt^2} + 4\frac{du}{dt} + 3u = 0, \quad u(0) = 1, \quad \frac{du}{dt}(0) = 0.$$

4- Let $f(x) = \cos 2x$ and $x_0 = 0$. Determine

- The third Taylor polynomial for f about x_0 .
- Find error bound at $x = 0.2$ and compare it to the actual error.

5- For the well-known Chua's circuit equation in chaotic studies that

$$\dot{x} = \alpha[y - x - f(x)], \quad \dot{y} = x - y + z, \quad \dot{z} = -\beta y - \gamma z, \quad t \in (0, 10),$$

where the nonlinear function $f(x)$ is described by

$$f(x) = bx + 0.5(a-b)(|x+1| - |x-1|) \text{ and } a < b < 0.$$

Write an M-function to describe the equation, and draw the phase trajectory for the parameters $\alpha = 9$, $\beta = 100/7$, $\gamma = 0$, $a = -8/7$, $b = -5/7$, and initial conditions

$$x(0) = -2.121304, \quad y(0) = -0.066170, \quad z(0) = 2.881090.$$

Good Luck

Dr. Tarek Aboelenen



امتحان الفرقة الثالثة شعبة الرياضيات

الزمن : ثلاث ساعات

رقم المقرر ورمزه : ١٣٤٦

المقرر : عمليات عشوائية وتطبيقاتها

أجب عن خمسة أسئلة فقط مما يأتي :- درجة جزء كل سؤال (خمس درجات)

١- (أ) لمجموعة المتغيرات العشوائية المستقلة $X_1, X_2, X_3, \dots$ بفرض أن التوقع الرياضي $E(X_i) = m$ والتباين $V(X_i)$ لكل منها محدود عرف كل من التقارب عن طريق الإحتمال وقانون الأعداد الكبرى (الضعيف).
(ب) بفرض أن $f f s s f s f f s s s f f s f f s$ هي إحدى النتائج الممكنة في محاولات برنولي العشوائية المستقلة بحيث أن $P(s) = p, P(f) = q, p + q = 1$ عرف عملية عشوائية في الفراغ R^2 موضحا ذلك بيانيا .

٢- (أ) في عملية برنولي العشوائية $\{X_n; n > 0\}$ بالإحتمال $p = 0.6$ إذا كان $X = X_1 + X_2$ ، $Y = X_1 + X_3$ احسب الإحتمالات الآتية : $P(X < 2, Y \leq 1)$ ، $P(2X < 3Y)$ ، $P(Y = X)$.
(ب) في السؤال (٢-أ) أوجد العزم الارتباطي بين X ، Y موضحا العلاقة بينهما .

٣- (أ) وضح العلاقة بين عملية برنولي العشوائية $\{X_n; n > 0\}$ و العملية العشوائية $\{Y_n; n \geq 0\}$ حيث أن المتغير Y_n يخضع لتوزيع ذي الحدين واذكر صفات كل منهما ثم عبر مع الاستنتاج عن إحتمال الحادث $(Y_{n+1} = k)$ من خلال إحتمالات الحوادث : $(Y_n = k)$ ، $(Y_n = k - 1)$ لأي عدد صحيح $k > 0$.
(ب) في العملية العشوائية $\{Y_n; n \geq 0\}$ أوجد كل من $E(Y_5)$ ، $E(Y_4^2)$ ، $P(Y_5 = 3, Y_7 = 4, Y_{14} = 9)$.

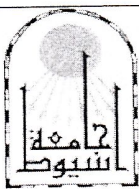
٤- (أ) عرف أزمنة النجاح T_k كعملية عشوائية موضحا العلاقة بينها وبين العملية العشوائية $\{Y_n; n \geq 0\}$ ثم اذكر فقط توزيع المتغير العشوائي T_k .
(ب) - في عملية بواسون العشوائية $\{N_t; t \geq 0\}$ بالمعدل $\lambda = 4$ احسب كل من الإحتمالات الآتية :
 $P(N_{1.5} = 2, N_4 = 5, N_{6.8} = 9)$ ، $P(N_3 = 5, N_7 = 9)$

٥- (أ) في عملية بواسون أو عملية الوصول المعودة $\{N_t; t \geq 0\}$ بالمعدل λ إثبت أن الإحتمال المشروط لعدد الوصول N_t بالنسبة إلى عدد الوصول N_{t+s} لكل $t > 0, s > 0$ يمثل توزيع ذي الحدين .
(ب) عرف العمليات العشوائية المستقلة ثم اثبت أن أي عمليتين مستقلتين لبواسون هو أيضا عملية بواسون .

٦- (أ) في عملية التجديد العشوائية $R = \{R_n; n \in N\}$ حيث N هي فئة الأعداد الصحيحة غير السالبة عرف دالة التجديد ثم عبر عنها من خلال توزيع المتغير R_n مع الاستنتاج .

(ب) في سلسلة ماركوف العشوائية المتقطعة $\{X_n; n \geq 0\}$ عرف مصفوفة الإحتمالات الإنتقالية بصفاتها المعروفة ثم احسب الإحتمال : $P(X_0 = 1, X_1 = 1, X_2 = 0, X_3 = 1, X_4 = 0, X_6 = 0)$ بفرض أن حالات الفراغ $(0, 1)$ والمصفوفة العشوائية

$$P = \begin{pmatrix} 1/2 & 1/2 \\ 1/3 & 2/3 \end{pmatrix} , \text{ ومنتجه الإحتمالات الابتدائية } \pi_0 = (2/5 \quad 3/5)$$

	المقرر: تحليل عددي (٣٢٣) الفرقة: المستوى الثالث الدرجة: ٥٠ درجة التاريخ: ٢٠١٨/٥/٢٩ الزمن: ثلاث ساعات	جامعة أسيوط كلية العلوم - قسم الرياضيات امتحان نهائي الفصل الدراسي الثاني للعام الجامعي ٢٠١٧/٢٠١٨
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Answer five questions only :- (10 marks for every question)

1-a) If the function $g \in C[a, b]$ and $g(x) \in [a, b] \forall x \in [a, b]$ and $g'(x)$ exist with $|g'(x)| \leq k < 1 \forall x \in [a, b]$ prove that the sequence defined by $P_n = g(P_{n-1}), n \geq 1$ will converge to the unique fixed point P and also $|P_{n+1} - P_n| \leq k^n |P_1 - P_0|$.

1-b) Verify that when Newton's method is used to compute $\sqrt{A}, A > 0$ (By solving the equation : $f(x) = x^2 - A$). The sequence of iterates is defined by : $x_{n+1} = (x_n + \frac{A}{x_n})/2$, and show that if the sequence $\{x_n\}$ is defined as the previous problem, then this method is quadratically convergence.

2-a) Derive Lagrange interpolation formula of degree n and write the error of the method.

2-b) For the given function $f(x) = \cos \pi x$ let $x_0 = -1, x_1 = 0, x_2 = 1$ construct the suitable interpolation polynomial and find the actual error.

3) Derive the formula of the Newton's interpolatory divided difference method and use this formula to obtain a polynomial of least degree that fits the values shown:

x	0	1	2	4	6
$f(x)$	1	9	23	93	259

من فضلك انظر خلف الورقة

السؤال الرابع :-

أ) يعرف الطي للدالتين $f(x)$, $g(x)$ كالآتي

$$f * g = \int_{-\infty}^{\infty} f(u) g(x-u) du$$

برهن علي أن تحويل فوريير للطرف الأيمن هو حاصل ضرب تحويل فوريير للدالتين $f(x)$, $g(x)$

ب) أوجد تحويل فوريير للدالة $f(x) = \begin{cases} 1 & |x| < a \\ 0 & |x| > a \end{cases}$ وأرسم $f(x)$ كذلك تحويلها عند $a = 3$ وأوجد

$$\int_{-\infty}^{\infty} \frac{\sin u}{u} du \quad \text{كذلك} \quad \int_{-\infty}^{\infty} \frac{\sin \alpha a \cos \alpha x}{\alpha} d\alpha$$

ج) ترك خيط لانهائي من السكون وكانت أزاحته الابتدائية عن محور x هي $f(x)$ أوجد الإزاحه عند أي زمن .

انتهت الأسئلة مع تمنياتنا بالتوفيق ،،،،

لجنة الممتحنين :- أ. د/ نجاه عبد الرحمن حسين ، أ. د/ فاروق علي السيد



الامتحان النهائي للفصل الدراسي الثاني للعام الجامعي ٢٠١٧/٢٠١٨ م
 للفرقة : الثالثة
 الشعبة : الرياضيات
 التاريخ : ٢٠١٨/٥/٢٤ م

الزمن : ساعتان

الدرجة الكلية : ٥٠ درجة

درجة كل سؤال : ١٧ درجة

أسم المقرر : الطرق الرياضية
 رقم المقرر ورمزه : ٣٣٤ ر

أجب عن ثلاثة أسئلة فقط مما يأتي :-

السؤال الأول :-

أوجد تحويل لابلاس للمشتقة التفاضلية للدالة $F(t)$ عند نقط الاتصال والانفصال للدالة .

أبرهن علي أن

$$\lim_{t \rightarrow 0} F(t) = \lim_{s \rightarrow \infty} s f(s)$$

$$\lim_{t \rightarrow \infty} F(t) = \lim_{s \rightarrow 0} s f(s)$$

$$\Gamma\left(\frac{1}{2}\right) = \sqrt{\pi}, \quad \int_0^{\infty} \delta(t) dt = 1, \quad L \sin \sqrt{t} = \frac{\sqrt{\pi}}{3} e^{-\frac{1}{4s}} s^{\frac{3}{2}}$$

السؤال الثاني :-

حل المعادلات الآتية :

$$t Y''(t) + Y'(t) + 4t Y(t) = 0, \quad y(0) = 3, y'(0) = 0$$

$$\frac{\partial U}{\partial x} = 2 \frac{\partial U}{\partial t} + U, \quad x > 0, t > 0 \quad U(x, 0) = 6 e^{-3x}$$

$$\int_0^t Y(u) Y(t-u) du = 16 \sin 4t$$

السؤال الثالث :-

(أ) فك الدالة $f(x) = x^2$, $0 < x < 2\pi$ بدلالة متسلسلة فوريير ثم أحسب المجموع

$$1 + \frac{1}{2^2} + \frac{1}{3^2} + \frac{1}{4^2} + \dots$$

(ب) صفيحة علي شكل دائري نصف قطرها الوحدة ووجهيها معزولين ونصف محيطها محفوظ عند درجة حرارة u_1

والآخر عند u_2 أوجد حالة الأتزان الحراري .

من فضلك أنظر بقية الأسئلة خلف الورقة ،،،،،



Answer the following questions (50 marks)

Q1.	Complete the following: (1)..... is a representation of a two-dimensional image as a finite set of digital values, called picture elements or pixels - Common image formats include.....(2).... ,(3)..... ,(4)..... (5)..... creates a Distance tool a draggable, resizable line that measures the distance between its endpoints. (6)..... These are the result of objects that are self-luminous, such as stars and light bulbs. (7).....the resulting output pixel is computed as a sum of products of the pixel values and mask coefficients in the pixel's neighborhood in the original image. - The Sobel operators used to compute edges are(8)..... ,(9)..... - Edge detector should have:(10)..... ,(11)..... - Types of noise are(12)..... ,(13)....	(13 marks)
Q2.	a) Compute Z from the following matlab script (6 marks) <pre> x = [150 10 90;80 50 60;121 160 20] y = [-1 0 1;-2 0 2;-1 0 1] z = imfilter(x,y,'corr') </pre> b) What is the Delta compression and compute the compressed data of the data (6 marks) 220 321 335 211 250 200 233 214 232 212	(12 marks)
Q3.	a) Write the MATLAB code used to: (4 marks) - Read any image then use affine transformation matrix for each of the operations below: - Flip the image right to left - Translation by [25, 15] pixels b) What are the main differences between: (8 marks) - Global thresholding and optimal thresholding. - Raster and vector image . - Interpixel redundancy and Psychovisual redundancy	(12 marks)

(Q5) (i) Assume that U, V are open intervals and let $f : U \rightarrow \mathbb{R}$ and $g : V \rightarrow \mathbb{R}$ be two differentiable functions such that $f(U) \subset V$. Prove that $g \circ f$ is differentiable on U and that $(g \circ f)' = (g' \circ f) \cdot f'$ [5 marks]

(ii) Prove that the function $f(x) := \frac{1}{x}$ is differentiable on $]0, \infty[$ but not uniformly continuous therein. [5 marks]

(Q6) (i) State and prove Rolle's theorem then use it to prove the mean value theorem. [6 marks]

(ii) Let I be an open interval. Apply the mean value theorem to prove that a function differentiable on I is

1. increasing if and only if $f' \geq 0$ on I ,

2. decreasing if and only if $f' \leq 0$ on I .

[4 marks]

With the best of luck,

Prof. Rashwan A. Rashwan,

Dr. Ahmed A. Abdelhakim



Time: 3 hours

Total mark: 50

Answer *only five* of the following questions:

(Q1) (i) Suppose that O_i , $i \geq 1$, are open subsets of $\mathbb{R}$. Prove that $\cup_{i \geq 1} O_i$ is also open in $\mathbb{R}$. [5 marks]

(ii) Let $S \subset \mathbb{R}$. Show that S is closed if and only if S contains the limit point of every convergent sequence of elements of S . [5 marks]

(Q2) (i) Prove that a sequence of real numbers converges if and only if it is a Cauchy sequence. [6 marks]

(ii) Show that if $(x_n)_{n \geq 1} \subset \mathbb{R}$ is a monotonically increasing sequence that is bounded above, then $x_n \rightarrow \sup_{n \geq 1} x_n$, as $n \rightarrow \infty$. [4 marks]

(Q3) (i) Show that $f : D \subset \mathbb{R} \rightarrow \mathbb{R}$ is continuous at $x_0 \in D$ if and only if the sequence $(f(x_n))_{n \geq 1}$ converges to $f(x_0)$ whenever $(x_n)_{n \geq 1}$ is a sequence in D that converges to x_0 . [6 marks]

(ii) Use the characterization given in (i) to prove the discontinuity at the origin of the function $f(x) = \begin{cases} \cos \frac{1}{x}, & x \neq 0; \\ 0, & x = 0. \end{cases}$ [4 marks]

(Q4) (i) Assume that D is a closed bounded subset of $\mathbb{R}$. Prove that if $f : D \rightarrow \mathbb{R}$ is continuous then f is bounded on D , and there exist $\alpha, \beta \in D$ such that $f(\alpha) = \max_{x \in D} f(x)$ and $f(\beta) = \min_{x \in D} f(x)$. [5 marks]

(ii) Argue by contradiction to demonstrate that if $f : [a, b] \rightarrow \mathbb{R}$ is continuous then it is uniformly continuous on $[a, b]$. [5 marks]

Please Turn over the page

Timer/Counter
Interrupt Mask
Register – TIMSK

Bit	7	6	5	4	3	2	1	0	
	OCIE2	TOIE2	OCIE1	OCIE1A	OCIE1B	TOIE1	OCIE0	TOIE0	TIMSK
Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

Bit 1 – OCIE0: Timer/Counter0 Output Compare Match Interrupt Enable
Bit 0 – TOIE0: Timer/Counter0 Overflow Interrupt Enable

Timer/Counter
Interrupt Flag Register
– TIFR

Bit	7	6	5	4	3	2	1	0	
	OCF2	TOV2	ICF1	OCF1A	OCF1B	TOV1	OCF0	TOV0	TIFR
Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

Bit 1 – OCF0: Output Compare Flag 0
Bit 0 – TOV0: Timer/Counter0 Overflow Flag

Timer/Counter1
Control Register A –
TCCR1A

Bit	7	6	5	4	3	2	1	0	
	COM1A1	COM1A0	COM1B1	COM1B0	FOC1A	FOC1B	WGM11	WGM10	TCCR1A
Read/Write	R/W	R/W	R/W	R/W	W	W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

Bit 7:6 – COM1A1:0: Compare Output Mode for Compare unit A
Bit 5:4 – COM1B1:0: Compare Output Mode for Compare unit B
Bit 3 – FOC1A: Force Output Compare for Compare unit A
Bit 2 – FOC1B: Force Output Compare for Compare unit B
Bit 1:0 – WGM11:0: Waveform Generation Mode

CS02	CS01	CS00	Description
0	0	0	No clock source (Timer/Counter stopped).
0	0	1	clk_{RCY} (No prescaling)
0	1	0	$clk_{RCY}/8$ (From prescaler)
0	1	1	$clk_{RCY}/64$ (From prescaler)
1	0	0	$clk_{RCY}/256$ (From prescaler)
1	0	1	$clk_{RCY}/1024$ (From prescaler)
1	1	0	External clock source on T0 pin. Clock on falling edge.
1	1	1	External clock source on T0 pin. Clock on rising edge.

COM1A1/COM1B1	COM1A0/COM1B0	Description
0	0	Normal port operation, OC1A/OC1B disconnected.
0	1	Toggle OC1A/OC1B on compare match
1	0	Clear OC1A/OC1B on compare match (Set output to low level)
1	1	Set OC1A/OC1B on compare match (Set output to high level)

Mode	WGM13	WGM12 (CTC1)	WGM11 (PWM11)	WGM10 (PWM10)	Timer/Counter Mode of Operation	TOP	Update of OCR1x	TOV1 Flag Set on
0	0	0	0	0	Normal	0xFFFF	Immediate	MAX
1	0	0	0	1	PWM, Phase Correct, 8-bit	0x00FF	TOP	BOTTOM
2	0	0	1	0	PWM, Phase Correct, 9-bit	0x01FF	TOP	BOTTOM
3	0	0	1	1	PWM, Phase Correct, 10-bit	0x03FF	TOP	BOTTOM
4	0	1	0	0	CTC	OCR1A	Immediate	MAX
5	0	1	0	1	Fast PWM, 8-bit	0x00FF	BOTTOM	TOP
6	0	1	1	0	Fast PWM, 9-bit	0x01FF	BOTTOM	TOP
7	0	1	1	1	Fast PWM, 10-bit	0x03FF	BOTTOM	TOP
8	1	0	0	0	PWM, Phase and Frequency Correct	ICR1	BOTTOM	BOTTOM
9	1	0	0	1	PWM, Phase and Frequency Correct	OCR1A	BOTTOM	BOTTOM
10	1	0	1	0	PWM, Phase Correct	ICR1	TOP	BOTTOM
11	1	0	1	1	PWM, Phase Correct	OCR1A	TOP	BOTTOM
12	1	1	0	0	CTC	ICR1	Immediate	MAX
13	1	1	0	1	Reserved	–	–	–
14	1	1	1	0	Fast PWM	ICR1	BOTTOM	TOP
15	1	1	1	1	Fast PWM	OCR1A	BOTTOM	TOP

Timer/Counter1
Control Register B –
TCCR1B

Bit	7	6	5	4	3	2	1	0	
	ICNC1	ICES1	–	WGM13	WGM12	CS12	CS11	CS10	TCCR1B
Read/Write	R/W	R/W	R	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

Bit 7 – ICNC1: Input Capture Noise Canceler
Bit 6 – ICES1: Input Capture Edge Select
Bit 5 – Reserved Bit
Bit 4:3 – WGM13:2: Waveform Generation Mode
Bit 2:0 – CS12:0: Clock Select

CS12	CS11	CS10	Description
0	0	0	No clock source (Timer/Counter stopped).
0	0	1	clk _{IO} /1 (No prescaling)
0	1	0	clk _{IO} /8 (From prescaler)
0	1	1	clk _{IO} /64 (From prescaler)
1	0	0	clk _{IO} /256 (From prescaler)
1	0	1	clk _{IO} /1024 (From prescaler)
1	1	0	External clock source on T1 pin. Clock on falling edge.
1	1	1	External clock source on T1 pin. Clock on rising edge.

Timer/Counter1 – TCNT1H and TCNT1L

Bit	7	6	5	4	3	2	1	0	
	TCNT1[15:8]								TCNT1H
	TCNT1[7:0]								TCNT1L
Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

Output Compare Register 1 B – OCR1BH and OCR1BL

Bit	7	6	5	4	3	2	1	0	
	OCR1B[15:8]								OCR1BH
	OCR1B[7:0]								OCR1BL
Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

Input Capture Register 1 – ICR1H and ICR1L

Bit	7	6	5	4	3	2	1	0	
	ICR1[15:8]								ICR1H
	ICR1[7:0]								ICR1L
Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

Timer/Counter Interrupt Mask Register – TIMSK⁽¹⁾

Bit	7	6	5	4	3	2	1	0	
	OCIE2	OCIE1	OCIE1A	OCIE1B	TOIE1	OCIE0	TOIE0		TIMSK
Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

- Bit 5 – OCIE1: Timer/Counter1, Input Capture Interrupt Enable
 Bit 4 – OCIE1A: Timer/Counter1, Output Compare A Match Interrupt Enable
 Bit 3 – OCIE1B: Timer/Counter1, Output Compare B Match Interrupt Enable
 Bit 2 – TOIE1: Timer/Counter1, Overflow Interrupt Enable

Timer/Counter Interrupt Flag Register – TIFR

Bit	7	6	5	4	3	2	1	0	
	OCF2	TOV2	ICF1	OCF1A	OCF1B	TOV1	OCF0	TOV0	TIFR
Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

- Bit 5 – ICF1: Timer/Counter1, Input Capture Flag
 Bit 4 – OCF1A: Timer/Counter1, Output Compare A Match Flag
 Bit 3 – OCF1B: Timer/Counter1, Output Compare B Match Flag
 Bit 2 – TOV1: Timer/Counter1, Overflow Flag

USART

Operating Mode	Equation for Calculating Baud Rate ⁽¹⁾	Equation for Calculating UBRR Value
Asynchronous Normal Mode (U2X = 0)	$BAUD = \frac{f_{osc}}{16(UBRR + 1)}$	$UBRR = \frac{f_{osc}}{16BAUD} - 1$
Asynchronous Double Speed Mode (U2X = 1)	$BAUD = \frac{f_{osc}}{8(UBRR + 1)}$	$UBRR = \frac{f_{osc}}{8BAUD} - 1$
Synchronous Master Mode	$BAUD = \frac{f_{osc}}{2(UBRR + 1)}$	$UBRR = \frac{f_{osc}}{2BAUD} - 1$

USART I/O Data Register – UDR

Bit	7	6	5	4	3	2	1	0	
	RXB[7:0]								UDR (Read)
	TXB[7:0]								UDR (Write)
Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

Timer/Counter
Interrupt Mask
Register – TIMSK

Bit	7	6	5	4	3	2	1	0	
	OCIE2	TOIE2	OCIE1	OCIE1A	OCIE1B	TOIE1	OCIE0	TOIE0	TIMSK
Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

Bit 1 – OCIE0: Timer/Counter0 Output Compare Match Interrupt Enable
Bit 0 – TOIE0: Timer/Counter0 Overflow Interrupt Enable

Timer/Counter
Interrupt Flag Register
– TIFR

Bit	7	6	5	4	3	2	1	0	
	OCF2	TOV2	ICF1	OCF1A	OCF1B	TOV1	OCF0	TOV0	TIFR
Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

Bit 1 – OCF0: Output Compare Flag 0
Bit 0 – TOV0: Timer/Counter0 Overflow Flag

Timer/Counter1
Control Register A –
TCCR1A

Bit	7	6	5	4	3	2	1	0	
	COM1A1	COM1A0	COM1B1	COM1B0	FOC1A	FOC1B	WGM11	WGM10	TCCR1A
Read/Write	R/W	R/W	R/W	R/W	W	W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

Bit 7:6 – COM1A1:0: Compare Output Mode for Compare unit A
Bit 5:4 – COM1B1:0: Compare Output Mode for Compare unit B
Bit 3 – FOC1A: Force Output Compare for Compare unit A
Bit 2 – FOC1B: Force Output Compare for Compare unit B
Bit 1:0 – WGM11:0: Waveform Generation Mode

CS02	CS01	CS00	Description
0	0	0	No clock source (Timer/Counter stopped).
0	0	1	$clk_{IO}/1$ (No prescaling)
0	1	0	$clk_{IO}/8$ (From prescaler)
0	1	1	$clk_{IO}/64$ (From prescaler)
1	0	0	$clk_{IO}/256$ (From prescaler)
1	0	1	$clk_{IO}/1024$ (From prescaler)
1	1	0	External clock source on T0 pin, Clock on falling edge.
1	1	1	External clock source on T0 pin, Clock on rising edge.

COM1A1/COM1B1	COM1A0/COM1B0	Description
0	0	Normal port operation, OC1A/OC1B disconnected.
0	1	Toggle OC1A/OC1B on compare match
1	0	Clear OC1A/OC1B on compare match (Set output to low level)
1	1	Set OC1A/OC1B on compare match (Set output to high level)

Mode	WGM13	WGM12 (CTC1)	WGM11 (PWM11)	WGM10 (PWM10)	Timer/Counter Mode of Operation	TOP	Update of OCR1x	TOV1 Flag Set on
0	0	0	0	0	Normal	0xFFFF	Immediate	MAX
1	0	0	0	1	PWM, Phase Correct, 8-bit	0x00FF	TOP	BOTTOM
2	0	0	1	0	PWM, Phase Correct, 9-bit	0x01FF	TOP	BOTTOM
3	0	0	1	1	PWM, Phase Correct, 10-bit	0x03FF	TOP	BOTTOM
4	0	1	0	0	CTC	OCR1A	Immediate	MAX
5	0	1	0	1	Fast PWM, 8-bit	0x00FF	BOTTOM	TOP
6	0	1	1	0	Fast PWM, 9-bit	0x01FF	BOTTOM	TOP
7	0	1	1	1	Fast PWM, 10-bit	0x03FF	BOTTOM	TOP
8	1	0	0	0	PWM, Phase and Frequency Correct	ICR1	BOTTOM	BOTTOM
9	1	0	0	1	PWM, Phase and Frequency Correct	OCR1A	BOTTOM	BOTTOM
10	1	0	1	0	PWM, Phase Correct	ICR1	TOP	BOTTOM
11	1	0	1	1	PWM, Phase Correct	OCR1A	TOP	BOTTOM
12	1	1	0	0	CTC	ICR1	Immediate	MAX
13	1	1	0	1	Reserved	–	–	–
14	1	1	1	0	Fast PWM	ICR1	BOTTOM	TOP
15	1	1	1	1	Fast PWM	OCR1A	BOTTOM	TOP

Timer/Counter1
Control Register B –
TCCR1B

Bit	7	6	5	4	3	2	1	0	
	ICNC1	ICES1	–	WGM13	WGM12	CS12	CS11	CS10	TCCR1B
Read/Write	R/W	R/W	R	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

Bit 7 – ICNC1: Input Capture Noise Canceler
Bit 6 – ICES1: Input Capture Edge Select
Bit 5 – Reserved Bit
Bit 4:3 – WGM13:2: Waveform Generation Mode
Bit 2:0 – CS12:0: Clock Select

CS12	CS11	CS10	Description
0	0	0	No clock source (Timer/Counter stopped).
0	0	1	$clk_{IO}/1$ (No prescaling)
0	1	0	$clk_{IO}/8$ (From prescaler)
0	1	1	$clk_{IO}/64$ (From prescaler)
1	0	0	$clk_{IO}/256$ (From prescaler)
1	0	1	$clk_{IO}/1024$ (From prescaler)
1	1	0	External clock source on T1 pin. Clock on falling edge.
1	1	1	External clock source on T1 pin. Clock on rising edge.

Timer/Counter1 – TCNT1H and TCNT1L

Bit	7	6	5	4	3	2	1	0	
	TCNT1[15:8]								TCNT1H
	TCNT1[7:0]								TCNT1L
Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

Output Compare Register 1 B – OCR1BH and OCR1BL

Bit	7	6	5	4	3	2	1	0	
	OCR1B[15:8]								OCR1BH
	OCR1B[7:0]								OCR1BL
Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

Input Capture Register 1 – ICR1H and ICR1L

Bit	7	6	5	4	3	2	1	0	
	ICR1[15:8]								ICR1H
	ICR1[7:0]								ICR1L
Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

Timer/Counter Interrupt Mask Register – TIMSK⁽¹⁾

Bit	7	6	5	4	3	2	1	0	
	OCIE2	TOIE2	TICIE1	OCIE1A	OCIE1B	TOIE1	OCIE0	TOIE0	TIMSK
Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

- Bit 5 – TICIE1: Timer/Counter1, Input Capture Interrupt Enable
 Bit 4 – OCIE1A: Timer/Counter1, Output Compare A Match Interrupt Enable
 Bit 3 – OCIE1B: Timer/Counter1, Output Compare B Match Interrupt Enable
 Bit 2 – TOIE1: Timer/Counter1, Overflow Interrupt Enable

Timer/Counter Interrupt Flag Register – TIFR

Bit	7	6	5	4	3	2	1	0	
	OCF2	TOV2	ICF1	OCF1A	OCF1B	TOV1	OCF0	TOV0	TIFR
Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

- Bit 5 – ICF1: Timer/Counter1, Input Capture Flag
 Bit 4 – OCF1A: Timer/Counter1, Output Compare A Match Flag
 Bit 3 – OCF1B: Timer/Counter1, Output Compare B Match Flag
 Bit 2 – TOV1: Timer/Counter1, Overflow Flag

USART

Operating Mode	Equation for Calculating Baud Rate ⁽¹⁾	Equation for Calculating UBRR Value
Asynchronous Normal Mode (U2X = 0)	$BAUD = \frac{f_{osc}}{16(UBRR + 1)}$	$UBRR = \frac{f_{osc}}{16BAUD} - 1$
Asynchronous Double Speed Mode (U2X = 1)	$BAUD = \frac{f_{osc}}{8(UBRR + 1)}$	$UBRR = \frac{f_{osc}}{8BAUD} - 1$
Synchronous Master Mode	$BAUD = \frac{f_{osc}}{2(UBRR + 1)}$	$UBRR = \frac{f_{osc}}{2BAUD} - 1$

USART I/O Data Register – UDR

Bit	7	6	5	4	3	2	1	0	
	RXB[7:0]								UDR (Read)
	TXB[7:0]								UDR (Write)
Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

USART Control and Status Register A – UCSRA

Bit	7	6	5	4	3	2	1	0	
	RXC	TXC	UDRE	FE	DOR	PE	U2X	MPCM	UCSRA
Read/Write	R	R/W	R	R	R	R	R/W	R/W	
Initial Value	0	0	1	0	0	0	0	0	

- Bit 7 – RXC: USART Receive Complete
- Bit 6 – TXC: USART Transmit Complete
- Bit 5 – UDRE: USART Data Register Empty
- Bit 4 – FE: Frame Error
- Bit 3 – DOR: Data OverRun
- Bit 2 – PE: Parity Error
- Bit 1 – U2X: Double the USART Transmission Speed
- Bit 0 – MPCM: Multi-processor Communication Mode

USART Control and Status Register B – UCSRB

Bit	7	6	5	4	3	2	1	0	
	RXCIE	TXCIE	UDRIE	RXEN	TXEN	UCSZ2	RXB8	TXB8	UCSRB
Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R	R/W	
Initial Value	0	0	0	0	0	0	0	0	

- Bit 7 – RXCIE: RX Complete Interrupt Enable
- Bit 6 – TXCIE: TX Complete Interrupt Enable
- Bit 5 – UDRIE: USART Data Register Empty Interrupt Enable
- Bit 4 – RXEN: Receiver Enable
- Bit 3 – TXEN: Transmitter Enable
- Bit 2 – UCSZ2: Character Size
- Bit 1 – RXB8: Receive Data Bit 8
- Bit 0 – TXB8: Transmit Data Bit 8

USART Control and Status Register C – UCSRC

Bit	7	6	5	4	3	2	1	0	
	URSEL	UMSEL	UPM1	UPM0	USBS	UCSZ1	UCSZ0	UCPOL	UCSRC
Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	
Initial Value	1	0	0	0	0	1	1	0	

- Bit 7 – URSEL: Register Select
- Bit 6 – UMSEL: USART Mode Select
- Bit 5:4 – UPM1:0: Parity Mode
- Bit 3 – USBS: Stop Bit Select
- Bit 2:1 – UCSZ1:0: Character Size
- Bit 0 – UCPOL: Clock Polarity

UMSEL	Mode
0	Asynchronous Operation
1	Synchronous Operation

USBS	Stop Bit(s)
0	1-bit
1	2-bit

UPM1	UPM0	Parity Mode
0	0	Disabled
0	1	Reserved
1	0	Enabled, Even Parity
1	1	Enabled, Odd Parity

UCPOL	Transmitted Data Changed (Output of Tx D Pin)	Received Data Sampled (Input on Rx D Pin)
0	Rising XCK Edge	Falling XCK Edge
1	Falling XCK Edge	Rising XCK Edge

Table 66. UCSZ Bits Settings

UCSZ2	UCSZ1	UCSZ0	Character Size
0	0	0	5-bit
0	0	1	6-bit
0	1	0	7-bit
0	1	1	8-bit
1	0	0	Reserved
1	0	1	Reserved
1	1	0	Reserved
1	1	1	9-bit

USART Baud Rate Registers – UBRRL and UBRRH

Bit	15	14	13	12	11	10	9	8	
	URSEL	-	-	-	-	UBRR[11:9]	-	-	UBRRH
	-	-	-	-	-	UBRR[7:0]	-	-	UBRRL
Read/Write	R/W	R	R	R	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	



Operation Research326 R

11-5-2018

Third Level: Computer Science Section

Time: 3 hours

Total Degree (50 marks)

Science Faculty

Mathematical Department

Answer the following Questions:

1-Use the Simplex method to solve the following linear programming

Maximize $Z = 10x_1 + 11x_2$

Subject to $x_1 + 2x_2 \leq 150$, $3x_1 + 4x_2 \leq 200$, $6x_1 + x_2 \leq 175$

and $x_1, x_2 \geq 0$

(10 marks)

2) Use the graphical and the algebraic method to solve the problem

Max $f(\underline{x}) = 5x_1 + 7x_2$ Subject to $5x_1 + 8x_2 \leq 24$, $x_1 + x_2 \leq 4$,

$10x_1 + 7x_2 \leq 35$ and $x_1, x_2 \geq 0$

(12.5marks)

3) Use the Lagrange multiplier method to find the extreme points of the problem

Minimize $f(\underline{x}) = x_1^2 + x_2^2 - 3x_1x_2$

Subject to $g(\underline{x}) = x_1^2 + x_2^2 - 8 = 0$.

(12.5marks)

4) Use the Hessian Matrix to find the local points of the problem

$f(\underline{x}) = f(x_1, x_2) = x_1^3 + x_2^3 + 2x_1^2 + 4x_2^2 + 6$

(10marks)

5) Find the local Points

$f(x) = 3x^4 - 20x^3 + 36x^2 + 16$ (5marks)

Best Wishes

Dr. Alaa Fahim



Operation Research326 R

11-5-2018

Third Level: Computer Science Section

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Best Wishes

Dr. Alaa Fahim

اجب عن خمسة فقط من الاسئلة الاتية :- (10 درجات لكل سؤال : بواقع 5 درجات لكل فقرة)

(1) (i) اوجد الحل العام للمعادلة : $p_1 + 3p_2 + 2p_3(1 + \sqrt{x_1 + x_2 + x_3 - u}) = 6$
(ii) اوجد الحل الخاص للمعادلة : $(y - z)[2xyp + (x^2 - y^2)q] + z(x^2 - y^2) = 0$
الذي يمر خلال المنحنى $y = 0, x^3 = z^2$

(2) اوجد الحل العام لكل من المعادلتين التفاضليتين الجزئيتين الاتيتين :-
(i) $(D_1^3 - D_1^2 D_2 - D_1 D_2^2 + D_2^3)z = \log(x + y)$
(ii) $(D_1^2 - a^2 D_2^2)z = x^2 + y^2$, ثابت مطلق a

(3) اوجد الحل العام لكل من المعادلتين التفاضليتين الجزئيتين الاتيتين :-
(i) $(D_1^2 D_2 + D_2^2 - 2)z = e^{2y} \sin 3x - e^x \cos 2y$
(ii) $(D_1^2 - D_2^2 - D_1 - 3D_2 - 2)z = e^{2x-3y} + x + y + 1$

(4) (i) احسب التكاملات الاتية :-
(a) $\int_0^{\infty} x^{-\frac{1}{3}}(1 + 2x)^{-3} dx$ (b) $\int_0^1 \sqrt{\log \frac{1}{x}} dx$

(ii) اثبت ان :-
(a) $\tan^{-1} x = x {}_2F_1(1, \frac{1}{2}; \frac{3}{2}; -x^2)$
(b) $(a - b) {}_2F_1(a, b; c; x) = a {}_2F_1(a + 1, b; c; x) - b {}_2F_1(a, b + 1; c; x)$

(5) اثبت ان دوال بسل من النوع الاول $J_n(x)$ تحقق الاتي :-
(i) $J_{-\frac{1}{2}}(x) = \sqrt{\frac{2}{\pi x}} \cos x$, (ii) $\int x^n J_{n-1}(x) dx = x^n J_n(x) + c$

(6) (i) اثبت ان كثيرات حدود لجندر $P_n(x)$ تحقق :-
(ii) احسب التكاملات الاتية :-
(a) $\int_{-1}^1 x P_n(x) P_{n+1}(x) dx$, (b) $\int_{-1}^1 x^2 P_n(x) P_{n+1}(x) dx$, (c) $\int_{-1}^1 x^2 P_n(x) dx$



أجب عن أسئلة الآتية :- (كل سؤال ١٠ درجات)

(١) (أ) أثبت قاعدة التضعيف لدالة جاما $\sqrt{\pi} \Gamma(2x) = 2^{2x-1} \Gamma(x) \Gamma\left(x + \frac{1}{2}\right), x > 0$

ثم استخدمها فى إثبات أن: $\Gamma\left(\frac{5}{6}\right) \left[\Gamma\left(\frac{1}{3}\right)\right]^2 = 2 \sqrt[3]{2} \sqrt{\frac{\pi^3}{3}}$

(ب) باستخدام دوال جاما و بيتا أوجد التكاملات الآتية: (i) $\int_0^{\frac{\pi}{2}} \sqrt{\tan \theta} d\theta$ (ii) $\int_0^{\infty} \frac{\sqrt{x}}{e^{x^3}} dx$

(٢) (أ) أثبت أن: $\Gamma(x) \Gamma(1-x) = \frac{\pi}{\sin \pi x}, 0 < x < 1$ ومن ثم أثبت أن

$\Gamma\left(x + \frac{1}{2}\right) \Gamma\left(\frac{1}{2} - x\right) = \frac{\pi}{\cos \pi x}$

(ب) أثبت أن:

(i) $\sqrt{1-x^2} T_n(x) = U_{n+1}(x) - x U_n(x),$

(ii) $(1-x^2) U'_n(x) = -n x U_n(x) + n U_{n-1}(x)$

(٣) أثبت أن:

(i) ${}_2F_1(\alpha, \beta; \gamma, x) = (1-x)^{-\beta} {}_2F_1\left(\gamma - \alpha, \beta; \gamma, \frac{x}{x-1}\right)$

(ii) ${}_1F_1\left(\frac{1}{2}; \frac{3}{2}, -x^2\right) = \frac{\sqrt{\pi}}{2x} \operatorname{erf}(x)$ حيث أن: $\operatorname{erf}(x) = \frac{2}{\sqrt{\pi}} \int_0^x e^{-t^2} dt$ هى دالة الخطأ

(iii) ${}_1F_1(\alpha + 1; \gamma, x) - {}_1F_1(\alpha; \gamma, x) - \frac{x}{\gamma} {}_1F_1(\alpha + 1; \gamma + 1, x) = 0$

(٤) (أ) أوجد مفكوك ليجندر للدالة: $f(x) = x^3$

(ب) أثبت أن: $H_n(x) = (-1)^n e^{x^2} \frac{d^n}{dx^n} (e^{-x^2})$ حيث $H_n(x)$ كثيرة حدود هيرميت.

(ج) أثبت أن: $J_{\frac{1}{2}}(x) = \sqrt{\frac{2}{\pi}} \frac{\sin x}{\sqrt{x}}$

(٥) (أ) باستخدام الصيغة التكاملية لدوال بسل أثبت أن: $\int_0^{\infty} e^{-3x} J_0(4x) dx = \frac{1}{5}$

(ب) أوجد الحل العام لمعادلة بسل التفاضلية:

$x^2 \frac{d^2 y}{dx^2} + x \frac{dy}{dx} + (x^2 - n^2)y = 0$



Question 1: Put *True* or *False* for each of the following items (30 marks)

1. To enter a formula into a cell, begin by typing an equal sign.
2. Functions are pre-defined worksheet formulas.
3. Formulas in Excel must be written in a very specific format, referred to as syntax.
4. The second order of precedence is for exponentiation.
5. When the formula in cell **B7** **=B4+B5+B6** is copied into cell **C7** the formula will be changed to **= C4+C5+C6**.
6. The error "#####" means Data being referenced is not available.
7. The range **B2:B7** is a range down a column.
8. To keep things clear and simple only add an absolute (\$) cell reference if absolutely necessary.
9. The formula **=ROUND(78.686788,-1)** results in the value 80 .
10. Placing an absolute sign in front of a ranged name (**\$budget**) is incorrect syntax.
11. The columns of the worksheet are named with Numbers.
12. Cells may contain only Labels and Values.
13. The cell address first lists the row name and then the column name.
14. This selected cell is referred to as the **active cell**.
15. The contents of the active cell will also be displayed on the **formula bar**.
16. A cell that is on sheet 3, in the second column third row would be referred to as **Sheet3@B3**.
17. Formatted Display is the number of decimal places that appear in a cell.
18. Formulas can be copied to perform different operations on a corresponding set of data.
19. The function **COUNT(value1,[value2],...)** counts non-blank cells.
20. The Average function ignore the blank cells.
21. TRUE and FALSE are called Boolean Values.
22. SPSS stands for Statistical Package for the Social Sciences.
23. SPSS is capable of handling large amounts of data.
24. SPSS has only two windows Data view and Output view.
25. **Transform** menu includes several options to change current variables.
26. In SPSS, Each column typically represents the data from 1 case.
27. In SPSS, The first column of variable view is Name.
28. In SPSS, you can sort data from **Transform** menu then **Sort Cases**.
29. Descriptive statistics are calculated using the **Analyze** menu.
30. Correlation is used to test the degree of association between variables.

Answer Sheet		
	True	False
1		
2		
3		
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9		
10		
11		
12		
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30		

Question 2: (10 marks)

	A	B	C	D	E	F	G
1		MT1	MT2	Final	Total	Honors	Passed
2	Possible points	100	100	200	400		320
3							
4	Blue	79	89	169	337	FALSE	TRUE
5	Jones	85	65	195	345	FALSE	TRUE
6	Grey	60	97	187	344	TRUE	TRUE
7	Mary	10	30	50	90	TRUE	FALSE
8							

Write the following Boolean functions

1. Blue's total and Jones' total are greater than Grey's:
2. Grey's total is not the maximum grade:
3. None of the students passed the course
4. Blue is not an Honors student
5. Blue didn't get a passing grade (320)

Question 3: (10 marks)

1. What are the difference between Data View, Variable View and Output View in SPSS?
2. Some significance tests are very restrictive about the form of data they can accept. What are the different types of measurement?
3. Describe how to test the degree of association between variables by SPSS.
4. Explain how to use SPSS to calculate the frequency and percent of females and males who did and did not have social problems.

Q2.

- a. Maintain two different Algorithm of crossover process with mention the probability of crossover (5 marks)
- b. Maintain two different Algorithm of mutation process with mention the probability of mutation. (5 marks)

Q3. a. Maintain tree type representation of solutions in genetic algorithm. (3 marks)

b. Using genetic algorithm to find the maximum value of the function $(15x - x^2)$ where parameter x varies between 0 and 15. For simplicity, we may assume that x takes only integer values. Using the genetic algorithm procedure in one step and begin with four solutions in initial solutions. (10 marks)

Q4. Discuss the internal structure of Taxi driver Robot. (7 marks)

Q5. Discuss the Tabu search method and maintain the type of memory using in this method and maintain the Tabu search algorithm. (10 marks)

==best wishes==

Dr. Alaa F. Mohamed

Answer the following questions: (50 Marks)

Question 1: Answer the following points (10 Marks)

- 1- Explain the internet "nuts and bolts"?
- 2- Explain the sources of packet delay?
- 3- What are protocols?
- 4- Explain Access network: digital subscriber line (DSL)?

Question 2: Answer the following points (10 Marks)

- 1- What is the network core?
- 2- Explain Packet Switching: queueing delay, loss?
- 3- Define throughput?
- 4- Define and explain traffic intensity?

Question 3: Answer the following points (10 Marks)

- 1- Explain the Internet protocol stack?
- 2- Mention some network applications?
- 3- Explain the application client-server architecture?
- 4- Explain P2P architecture?

Question 4: Answer the following points (10 Marks)

- 1- HTTP is "stateless". What does that mean?
- 2- Compare between persistent HTTP and non-persistent HTTP?
- 3- Give examples of HTTP response status codes?
- 4- Explain the term (web caches) and how it is useful?

Question 5: Answer the following points (10 Marks)

- 1- Give a DNS name resolution example?
- 2- Compare between multiplexing and demultiplexing? Support your answer with a diagram?
- 3- Define and explain the use of ACKs and NAKs?
- 4- Define and explain HOL? Support your answer with a diagram?

جامعة أسيوط	مايو 2018	كود المقرر: 356 رك
كلية العلوم		المقرر : مقدمة فى الحسابات العلمية
قسم الرياضيات		الزمن : ساعتان

Answer the following questions by using MATLAB language: (50 marks)

1- Using Newton's forward difference formula, find $y(0.1)$ using the table below:

x	0.0	0.2	0.4	0.6	0.8
y	1.000	1.22140	1.49182	1.82212	2.22554

2- Solve the differential equation by Adams method (without using nested for loops) at $x=0.2$:

$$\frac{dy}{dt} = t^2 - y, \quad y(0) = 1, \quad h = 0.05.$$

and compare it with the analytic solution $y = -e^{-t} + t^2 - 2t + 2$.

3- Solve the following initial value problem:

$$\frac{d^2u}{dt^2} + 4\frac{du}{dt} + 3u = 0, \quad u(0) = 1, \quad \frac{du}{dt}(0) = 0.$$

4- Let $f(x) = \cos 2x$ and $x_0 = 0$. Determine

- The third Taylor polynomial for f about x_0 .
- Find error bound at $x = 0.2$ and compare it to the actual error.

5- For the well-known Chua's circuit equation in chaotic studies that

$$\dot{x} = \alpha[y - x - f(x)], \quad \dot{y} = x - y + z, \quad \dot{z} = -\beta y - \gamma z, \quad t \in (0, 10),$$

where the nonlinear function $f(x)$ is described by

$$f(x) = bx + 0.5(a-b)(|x+1| - |x-1|) \text{ and } a < b < 0.$$

Write an M-function to describe the equation, and draw the phase trajectory for the parameters $\alpha = 9$, $\beta = 100/7$, $\gamma = 0$, $a = -8/7$, $b = -5/7$, and initial conditions

$$x(0) = -2.121304, \quad y(0) = -0.066170, \quad z(0) = 2.881090.$$

Good Luck

Dr. Tarek Aboelenen



امتحان الفرقة الثالثة شعبة الرياضيات

الزمن : ثلاث ساعات

رقم المقرر ورمزه : ١٣٤٦

المقرر : عمليات عشوائية وتطبيقاتها

أجب عن خمسة أسئلة فقط مما يأتي :- درجة جزء كل سؤال (خمس درجات)

١- (أ) لمجموعة المتغيرات العشوائية المستقلة $X_1, X_2, X_3, \dots$ بفرض أن التوقع الرياضي $E(X_i) = m$ والتباين $V(X_i)$ لكل منها محدود عرف كل من التقارب عن طريق الإحتمال وقانون الأعداد الكبرى (الضعيف).
(ب) بفرض أن $f f s s f s f f s s s f f s f f s$ هي إحدى النتائج الممكنة في محاولات برنولي العشوائية المستقلة بحيث أن $P(s) = p, P(f) = q, p + q = 1$ عرف عملية عشوائية في الفراغ R^2 موضحا ذلك بيانيا .

٢- (أ) في عملية برنولي العشوائية $\{X_n; n > 0\}$ بالإحتمال $p = 0.6$ إذا كان $X = X_1 + X_2$ ، $Y = X_1 + X_3$ احسب الإحتمالات الآتية : $P(X < 2, Y \leq 1)$ ، $P(2X < 3Y)$ ، $P(Y = X)$.
(ب) في السؤال (٢-أ) أوجد العزم الارتباطي بين X ، Y موضحا العلاقة بينهما .

٣- (أ) وضح العلاقة بين عملية برنولي العشوائية $\{X_n; n > 0\}$ و العملية العشوائية $\{Y_n; n \geq 0\}$ حيث أن المتغير Y_n يخضع لتوزيع ذي الحدين واذكر صفات كل منهما ثم عبر مع الإستنتاج عن إحتمال الحادث $(Y_{n+1} = k)$ من خلال إحتمالات الحوادث : $(Y_n = k)$ ، $(Y_n = k - 1)$ لأي عدد صحيح $k > 0$.
(ب) في العملية العشوائية $\{Y_n; n \geq 0\}$ أوجد كل من $E(Y_5)$ ، $E(Y_4^2)$ ، $P(Y_5 = 3, Y_7 = 4, Y_{14} = 9)$.

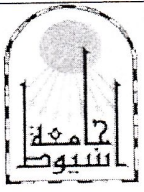
٤- (أ) عرف أزمنة النجاح T_k كعملية عشوائية موضحا العلاقة بينها وبين العملية العشوائية $\{Y_n; n \geq 0\}$ ثم اذكر فقط توزيع المتغير العشوائي T_k .
(ب) - في عملية بواسون العشوائية $\{N_t; t \geq 0\}$ بالمعدل $\lambda = 4$ احسب كل من الإحتمالات الآتية :
 $P(N_{1.5} = 2, N_4 = 5, N_{6.8} = 9)$ ، $P(N_3 = 5, N_7 = 9)$

٥- (أ) في عملية بواسون أو عملية الوصول المعودة $\{N_t; t \geq 0\}$ بالمعدل λ إثبت أن الإحتمال المشروط لعدد الوصول N_t بالنسبة إلى عدد الوصول N_{t+s} لكل $t > 0, s > 0$ يمثل توزيع ذي الحدين.
(ب) عرف العمليات العشوائية المستقلة ثم اثبت أن أي عمليتين مستقلتين لبواسون هو أيضا عملية بواسون .

٦- (أ) في عملية التجديد العشوائية $R = \{R_n; n \in N\}$ حيث N هي فئة الأعداد الصحيحة غير السالبة عرف دالة التجديد ثم عبر عنها من خلال توزيع المتغير R_n مع الإستنتاج .

(ب) في سلسلة ماركوف العشوائية المتقطعة $\{X_n; n \geq 0\}$ عرف مصفوفة الإحتمالات الإنتقالية بصفاتها المعروفة ثم احسب الإحتمال : $P(X_0 = 1, X_1 = 1, X_2 = 0, X_3 = 1, X_4 = 0, X_6 = 0)$ بفرض أن حالات الفراغ $(0, 1)$ والمصفوفة العشوائية

$$P = \begin{pmatrix} 1/2 & 1/2 \\ 1/3 & 2/3 \end{pmatrix} , \text{ ومنتجه الإحتمالات الابتدائية } \pi_0 = (2/5 \quad 3/5)$$

	المقرر: تحليل عددي (٣٢٣) الفرقة: المستوى الثالث الدرجة: ٥٠ درجة التاريخ: ٢٠١٨/٥/٢٩ الزمن: ثلاث ساعات	جامعة أسيوط كلية العلوم - قسم الرياضيات امتحان نهائي الفصل الدراسي الثاني للعام الجامعي ٢٠١٧/٢٠١٨
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Answer five questions only :- (10 marks for every question)

1-a) If the function $g \in C[a, b]$ and $g(x) \in [a, b] \forall x \in [a, b]$ and $g'(x)$ exist with $|g'(x)| \leq k < 1 \forall x \in [a, b]$ prove that the sequence defined by $P_n = g(P_{n-1}), n \geq 1$ will converge to the unique fixed point P and also $|P_{n+1} - P_n| \leq k^n |P_1 - P_0|$.

1-b) Verify that when Newton's method is used to compute $\sqrt{A}, A > 0$ (By solving the equation : $f(x) = x^2 - A$). The sequence of iterates is defined by : $x_{n+1} = (x_n + \frac{A}{x_n})/2$, and show that if the sequence $\{x_n\}$ is defined as the previous problem, then this method is quadratically convergence.

2-a) Derive Lagrange interpolation formula of degree n and write the error of the method.

2-b) For the given function $f(x) = \cos \pi x$ let $x_0 = -1, x_1 = 0, x_2 = 1$ construct the suitable interpolation polynomial and find the actual error.

3) Derive the formula of the Newton's interpolatory divided difference method and use this formula to obtain a polynomial of least degree that fits the values shown:

x	0	1	2	4	6
$f(x)$	1	9	23	93	259

من فضلك انظر خلف الورقة

السؤال الرابع :-

أ) يعرف الطي للدالتين $f(x)$, $g(x)$ كالآتي

$$f * g = \int_{-\infty}^{\infty} f(u) g(x-u) du$$

برهن علي أن تحويل فوريير للطرف الأيمن هو حاصل ضرب تحويل فوريير للدالتين $f(x)$, $g(x)$

ب) أوجد تحويل فوريير للدالة $f(x) = \begin{cases} 1 & |x| < a \\ 0 & |x| > a \end{cases}$ وأرسم $f(x)$ كذلك تحويلها عند $a = 3$ وأوجد

$$\int_{-\infty}^{\infty} \frac{\sin u}{u} du \quad \text{كذلك} \quad \int_{-\infty}^{\infty} \frac{\sin \alpha a \cos \alpha x}{\alpha} d\alpha$$

ج) ترك خيط لانهائي من السكون وكانت أزاحته الابتدائية عن محور x هي $f(x)$ أوجد الإزاحه عند أي زمن .

انتهت الأسئلة مع تمنياتنا بالتوفيق ،،،،

لجنة الممتحنين :- أ.د/ نجاه عبد الرحمن حسين ، أ.د/ فاروق علي السيد



الامتحان النهائي للفصل الدراسي الثاني للعام الجامعي ٢٠١٧/٢٠١٨ م
 للفرقة : الثالثة : الشعبة : الرياضيات التاريخ : ٢٠١٨/٥/٢٤ م

الزمن : ساعتان

الدرجة الكلية : ٥٠ درجة

درجة كل سؤال : ١٧ درجة

أسم المقرر : الطرق الرياضية
 رقم المقرر ورمزه : ٣٣٤ ر

أجب عن ثلاثة أسئلة فقط مما يأتي :-

السؤال الأول :-

أوجد تحويل لابلاس للمشتقة التفاضلية للدالة $F(t)$ عند نقط الاتصال والانفصال للدالة .

أبرهن علي أن

$$\lim_{t \rightarrow 0} F(t) = \lim_{s \rightarrow \infty} s f(s)$$

$$\lim_{t \rightarrow \infty} F(t) = \lim_{s \rightarrow 0} s f(s)$$

$$\Gamma\left(\frac{1}{2}\right) = \sqrt{\pi}, \quad \int_0^{\infty} \delta(t) dt = 1, \quad L \sin \sqrt{t} = \frac{\sqrt{\pi}}{3} e^{-\frac{1}{4s}} s^{\frac{3}{2}}$$

السؤال الثاني :-

حل المعادلات الآتية :

$$t Y''(t) + Y'(t) + 4t Y(t) = 0, \quad y(0) = 3, y'(0) = 0$$

$$\frac{\partial U}{\partial x} = 2 \frac{\partial U}{\partial t} + U, \quad x > 0, t > 0 \quad U(x, 0) = 6 e^{-3x}$$

$$\int_0^t Y(u) Y(t-u) du = 16 \sin 4t$$

السؤال الثالث :-

(أ) فك الدالة $f(x) = x^2$, $0 < x < 2\pi$ بدلالة متسلسلة فوريير ثم أحسب المجموع

$$1 + \frac{1}{2^2} + \frac{1}{3^2} + \frac{1}{4^2} + \dots$$

(ب) صفيحة علي شكل دائري نصف قطرها الوحدة ووجهيها معزولين ونصف محيطها محفوظ عند درجة حرارة u_1

والآخر عند u_2 أوجد حالة الأتزان الحراري .

من فضلك أنظر بقية الأسئلة خلف الورقة ،،،،،



Answer the following questions (50 marks)

Q1.	Complete the following: (1)..... is a representation of a two-dimensional image as a finite set of digital values, called picture elements or pixels - Common image formats include.....(2).... ,(3)..... ,(4)..... (5)..... creates a Distance tool a draggable, resizable line that measures the distance between its endpoints. (6)..... These are the result of objects that are self-luminous, such as stars and light bulbs. (7).....the resulting output pixel is computed as a sum of products of the pixel values and mask coefficients in the pixel's neighborhood in the original image. - The Sobel operators used to compute edges are(8)..... ,(9)..... - Edge detector should have:(10)..... ,(11)..... - Types of noise are(12)..... ,(13)....	(13 marks)
Q2.	a) Compute Z from the following matlab script (6 marks) <pre> x = [150 10 90;80 50 60;121 160 20] y = [-1 0 1;-2 0 2;-1 0 1] z = imfilter(x,y,'corr') </pre> b) What is the Delta compression and compute the compressed data of the data (6 marks) 220 321 335 211 250 200 233 214 232 212	(12 marks)
Q3.	a) Write the MATLAB code used to: (4 marks) - Read any image then use affine transformation matrix for each of the operations below: - Flip the image right to left - Translation by [25, 15] pixels b) What are the main differences between: (8 marks) - Global thresholding and optimal thresholding. - Raster and vector image . - Interpixel redundancy and Psychovisual redundancy	(12 marks)

(Q5) (i) Assume that U, V are open intervals and let $f : U \rightarrow \mathbb{R}$ and $g : V \rightarrow \mathbb{R}$ be two differentiable functions such that $f(U) \subset V$. Prove that $g \circ f$ is differentiable on U and that $(g \circ f)' = (g' \circ f) \cdot f'$ [5 marks]

(ii) Prove that the function $f(x) := \frac{1}{x}$ is differentiable on $]0, \infty[$ but not uniformly continuous therein. [5 marks]

(Q6) (i) State and prove Rolle's theorem then use it to prove the mean value theorem. [6 marks]

(ii) Let I be an open interval. Apply the mean value theorem to prove that a function differentiable on I is

1. increasing if and only if $f' \geq 0$ on I ,

2. decreasing if and only if $f' \leq 0$ on I .

[4 marks]

With the best of luck,

Prof. Rashwan A. Rashwan,

Dr. Ahmed A. Abdelhakim



Time: 3 hours

Total mark: 50

Answer *only five* of the following questions:

(Q1) (i) Suppose that O_i , $i \geq 1$, are open subsets of $\mathbb{R}$. Prove that $\cup_{i \geq 1} O_i$ is also open in $\mathbb{R}$. [5 marks]

(ii) Let $S \subset \mathbb{R}$. Show that S is closed if and only if S contains the limit point of every convergent sequence of elements of S . [5 marks]

(Q2) (i) Prove that a sequence of real numbers converges if and only if it is a Cauchy sequence. [6 marks]

(ii) Show that if $(x_n)_{n \geq 1} \subset \mathbb{R}$ is a monotonically increasing sequence that is bounded above, then $x_n \rightarrow \sup_{n \geq 1} x_n$, as $n \rightarrow \infty$. [4 marks]

(Q3) (i) Show that $f : D \subset \mathbb{R} \rightarrow \mathbb{R}$ is continuous at $x_0 \in D$ if and only if the sequence $(f(x_n))_{n \geq 1}$ converges to $f(x_0)$ whenever $(x_n)_{n \geq 1}$ is a sequence in D that converges to x_0 . [6 marks]

(ii) Use the characterization given in (i) to prove the discontinuity at the origin of the function $f(x) = \begin{cases} \cos \frac{1}{x}, & x \neq 0; \\ 0, & x = 0. \end{cases}$ [4 marks]

(Q4) (i) Assume that D is a closed bounded subset of $\mathbb{R}$. Prove that if $f : D \rightarrow \mathbb{R}$ is continuous then f is bounded on D , and there exist $\alpha, \beta \in D$ such that $f(\alpha) = \max_{x \in D} f(x)$ and $f(\beta) = \min_{x \in D} f(x)$. [5 marks]

(ii) Argue by contradiction to demonstrate that if $f : [a, b] \rightarrow \mathbb{R}$ is continuous then it is uniformly continuous on $[a, b]$. [5 marks]

Please Turn over the page



أجب عن أسئلة الآتية :- (كل سؤال ١٠ درجات)

(١) (أ) أثبت قاعدة التضعيف لدالة جاما $\sqrt{\pi} \Gamma(2x) = 2^{2x-1} \Gamma(x) \Gamma\left(x + \frac{1}{2}\right), x > 0$

ثم استخدمها فى إثبات أن: $\Gamma\left(\frac{5}{6}\right) \left[\Gamma\left(\frac{1}{3}\right)\right]^2 = 2 \sqrt[3]{2} \sqrt{\frac{\pi^3}{3}}$

(ب) باستخدام دوال جاما و بيتا أوجد التكاملات الآتية: (i) $\int_0^{\frac{\pi}{2}} \sqrt{\tan \theta} d\theta$ (ii) $\int_0^{\infty} \frac{\sqrt{x}}{e^{x^3}} dx$

(٢) (أ) أثبت أن: $\Gamma(x) \Gamma(1-x) = \frac{\pi}{\sin \pi x}, 0 < x < 1$ ومن ثم أثبت أن

$\Gamma\left(x + \frac{1}{2}\right) \Gamma\left(\frac{1}{2} - x\right) = \frac{\pi}{\cos \pi x}$

(ب) أثبت أن:

(i) $\sqrt{1-x^2} T_n(x) = U_{n+1}(x) - x U_n(x),$

(ii) $(1-x^2) U'_n(x) = -n x U_n(x) + n U_{n-1}(x)$

(٣) أثبت أن:

(i) ${}_2F_1(\alpha, \beta; \gamma, x) = (1-x)^{-\beta} {}_2F_1\left(\gamma - \alpha, \beta; \gamma, \frac{x}{x-1}\right)$

(ii) ${}_1F_1\left(\frac{1}{2}; \frac{3}{2}, -x^2\right) = \frac{\sqrt{\pi}}{2x} \operatorname{erf}(x)$ حيث أن: $\operatorname{erf}(x) = \frac{2}{\sqrt{\pi}} \int_0^x e^{-t^2} dt$ هى دالة الخطأ

(iii) ${}_1F_1(\alpha + 1; \gamma, x) - {}_1F_1(\alpha; \gamma, x) - \frac{x}{\gamma} {}_1F_1(\alpha + 1; \gamma + 1, x) = 0$

(٤) (أ) أوجد مفكوك ليجندر للدالة: $f(x) = x^3$

(ب) أثبت أن: $H_n(x) = (-1)^n e^{x^2} \frac{d^n}{dx^n} (e^{-x^2})$ حيث $H_n(x)$ كثيرة حدود هيرميت.

(ج) أثبت أن: $J_{\frac{1}{2}}(x) = \sqrt{\frac{2}{\pi}} \frac{\sin x}{\sqrt{x}}$

(٥) (أ) باستخدام الصيغة التكاملية لدوال بسل أثبت أن: $\int_0^{\infty} e^{-3x} J_0(4x) dx = \frac{1}{5}$

(ب) أوجد الحل العام لمعادلة بسل التفاضلية:

$x^2 \frac{d^2 y}{dx^2} + x \frac{dy}{dx} + (x^2 - n^2)y = 0$



Question 1: Put True or False for each of the following items (30 marks)

1. To enter a formula into a cell, begin by typing an equal sign.
2. Functions are pre-defined worksheet formulas.
3. Formulas in Excel must be written in a very specific format, referred to as syntax.
4. The second order of precedence is for exponentiation.
5. When the formula in cell **B7 =B4+B5+B6** is copied into cell **C7** the formula will be changed to **= C4+C5+C6**.
6. The error "#####" means Data being referenced is not available.
7. The range **B2:B7** is a range down a column.
8. To keep things clear and simple only add an absolute (\$) cell reference if absolutely necessary.
9. The formula **=ROUND(78.686788,-1)** results in the value 80 .
10. Placing an absolute sign in front of a ranged name (**\$budget**) is incorrect syntax.
11. The columns of the worksheet are named with Numbers.
12. Cells may contain only Labels and Values.
13. The cell address first lists the row name and then the column name.
14. This selected cell is referred to as the **active cell**.
15. The contents of the active cell will also be displayed on the **formula bar**.
16. A cell that is on sheet 3, in the second column third row would be referred to as **Sheet3@B3**.
17. Formatted Display is the number of decimal places that appear in a cell.
18. Formulas can be copied to perform different operations on a corresponding set of data.
19. The function **COUNT(value1,[value2],...)** counts non-blank cells.
20. The Average function ignore the blank cells.
21. TRUE and FALSE are called Boolean Values.
22. SPSS stands for Statistical Package for the Social Sciences.
23. SPSS is capable of handling large amounts of data.
24. SPSS has only two windows Data view and Output view.
25. **Transform** menu includes several options to change current variables.
26. In SPSS, Each column typically represents the data from 1 case.
27. In SPSS, The first column of variable view is Name.
28. In SPSS, you can sort data from **Transform** menu then **Sort Cases**.
29. Descriptive statistics are calculated using the **Analyze** menu.
30. Correlation is used to test the degree of association between variables.

Answer Sheet		
	True	False
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30		

Question 2: (10 marks)

	A	B	C	D	E	F	G
1		MT1	MT2	Final	Total	Honors	Passed
2	Possible points	100	100	200	400		320
3							
4	Blue	79	89	169	337	FALSE	TRUE
5	Jones	85	65	195	345	FALSE	TRUE
6	Grey	60	97	187	344	TRUE	TRUE
7	Mary	10	30	50	90	TRUE	FALSE
8							

Write the following Boolean functions

1. Blue's total and Jones' total are greater than Grey's:
2. Grey's total is not the maximum grade:
3. None of the students passed the course
4. Blue is not an Honors student
5. Blue didn't get a passing grade (320)

Question 3: (10 marks)

1. What are the difference between Data View, Variable View and Output View in SPSS?
2. Some significance tests are very restrictive about the form of data they can accept. What are the different types of measurement?
3. Describe how to test the degree of association between variables by SPSS.
4. Explain how to use SPSS to calculate the frequency and percent of females and males who did and did not have social problems.

Q2.

- a. Maintain two different Algorithm of crossover process with mention the probability of crossover (5 marks)
- b. Maintain two different Algorithm of mutation process with mention the probability of mutation. (5 marks)

Q3. a. Maintain tree type representation of solutions in genetic algorithm. (3 marks)

b. Using genetic algorithm to find the maximum value of the function $(15x - x^2)$ where parameter x varies between 0 and 15. For simplicity, we may assume that x takes only integer values. Using the genetic algorithm procedure in one step and begin with four solutions in initial solutions. (10 marks)

Q4. Discuss the internal structure of Taxi driver Robot. (7 marks)

Q5. Discuss the Tabu search method and maintain the type of memory using in this method and maintain the Tabu search algorithm. (10 marks)

==best wishes==

Dr. Alaa F. Mohamed

Answer the following questions: (50 Marks)

Question 1: Answer the following points (10 Marks)

- 1- Explain the internet "nuts and bolts"?
- 2- Explain the sources of packet delay?
- 3- What are protocols?
- 4- Explain Access network: digital subscriber line (DSL)?

Question 2: Answer the following points (10 Marks)

- 1- What is the network core?
- 2- Explain Packet Switching: queueing delay, loss?
- 3- Define throughput?
- 4- Define and explain traffic intensity?

Question 3: Answer the following points (10 Marks)

- 1- Explain the Internet protocol stack?
- 2- Mention some network applications?
- 3- Explain the application client-server architecture?
- 4- Explain P2P architecture?

Question 4: Answer the following points (10 Marks)

- 1- HTTP is "stateless". What does that mean?
- 2- Compare between persistent HTTP and non-persistent HTTP?
- 3- Give examples of HTTP response status codes?
- 4- Explain the term (web caches) and how it is useful?

Question 5: Answer the following points (10 Marks)

- 1- Give a DNS name resolution example?
- 2- Compare between multiplexing and demultiplexing? Support your answer with a diagram?
- 3- Define and explain the use of ACKs and NAKs?
- 4- Define and explain HOL? Support your answer with a diagram?

جامعة أسيوط	مايو 2018	كود المقرر: 356 رك
كلية العلوم		المقرر : مقدمة فى الحسابات العلمية
قسم الرياضيات		الزمن : ساعتان

Answer the following questions by using MATLAB language: (50 marks)

1- Using Newton's forward difference formula, find $y(0.1)$ using the table below:

x	0.0	0.2	0.4	0.6	0.8
y	1.000	1.22140	1.49182	1.82212	2.22554

2- Solve the differential equation by Adams method (without using nested for loops) at $x=0.2$:

$$\frac{dy}{dt} = t^2 - y, \quad y(0) = 1, \quad h = 0.05.$$

and compare it with the analytic solution $y = -e^{-t} + t^2 - 2t + 2$.

3- Solve the following initial value problem:

$$\frac{d^2u}{dt^2} + 4\frac{du}{dt} + 3u = 0, \quad u(0) = 1, \quad \frac{du}{dt}(0) = 0.$$

4- Let $f(x) = \cos 2x$ and $x_0 = 0$. Determine

- The third Taylor polynomial for f about x_0 .
- Find error bound at $x = 0.2$ and compare it to the actual error.

5- For the well-known Chua's circuit equation in chaotic studies that

$$\dot{x} = \alpha[y - x - f(x)], \quad \dot{y} = x - y + z, \quad \dot{z} = -\beta y - \gamma z, \quad t \in (0, 10),$$

where the nonlinear function $f(x)$ is described by

$$f(x) = bx + 0.5(a-b)(|x+1| - |x-1|) \text{ and } a < b < 0.$$

Write an M-function to describe the equation, and draw the phase trajectory for the parameters $\alpha = 9$, $\beta = 100/7$, $\gamma = 0$, $a = -8/7$, $b = -5/7$, and initial conditions

$$x(0) = -2.121304, \quad y(0) = -0.066170, \quad z(0) = 2.881090.$$

Good Luck

Dr. Tarek Aboelenen



امتحان الفرقة الثالثة شعبة الرياضيات

الزمن : ثلاث ساعات

رقم المقرر ورمزه : ١٣٤٦

المقرر : عمليات عشوائية وتطبيقاتها

أجب عن خمسة أسئلة فقط مما يأتي :- درجة جزء كل سؤال (خمس درجات)

١- (أ) لمجموعة المتغيرات العشوائية المستقلة $X_1, X_2, X_3, \dots$ بفرض أن التوقع الرياضي $E(X_i) = m$ والتباين $V(X_i)$ لكل منها محدود عرف كل من التقارب عن طريق الإحتمال وقانون الأعداد الكبرى (الضعيف).
(ب) بفرض أن $f f s s f s f f s s s f f s f f s$ هي إحدى النتائج الممكنة في محاولات برنولي العشوائية المستقلة بحيث أن $P(s) = p, P(f) = q, p + q = 1$ عرف عملية عشوائية في الفراغ R^2 موضحا ذلك بيانيا .

٢- (أ) في عملية برنولي العشوائية $\{X_n; n > 0\}$ بالإحتمال $p = 0.6$ إذا كان $X = X_1 + X_2$ ، $Y = X_1 + X_3$ احسب الإحتمالات الآتية : $P(X < 2, Y \leq 1)$ ، $P(2X < 3Y)$ ، $P(Y = X)$.
(ب) في السؤال (٢-أ) أوجد العزم الارتباطي بين X ، Y موضحا العلاقة بينهما .

٣- (أ) وضح العلاقة بين عملية برنولي العشوائية $\{X_n; n > 0\}$ و العملية العشوائية $\{Y_n; n \geq 0\}$ حيث أن المتغير Y_n يخضع لتوزيع ذي الحدين واذكر صفات كل منهما ثم عبر مع الاستنتاج عن إحتمال الحادث $(Y_{n+1} = k)$ من خلال إحتمالات الحوادث : $(Y_n = k)$ ، $(Y_n = k - 1)$ لأي عدد صحيح $k > 0$.
(ب) في العملية العشوائية $\{Y_n; n \geq 0\}$ أوجد كل من $E(Y_5)$ ، $E(Y_4^2)$ ، $P(Y_5 = 3, Y_7 = 4, Y_{14} = 9)$.

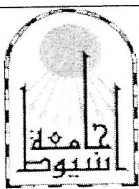
٤- (أ) عرف أزمنة النجاح T_k كعملية عشوائية موضحا العلاقة بينها وبين العملية العشوائية $\{Y_n; n \geq 0\}$ ثم اذكر فقط توزيع المتغير العشوائي T_k .
(ب) - في عملية بواسون العشوائية $\{N_t; t \geq 0\}$ بالمعدل $\lambda = 4$ احسب كل من الإحتمالات الآتية :
 $P(N_{1.5} = 2, N_4 = 5, N_{6.8} = 9)$ ، $P(N_3 = 5, N_7 = 9)$

٥- (أ) في عملية بواسون أو عملية الوصول المعودة $\{N_t; t \geq 0\}$ بالمعدل λ إثبت أن الإحتمال المشروط لعدد الوصول N_t بالنسبة إلى عدد الوصول N_{t+s} لكل $t > 0, s > 0$ يمثل توزيع ذي الحدين.
(ب) عرف العمليات العشوائية المستقلة ثم اثبت أن أي عمليتين مستقلتين لبواسون هو أيضا عملية بواسون .

٦- (أ) في عملية التجديد العشوائية $R = \{R_n; n \in N\}$ حيث N هي فئة الأعداد الصحيحة غير السالبة عرف دالة التجديد ثم عبر عنها من خلال توزيع المتغير R_n مع الاستنتاج .

(ب) في سلسلة ماركوف العشوائية المتقطعة $\{X_n; n \geq 0\}$ عرف مصفوفة الإحتمالات الإنتقالية بصفاتها المعروفة ثم احسب الإحتمال : $P(X_0 = 1, X_1 = 1, X_2 = 0, X_3 = 1, X_4 = 0, X_6 = 0)$ بفرض أن حالات الفراغ $(0, 1)$ والمصفوفة العشوائية

$$P = \begin{pmatrix} 1/2 & 1/2 \\ 1/3 & 2/3 \end{pmatrix} , \text{ ومنتجه الإحتمالات الابتدائية } \pi_0 = (2/5 \quad 3/5)$$

	المقرر: تحليل عددي (٣٢٣) الفرقة: المستوى الثالث الدرجة: ٥٠ درجة التاريخ: ٢٠١٨/٥/٢٩ الزمن: ثلاث ساعات	جامعة أسيوط كلية العلوم - قسم الرياضيات امتحان نهائي الفصل الدراسي الثاني للعام الجامعي ٢٠١٧/٢٠١٨
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Answer five questions only :- (10 marks for every question)

1-a) If the function $g \in C[a, b]$ and $g(x) \in [a, b] \forall x \in [a, b]$ and $g'(x)$ exist with $|g'(x)| \leq k < 1 \forall x \in [a, b]$ prove that the sequence defined by $P_n = g(P_{n-1}), n \geq 1$ will converge to the unique fixed point P and also $|P_{n+1} - P_n| \leq k^n |P_1 - P_0|$.

1-b) Verify that when Newton's method is used to compute $\sqrt{A}, A > 0$ (By solving the equation : $f(x) = x^2 - A$). The sequence of iterates is defined by : $x_{n+1} = (x_n + \frac{A}{x_n})/2$, and show that if the sequence $\{x_n\}$ is defined as the previous problem, then this method is quadratically convergence.

2-a) Derive Lagrange interpolation formula of degree n and write the error of the method.

2-b) For the given function $f(x) = \cos \pi x$ let $x_0 = -1, x_1 = 0, x_2 = 1$ construct the suitable interpolation polynomial and find the actual error.

3) Derive the formula of the Newton's interpolatory divided difference method and use this formula to obtain a polynomial of least degree that fits the values shown:

x	0	1	2	4	6
$f(x)$	1	9	23	93	259

من فضلك انظر خلف الورقة

السؤال الرابع :-

أ) يعرف الطي للدالتين $f(x)$, $g(x)$ كالآتي

$$f * g = \int_{-\infty}^{\infty} f(u) g(x-u) du$$

برهن علي أن تحويل فوريير للطرف الأيمن هو حاصل ضرب تحويلي فوريير للدالتين $f(x)$, $g(x)$

ب) أوجد تحويل فوريير للدالة $f(x) = \begin{cases} 1 & |x| < a \\ 0 & |x| > a \end{cases}$ وأرسم $f(x)$ كذلك تحويلها عند $a = 3$ وأوجد

$$\int_{-\infty}^{\infty} \frac{\sin u}{u} du \quad \text{كذلك} \quad \int_{-\infty}^{\infty} \frac{\sin \alpha a \cos \alpha x}{\alpha} d\alpha$$

ج) ترك خيط لانهائي من السكون وكانت أزاحته الابتدائية عن محور x هي $f(x)$ أوجد الإزاحه عند أي زمن .

انتهت الأسئلة مع تمنياتنا بالتوفيق ،،،،

لجنة الممتحنين :- أ.د/ نجاه عبد الرحمن حسين ، أ.د/ فاروق علي السيد



الامتحان النهائي للفصل الدراسي الثاني للعام الجامعي ٢٠١٧/٢٠١٨ م
 للفرقة : الثالثة
 الشعبة : الرياضيات
 التاريخ : ٢٠١٨/٥/٢٤ م

الزمن : ساعتان

الدرجة الكلية : ٥٠ درجة

درجة كل سؤال : ١٧ درجة

أسم المقرر : الطرق الرياضية
 رقم المقرر ورمزه : ٣٣٤ ر

أجب عن ثلاثة أسئلة فقط مما يأتي :-

السؤال الأول :-

أوجد تحويل لابلاس للمشتقة التفاضلية للدالة $F(t)$ عند نقط الاتصال والانفصال للدالة .

أبرهن علي أن

$$\lim_{t \rightarrow 0} F(t) = \lim_{s \rightarrow \infty} s f(s)$$

$$\lim_{t \rightarrow \infty} F(t) = \lim_{s \rightarrow 0} s f(s)$$

$$\Gamma\left(\frac{1}{2}\right) = \sqrt{\pi}, \quad \int_0^{\infty} \delta(t) dt = 1, \quad L \sin \sqrt{t} = \frac{\sqrt{\pi}}{3} e^{-\frac{1}{4s}} s^{\frac{3}{2}}$$

السؤال الثاني :-

حل المعادلات الآتية :

$$t Y''(t) + Y'(t) + 4t Y(t) = 0, \quad y(0) = 3, y'(0) = 0$$

$$\frac{\partial U}{\partial x} = 2 \frac{\partial U}{\partial t} + U, \quad x > 0, t > 0 \quad U(x, 0) = 6 e^{-3x}$$

$$\int_0^t Y(u) Y(t-u) du = 16 \sin 4t$$

السؤال الثالث :-

(أ) فك الدالة $f(x) = x^2$, $0 < x < 2\pi$ بدلالة متسلسلة فوريير ثم أحسب المجموع

$$1 + \frac{1}{2^2} + \frac{1}{3^2} + \frac{1}{4^2} + \dots$$

(ب) صفيحة علي شكل دائري نصف قطرها الوحدة ووجهيها معزولين ونصف محيطها محفوظ عند درجة حرارة u_1

والآخر عند u_2 أوجد حالة الأتزان الحراري .

من فضلك أنظر بقية الأسئلة خلف الورقة ،،،،،



Answer the following questions (50 marks)

Q1.	Complete the following: (1)..... is a representation of a two-dimensional image as a finite set of digital values, called picture elements or pixels - Common image formats include.....(2).... ,(3)..... ,(4)..... (5)..... creates a Distance tool a draggable, resizable line that measures the distance between its endpoints. (6)..... These are the result of objects that are self-luminous, such as stars and light bulbs. (7).....the resulting output pixel is computed as a sum of products of the pixel values and mask coefficients in the pixel's neighborhood in the original image. - The Sobel operators used to compute edges are(8)..... ,(9)..... - Edge detector should have:(10)..... ,(11)..... - Types of noise are(12)..... ,(13)....	(13 marks)
Q2.	a) Compute Z from the following matlab script (6 marks) <pre> x = [150 10 90;80 50 60;121 160 20] y = [-1 0 1;-2 0 2;-1 0 1] z = imfilter(x,y,'corr') </pre> b) What is the Delta compression and compute the compressed data of the data (6 marks) 220 321 335 211 250 200 233 214 232 212	(12 marks)
Q3.	a) Write the MATLAB code used to: (4 marks) - Read any image then use affine transformation matrix for each of the operations below: - Flip the image right to left - Translation by [25, 15] pixels b) What are the main differences between: (8 marks) - Global thresholding and optimal thresholding. - Raster and vector image . - Interpixel redundancy and Psychovisual redundancy	(12 marks)

(Q5) (i) Assume that U, V are open intervals and let $f : U \rightarrow \mathbb{R}$ and $g : V \rightarrow \mathbb{R}$ be two differentiable functions such that $f(U) \subset V$. Prove that $g \circ f$ is differentiable on U and that $(g \circ f)' = (g' \circ f) \cdot f'$ [5 marks]

(ii) Prove that the function $f(x) := \frac{1}{x}$ is differentiable on $]0, \infty[$ but not uniformly continuous therein. [5 marks]

(Q6) (i) State and prove Rolle's theorem then use it to prove the mean value theorem. [6 marks]

(ii) Let I be an open interval. Apply the mean value theorem to prove that a function differentiable on I is

1. increasing if and only if $f' \geq 0$ on I ,

2. decreasing if and only if $f' \leq 0$ on I .

[4 marks]

With the best of luck,

Prof. Rashwan A. Rashwan,

Dr. Ahmed A. Abdelhakim



Time: 3 hours

Total mark: 50

Answer *only five* of the following questions:

(Q1) (i) Suppose that O_i , $i \geq 1$, are open subsets of $\mathbb{R}$. Prove that $\cup_{i \geq 1} O_i$ is also open in $\mathbb{R}$. [5 marks]

(ii) Let $S \subset \mathbb{R}$. Show that S is closed if and only if S contains the limit point of every convergent sequence of elements of S . [5 marks]

(Q2) (i) Prove that a sequence of real numbers converges if and only if it is a Cauchy sequence. [6 marks]

(ii) Show that if $(x_n)_{n \geq 1} \subset \mathbb{R}$ is a monotonically increasing sequence that is bounded above, then $x_n \rightarrow \sup_{n \geq 1} x_n$, as $n \rightarrow \infty$. [4 marks]

(Q3) (i) Show that $f : D \subset \mathbb{R} \rightarrow \mathbb{R}$ is continuous at $x_0 \in D$ if and only if the sequence $(f(x_n))_{n \geq 1}$ converges to $f(x_0)$ whenever $(x_n)_{n \geq 1}$ is a sequence in D that converges to x_0 . [6 marks]

(ii) Use the characterization given in (i) to prove the discontinuity at the origin of the function $f(x) = \begin{cases} \cos \frac{1}{x}, & x \neq 0; \\ 0, & x = 0. \end{cases}$ [4 marks]

(Q4) (i) Assume that D is a closed bounded subset of $\mathbb{R}$. Prove that if $f : D \rightarrow \mathbb{R}$ is continuous then f is bounded on D , and there exist $\alpha, \beta \in D$ such that $f(\alpha) = \max_{x \in D} f(x)$ and $f(\beta) = \min_{x \in D} f(x)$. [5 marks]

(ii) Argue by contradiction to demonstrate that if $f : [a, b] \rightarrow \mathbb{R}$ is continuous then it is uniformly continuous on $[a, b]$. [5 marks]

Please Turn over the page

اجب عن خمسة فقط من الاسئلة الاتية :- (10 درجات لكل سؤال : بواقع 5 درجات لكل فقرة)

(1) (i) اوجد الحل العام للمعادلة : $p_1 + 3p_2 + 2p_3(1 + \sqrt{x_1 + x_2 + x_3 - u}) = 6$
(ii) اوجد الحل الخاص للمعادلة : $(y - z)[2xyp + (x^2 - y^2)q] + z(x^2 - y^2) = 0$
الذي يمر خلال المنحنى $y = 0, x^3 = z^2$

(2) اوجد الحل العام لكل من المعادلتين التفاضليتين الجزئيتين الاتيتين :-
(i) $(D_1^3 - D_1^2 D_2 - D_1 D_2^2 + D_2^3)z = \log(x + y)$
(ii) $(D_1^2 - a^2 D_2^2)z = x^2 + y^2$, ثابت مطلق a

(3) اوجد الحل العام لكل من المعادلتين التفاضليتين الجزئيتين الاتيتين :-
(i) $(D_1^2 D_2 + D_2^2 - 2)z = e^{2y} \sin 3x - e^x \cos 2y$
(ii) $(D_1^2 - D_2^2 - D_1 - 3D_2 - 2)z = e^{2x-3y} + x + y + 1$

(4) (i) احسب التكاملات الاتية :-
(a) $\int_0^{\infty} x^{-\frac{1}{3}}(1 + 2x)^{-3} dx$ (b) $\int_0^1 \sqrt{\log \frac{1}{x}} dx$

(ii) اثبت ان :-
(a) $\tan^{-1} x = x {}_2F_1(1, \frac{1}{2}; \frac{3}{2}; -x^2)$
(b) $(a - b) {}_2F_1(a, b; c; x) = a {}_2F_1(a + 1, b; c; x) - b {}_2F_1(a, b + 1; c; x)$

(5) اثبت ان دوال بسل من النوع الاول $J_n(x)$ تحقق الاتي :-
(i) $J_{-\frac{1}{2}}(x) = \sqrt{\frac{2}{\pi x}} \cos x$, (ii) $\int x^n J_{n-1}(x) dx = x^n J_n(x) + c$

(6) (i) اثبت ان كثيرات حدود لجندر $P_n(x)$ تحقق :-
(ii) احسب التكاملات الاتية :-
(a) $\int_{-1}^1 x P_n(x) P_{n+1}(x) dx$, (b) $\int_{-1}^1 x^2 P_n(x) P_{n+1}(x) dx$, (c) $\int_{-1}^1 x^2 P_n(x) dx$



أجب عن أسئلة الآتية :- (كل سؤال ١٠ درجات)

(١) (أ) أثبت قاعدة التضعيف لدالة جاما $\sqrt{\pi} \Gamma(2x) = 2^{2x-1} \Gamma(x) \Gamma\left(x + \frac{1}{2}\right), x > 0$

ثم استخدمها فى إثبات أن: $\Gamma\left(\frac{5}{6}\right) \left[\Gamma\left(\frac{1}{3}\right)\right]^2 = 2 \sqrt[3]{2} \sqrt{\frac{\pi^3}{3}}$

(ب) باستخدام دوال جاما و بيتا أوجد التكاملات الآتية: (i) $\int_0^{\frac{\pi}{2}} \sqrt{\tan \theta} d\theta$ (ii) $\int_0^{\infty} \frac{\sqrt{x}}{e^{x^3}} dx$

(٢) (أ) أثبت أن: $\Gamma(x) \Gamma(1-x) = \frac{\pi}{\sin \pi x}, 0 < x < 1$ ومن ثم أثبت أن

$\Gamma\left(x + \frac{1}{2}\right) \Gamma\left(\frac{1}{2} - x\right) = \frac{\pi}{\cos \pi x}$

(ب) أثبت أن:

(i) $\sqrt{1-x^2} T_n(x) = U_{n+1}(x) - x U_n(x),$

(ii) $(1-x^2) U'_n(x) = -n x U_n(x) + n U_{n-1}(x)$

(٣) أثبت أن:

(i) ${}_2F_1(\alpha, \beta; \gamma, x) = (1-x)^{-\beta} {}_2F_1\left(\gamma - \alpha, \beta; \gamma, \frac{x}{x-1}\right)$

(ii) ${}_1F_1\left(\frac{1}{2}; \frac{3}{2}, -x^2\right) = \frac{\sqrt{\pi}}{2x} \operatorname{erf}(x)$ حيث أن: $\operatorname{erf}(x) = \frac{2}{\sqrt{\pi}} \int_0^x e^{-t^2} dt$ هى دالة الخطأ

(iii) ${}_1F_1(\alpha + 1; \gamma, x) - {}_1F_1(\alpha; \gamma, x) - \frac{x}{\gamma} {}_1F_1(\alpha + 1; \gamma + 1, x) = 0$

(٤) (أ) أوجد مفكوك ليجندر للدالة: $f(x) = x^3$

(ب) أثبت أن: $H_n(x) = (-1)^n e^{x^2} \frac{d^n}{dx^n} (e^{-x^2})$ حيث $H_n(x)$ كثيرة حدود هيرميت.

(ج) أثبت أن: $J_{\frac{1}{2}}(x) = \sqrt{\frac{2}{\pi}} \frac{\sin x}{\sqrt{x}}$

(٥) (أ) باستخدام الصيغة التكاملية لدوال بسل أثبت أن: $\int_0^{\infty} e^{-3x} J_0(4x) dx = \frac{1}{5}$

(ب) أوجد الحل العام لمعادلة بسل التفاضلية:

$x^2 \frac{d^2 y}{dx^2} + x \frac{dy}{dx} + (x^2 - n^2)y = 0$



Question 1: Put True or False for each of the following items (30 marks)

1. To enter a formula into a cell, begin by typing an equal sign.
2. Functions are pre-defined worksheet formulas.
3. Formulas in Excel must be written in a very specific format, referred to as syntax.
4. The second order of precedence is for exponentiation.
5. When the formula in cell **B7 =B4+B5+B6** is copied into cell **C7** the formula will be changed to **= C4+C5+C6**.
6. The error "#####" means Data being referenced is not available.
7. The range **B2:B7** is a range down a column.
8. To keep things clear and simple only add an absolute (\$) cell reference if absolutely necessary.
9. The formula **=ROUND(78.686788,-1)** results in the value 80 .
10. Placing an absolute sign in front of a ranged name (**\$budget**) is incorrect syntax.
11. The columns of the worksheet are named with Numbers.
12. Cells may contain only Labels and Values.
13. The cell address first lists the row name and then the column name.
14. This selected cell is referred to as the **active cell**.
15. The contents of the active cell will also be displayed on the **formula bar**.
16. A cell that is on sheet 3, in the second column third row would be referred to as **Sheet3@B3**.
17. Formatted Display is the number of decimal places that appear in a cell.
18. Formulas can be copied to perform different operations on a corresponding set of data.
19. The function **COUNT(value1,[value2],...)** counts non-blank cells.
20. The Average function ignore the blank cells.
21. TRUE and FALSE are called Boolean Values.
22. SPSS stands for Statistical Package for the Social Sciences.
23. SPSS is capable of handling large amounts of data.
24. SPSS has only two windows Data view and Output view.
25. **Transform** menu includes several options to change current variables.
26. In SPSS, Each column typically represents the data from 1 case.
27. In SPSS, The first column of variable view is Name.
28. In SPSS, you can sort data from **Transform** menu then **Sort Cases**.
29. Descriptive statistics are calculated using the **Analyze** menu.
30. Correlation is used to test the degree of association between variables.

Answer Sheet		
	True	False
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Question 2: (10 marks)

	A	B	C	D	E	F	G
1		MT1	MT2	Final	Total	Honors	Passed
2	Possible points	100	100	200	400		320
3							
4	Blue	79	89	169	337	FALSE	TRUE
5	Jones	85	65	195	345	FALSE	TRUE
6	Grey	60	97	187	344	TRUE	TRUE
7	Mary	10	30	50	90	TRUE	FALSE
8							

Write the following Boolean functions

1. Blue's total and Jones' total are greater than Grey's:
2. Grey's total is not the maximum grade:
3. None of the students passed the course
4. Blue is not an Honors student
5. Blue didn't get a passing grade (320)

Question 3: (10 marks)

1. What are the difference between Data View, Variable View and Output View in SPSS?
2. Some significance tests are very restrictive about the form of data they can accept. What are the different types of measurement?
3. Describe how to test the degree of association between variables by SPSS.
4. Explain how to use SPSS to calculate the frequency and percent of females and males who did and did not have social problems.

Q2.

- a. Maintain two different Algorithm of crossover process with mention the probability of crossover (5 marks)
- b. Maintain two different Algorithm of mutation process with mention the probability of mutation. (5 marks)

Q3. a. Maintain tree type representation of solutions in genetic algorithm. (3 marks)

b. Using genetic algorithm to find the maximum value of the function $(15x - x^2)$ where parameter x varies between 0 and 15. For simplicity, we may assume that x takes only integer values. Using the genetic algorithm procedure in one step and begin with four solutions in initial solutions. (10 marks)

Q4. Discuss the internal structure of Taxi driver Robot. (7 marks)

Q5. Discuss the Tabu search method and maintain the type of memory using in this method and maintain the Tabu search algorithm. (10 marks)

==best wishes==

Dr. Alaa F. Mohamed

Answer the following questions: (50 Marks)

Question 1: Answer the following points (10 Marks)

- 1- Explain the internet "nuts and bolts"?
- 2- Explain the sources of packet delay?
- 3- What are protocols?
- 4- Explain Access network: digital subscriber line (DSL)?

Question 2: Answer the following points (10 Marks)

- 1- What is the network core?
- 2- Explain Packet Switching: queueing delay, loss?
- 3- Define throughput?
- 4- Define and explain traffic intensity?

Question 3: Answer the following points (10 Marks)

- 1- Explain the Internet protocol stack?
- 2- Mention some network applications?
- 3- Explain the application client-server architecture?
- 4- Explain P2P architecture?

Question 4: Answer the following points (10 Marks)

- 1- HTTP is "stateless". What does that mean?
- 2- Compare between persistent HTTP and non-persistent HTTP?
- 3- Give examples of HTTP response status codes?
- 4- Explain the term (web caches) and how it is useful?

Question 5: Answer the following points (10 Marks)

- 1- Give a DNS name resolution example?
- 2- Compare between multiplexing and demultiplexing? Support your answer with a diagram?
- 3- Define and explain the use of ACKs and NAKs?
- 4- Define and explain HOL? Support your answer with a diagram?

جامعة أسيوط	مايو 2018	كود المقرر: 356 رك
كلية العلوم		المقرر : مقدمة فى الحسابات العلمية
قسم الرياضيات		الزمن : ساعتان

Answer the following questions by using MATLAB language: (50 marks)

1- Using Newton's forward difference formula, find $y(0.1)$ using the table below:

x	0.0	0.2	0.4	0.6	0.8
y	1.000	1.22140	1.49182	1.82212	2.22554

2- Solve the differential equation by Adams method (without using nested for loops) at $x=0.2$:

$$\frac{dy}{dt} = t^2 - y, \quad y(0) = 1, \quad h = 0.05.$$

and compare it with the analytic solution $y = -e^{-t} + t^2 - 2t + 2$.

3- Solve the following initial value problem:

$$\frac{d^2u}{dt^2} + 4\frac{du}{dt} + 3u = 0, \quad u(0) = 1, \quad \frac{du}{dt}(0) = 0.$$

4- Let $f(x) = \cos 2x$ and $x_0 = 0$. Determine

- The third Taylor polynomial for f about x_0 .
- Find error bound at $x = 0.2$ and compare it to the actual error.

5- For the well-known Chua's circuit equation in chaotic studies that

$$\dot{x} = \alpha[y - x - f(x)], \quad \dot{y} = x - y + z, \quad \dot{z} = -\beta y - \gamma z, \quad t \in (0, 10),$$

where the nonlinear function $f(x)$ is described by

$$f(x) = bx + 0.5(a-b)(|x+1| - |x-1|) \text{ and } a < b < 0.$$

Write an M-function to describe the equation, and draw the phase trajectory for the parameters $\alpha = 9$, $\beta = 100/7$, $\gamma = 0$, $a = -8/7$, $b = -5/7$, and initial conditions

$$x(0) = -2.121304, \quad y(0) = -0.066170, \quad z(0) = 2.881090.$$

Good Luck

Dr. Tarek Aboelenen



امتحان الفرقة الثالثة شعبة الرياضيات

الزمن : ثلاث ساعات

رقم المقرر ورمزه : ١٣٤٦

المقرر : عمليات عشوائية وتطبيقاتها

أجب عن خمسة أسئلة فقط مما يأتي :- درجة جزء كل سؤال (خمس درجات)

١- (أ) لمجموعة المتغيرات العشوائية المستقلة $X_1, X_2, X_3, \dots$ بفرض أن التوقع الرياضي $E(X_i) = m$ والتباين $V(X_i)$ لكل منها محدود عرف كل من التقارب عن طريق الإحتمال وقانون الأعداد الكبرى (الضعيف).
(ب) - بفرض أن $f f s s f s f f s s s f f s f f s$ هي إحدى النتائج الممكنة في محاولات برنولي العشوائية المستقلة بحيث أن $P(s) = p, P(f) = q, p + q = 1$ عرف عملية عشوائية في الفراغ R^2 موضحا ذلك بيانيا .

٢- (أ) في عملية برنولي العشوائية $\{X_n; n > 0\}$ بالإحتمال $p = 0.6$ إذا كان $X = X_1 + X_2$ ، $Y = X_1 + X_3$ احسب الإحتمالات الآتية : $P(X < 2, Y \leq 1)$ ، $P(2X < 3Y)$ ، $P(Y = X)$.
(ب) في السؤال (٢-أ) أوجد العزم الارتباطي بين X ، Y موضحا العلاقة بينهما .

٣- (أ) وضح العلاقة بين عملية برنولي العشوائية $\{X_n; n > 0\}$ و العملية العشوائية $\{Y_n; n \geq 0\}$ حيث أن المتغير Y_n يخضع لتوزيع ذي الحدين واذكر صفات كل منهما ثم عبر مع الاستنتاج عن إحتمال الحادث $(Y_{n+1} = k)$ من خلال إحتمالات الحوادث : $(Y_n = k)$ ، $(Y_n = k - 1)$ لأي عدد صحيح $k > 0$.
(ب) - في العملية العشوائية $\{Y_n; n \geq 0\}$ أوجد كل من $E(Y_5)$ ، $E(Y_4^2)$ ، $P(Y_5 = 3, Y_7 = 4, Y_{14} = 9)$.

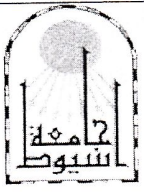
٤- (أ) عرف أزمنة النجاح T_k كعملية عشوائية موضحا العلاقة بينها وبين العملية العشوائية $\{Y_n; n \geq 0\}$ ثم اذكر فقط توزيع المتغير العشوائي T_k .
(ب) - في عملية بواسون العشوائية $\{N_t; t \geq 0\}$ بالمعدل $\lambda = 4$ احسب كل من الإحتمالات الآتية :
 $P(N_{1.5} = 2, N_4 = 5, N_{6.8} = 9)$ ، $P(N_3 = 5, N_7 = 9)$

٥- (أ) في عملية بواسون أو عملية الوصول المعودة $\{N_t; t \geq 0\}$ بالمعدل λ إثبت أن الإحتمال المشروط لعدد الوصول N_t بالنسبة إلى عدد الوصول N_{t+s} لكل $t > 0, s > 0$ يمثل توزيع ذي الحدين.
(ب) - عرف العمليات العشوائية المستقلة ثم اثبت أن أي عمليتين مستقلتين لبواسون هو أيضا عملية بواسون .

٦- (أ) في عملية التجديد العشوائية $R = \{R_n; n \in N\}$ حيث N هي فئة الأعداد الصحيحة غير السالبة عرف دالة التجديد ثم عبر عنها من خلال توزيع المتغير R_n مع الاستنتاج .

(ب) في سلسلة ماركوف العشوائية المتقطعة $\{X_n; n \geq 0\}$ عرف مصفوفة الإحتمالات الإنتقالية بصفاتها المعروفة ثم احسب الإحتمال : $P(X_0 = 1, X_1 = 1, X_2 = 0, X_3 = 1, X_4 = 0, X_6 = 0)$ بفرض أن حالات الفراغ $(0, 1)$ والمصفوفة العشوائية

$$P = \begin{pmatrix} 1/2 & 1/2 \\ 1/3 & 2/3 \end{pmatrix} , \text{ ومنتجه الإحتمالات الابتدائية } \pi_0 = (2/5 \quad 3/5)$$

	المقرر: تحليل عددي (٣٢٣) الفرقة: المستوى الثالث الدرجة: ٥٠ درجة التاريخ: ٢٠١٨/٥/٢٩ الزمن: ثلاث ساعات	جامعة أسيوط كلية العلوم - قسم الرياضيات امتحان نهائي الفصل الدراسي الثاني للعام الجامعي ٢٠١٧/٢٠١٨
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Answer five questions only :- (10 marks for every question)

1-a) If the function $g \in C[a, b]$ and $g(x) \in [a, b] \forall x \in [a, b]$ and $g'(x)$ exist with $|g'(x)| \leq k < 1 \forall x \in [a, b]$ prove that the sequence defined by $P_n = g(P_{n-1}), n \geq 1$ will converge to the unique fixed point P and also $|P_{n+1} - P_n| \leq k^n |P_1 - P_0|$.

1-b) Verify that when Newton's method is used to compute $\sqrt{A}, A > 0$ (By solving the equation : $f(x) = x^2 - A$). The sequence of iterates is defined by : $x_{n+1} = (x_n + \frac{A}{x_n})/2$, and show that if the sequence $\{x_n\}$ is defined as the previous problem, then this method is quadratically convergence.

2-a) Derive Lagrange interpolation formula of degree n and write the error of the method.

2-b) For the given function $f(x) = \cos \pi x$ let $x_0 = -1, x_1 = 0, x_2 = 1$ construct the suitable interpolation polynomial and find the actual error.

3) Derive the formula of the Newton's interpolatory divided difference method and use this formula to obtain a polynomial of least degree that fits the values shown:

x	0	1	2	4	6
$f(x)$	1	9	23	93	259

من فضلك انظر خلف الورقة

السؤال الرابع :-

أ) يعرف الطي للدالتين $f(x)$, $g(x)$ كالآتي

$$f * g = \int_{-\infty}^{\infty} f(u) g(x-u) du$$

برهن علي أن تحويل فوريير للطرف الأيمن هو حاصل ضرب تحويل فوريير للدالتين $f(x)$, $g(x)$

ب) أوجد تحويل فوريير للدالة $f(x) = \begin{cases} 1 & |x| < a \\ 0 & |x| > a \end{cases}$ وأرسم $f(x)$ كذلك تحويلها عند $a = 3$ وأوجد

$$\int_{-\infty}^{\infty} \frac{\sin u}{u} du \quad \text{كذلك} \quad \int_{-\infty}^{\infty} \frac{\sin \alpha a \cos \alpha x}{\alpha} d\alpha$$

ج) ترك خيط لانهاضي من السكون وكانت أزاحتها الابتدائية عن محور x هي $f(x)$ أوجد الإزاحة عند أي زمن .

انتهت الأسئلة مع تمنياتنا بالتوفيق ،،،،

لجنة الممتحنين :- أ. د/ نجاه عبد الرحمن حسين ، أ. د/ فاروق علي السيد



الامتحان النهائي للفصل الدراسي الثاني للعام الجامعي ٢٠١٧/٢٠١٨ م
 للفرقة : الثالثة
 الشعبة : الرياضيات
 التاريخ : ٢٠١٨/٥/٢٤ م

الزمن : ساعتان

الدرجة الكلية : ٥٠ درجة

أسم المقرر : الطرق الرياضية
 رقم المقرر ورمزه : ٣٣٤ ر

درجة كل سؤال : ١٧ درجة

أجب عن ثلاثة أسئلة فقط مما يأتي :-

السؤال الأول :-

أوجد تحويل لابلاس للمشتقة التفاضلية للدالة $F(t)$ عند نقط الاتصال والانفصال للدالة .

أبرهن علي أن

$$\lim_{t \rightarrow 0} F(t) = \lim_{s \rightarrow \infty} s f(s)$$

$$\lim_{t \rightarrow \infty} F(t) = \lim_{s \rightarrow 0} s f(s)$$

$$\Gamma\left(\frac{1}{2}\right) = \sqrt{\pi}, \quad \int_0^{\infty} \delta(t) dt = 1, \quad L \sin \sqrt{t} = \frac{\sqrt{\pi}}{3} e^{-\frac{1}{4s}} s^{\frac{3}{2}}$$

السؤال الثاني :-

حل المعادلات الآتية :

$$t Y''(t) + Y'(t) + 4t Y(t) = 0, \quad y(0) = 3, y'(0) = 0$$

$$\frac{\partial U}{\partial x} = 2 \frac{\partial U}{\partial t} + U, \quad x > 0, t > 0 \quad U(x, 0) = 6 e^{-3x}$$

$$\int_0^t Y(u) Y(t-u) du = 16 \sin 4t$$

السؤال الثالث :-

(أ) فك الدالة $f(x) = x^2$, $0 < x < 2\pi$ بدلالة متسلسلة فوريير ثم أحسب المجموع

$$1 + \frac{1}{2^2} + \frac{1}{3^2} + \frac{1}{4^2} + \dots$$

(ب) صفيحة علي شكل دائري نصف قطرها الوحدة ووجهيها معزولين ونصف محيطها محفوظ عند درجة حرارة u_1

والآخر عند u_2 أوجد حالة الأتزان الحراري .

من فضلك أنظر بقية الأسئلة خلف الورقة ،،،،،



Answer the following questions (50 marks)

Q1.	Complete the following: (1)..... is a representation of a two-dimensional image as a finite set of digital values, called picture elements or pixels - Common image formats include.....(2).... ,(3)..... ,(4)..... (5)..... creates a Distance tool a draggable, resizable line that measures the distance between its endpoints. (6)..... These are the result of objects that are self-luminous, such as stars and light bulbs. (7).....the resulting output pixel is computed as a sum of products of the pixel values and mask coefficients in the pixel's neighborhood in the original image. - The Sobel operators used to compute edges are(8)..... ,(9)..... - Edge detector should have:(10)..... ,(11)..... - Types of noise are(12)..... ,(13)....	(13 marks)
Q2.	a) Compute Z from the following matlab script (6 marks) <pre> x = [150 10 90;80 50 60;121 160 20] y = [-1 0 1;-2 0 2;-1 0 1] z = imfilter(x,y,'corr') </pre> b) What is the Delta compression and compute the compressed data of the data (6 marks) 220 321 335 211 250 200 233 214 232 212	(12 marks)
Q3.	a) Write the MATLAB code used to: (4 marks) - Read any image then use affine transformation matrix for each of the operations below: - Flip the image right to left - Translation by [25, 15] pixels b) What are the main differences between: (8 marks) - Global thresholding and optimal thresholding. - Raster and vector image . - Interpixel redundancy and Psychovisual redundancy	(12 marks)

(Q5) (i) Assume that U, V are open intervals and let $f : U \rightarrow \mathbb{R}$ and $g : V \rightarrow \mathbb{R}$ be two differentiable functions such that $f(U) \subset V$. Prove that $g \circ f$ is differentiable on U and that $(g \circ f)' = (g' \circ f) \cdot f'$ [5 marks]

(ii) Prove that the function $f(x) := \frac{1}{x}$ is differentiable on $]0, \infty[$ but not uniformly continuous therein. [5 marks]

(Q6) (i) State and prove Rolle's theorem then use it to prove the mean value theorem. [6 marks]

(ii) Let I be an open interval. Apply the mean value theorem to prove that a function differentiable on I is

1. increasing if and only if $f' \geq 0$ on I ,

2. decreasing if and only if $f' \leq 0$ on I .

[4 marks]

With the best of luck,

Prof. Rashwan A. Rashwan,

Dr. Ahmed A. Abdelhakim



Time: 3 hours

Total mark: 50

Answer *only five* of the following questions:

(Q1) (i) Suppose that O_i , $i \geq 1$, are open subsets of $\mathbb{R}$. Prove that $\cup_{i \geq 1} O_i$ is also open in $\mathbb{R}$. [5 marks]

(ii) Let $S \subset \mathbb{R}$. Show that S is closed if and only if S contains the limit point of every convergent sequence of elements of S . [5 marks]

(Q2) (i) Prove that a sequence of real numbers converges if and only if it is a Cauchy sequence. [6 marks]

(ii) Show that if $(x_n)_{n \geq 1} \subset \mathbb{R}$ is a monotonically increasing sequence that is bounded above, then $x_n \rightarrow \sup_{n \geq 1} x_n$, as $n \rightarrow \infty$. [4 marks]

(Q3) (i) Show that $f : D \subset \mathbb{R} \rightarrow \mathbb{R}$ is continuous at $x_0 \in D$ if and only if the sequence $(f(x_n))_{n \geq 1}$ converges to $f(x_0)$ whenever $(x_n)_{n \geq 1}$ is a sequence in D that converges to x_0 . [6 marks]

(ii) Use the characterization given in (i) to prove the discontinuity at the origin of the function $f(x) = \begin{cases} \cos \frac{1}{x}, & x \neq 0; \\ 0, & x = 0. \end{cases}$ [4 marks]

(Q4) (i) Assume that D is a closed bounded subset of $\mathbb{R}$. Prove that if $f : D \rightarrow \mathbb{R}$ is continuous then f is bounded on D , and there exist $\alpha, \beta \in D$ such that $f(\alpha) = \max_{x \in D} f(x)$ and $f(\beta) = \min_{x \in D} f(x)$. [5 marks]

(ii) Argue by contradiction to demonstrate that if $f : [a, b] \rightarrow \mathbb{R}$ is continuous then it is uniformly continuous on $[a, b]$. [5 marks]

Please Turn over the page

Timer/Counter
Interrupt Mask
Register – TIMSK

Bit	7	6	5	4	3	2	1	0	
	OCIE2	TOIE2	OCIE1	OCIE1A	OCIE1B	TOIE1	OCIE0	TOIE0	TIMSK
Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

Bit 1 – OCIE0: Timer/Counter0 Output Compare Match Interrupt Enable
Bit 0 – TOIE0: Timer/Counter0 Overflow Interrupt Enable

Timer/Counter
Interrupt Flag Register
– TIFR

Bit	7	6	5	4	3	2	1	0	
	OCF2	TOV2	OCF1	OCF1A	OCF1B	TOV1	OCF0	TOV0	TIFR
Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

Bit 1 – OCF0: Output Compare Flag 0
Bit 0 – TOV0: Timer/Counter0 Overflow Flag

Timer/Counter1
Control Register A –
TCCR1A

Bit	7	6	5	4	3	2	1	0	
	COM1A1	COM1A0	COM1B1	COM1B0	FOC1A	FOC1B	WGM11	WGM10	TCCR1A
Read/Write	R/W	R/W	R/W	R/W	W	W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

Bit 7:6 – COM1A1:0: Compare Output Mode for Compare unit A
Bit 5:4 – COM1B1:0: Compare Output Mode for Compare unit B
Bit 3 – FOC1A: Force Output Compare for Compare unit A
Bit 2 – FOC1B: Force Output Compare for Compare unit B
Bit 1:0 – WGM11:0: Waveform Generation Mode

CS02	CS01	CS00	Description
0	0	0	No clock source (Timer/Counter stopped).
0	0	1	$clk_{IO}/1$ (No prescaling)
0	1	0	$clk_{IO}/8$ (From prescaler)
0	1	1	$clk_{IO}/64$ (From prescaler)
1	0	0	$clk_{IO}/256$ (From prescaler)
1	0	1	$clk_{IO}/1024$ (From prescaler)
1	1	0	External clock source on T0 pin, Clock on falling edge.
1	1	1	External clock source on T0 pin, Clock on rising edge.

COM1A1/COM1B1	COM1A0/COM1B0	Description
0	0	Normal port operation, OC1A/OC1B disconnected.
0	1	Toggle OC1A/OC1B on compare match
1	0	Clear OC1A/OC1B on compare match (Set output to low level)
1	1	Set OC1A/OC1B on compare match (Set output to high level)

Mode	WGM13	WGM12 (CTC1)	WGM11 (PWM11)	WGM10 (PWM10)	Timer/Counter Mode of Operation	TOP	Update of OCR1x	TOV1 Flag Set on
0	0	0	0	0	Normal	0xFFFF	Immediate	MAX
1	0	0	0	1	PWM, Phase Correct, 8-bit	0x00FF	TOP	BOTTOM
2	0	0	1	0	PWM, Phase Correct, 9-bit	0x01FF	TOP	BOTTOM
3	0	0	1	1	PWM, Phase Correct, 10-bit	0x03FF	TOP	BOTTOM
4	0	1	0	0	CTC	OCR1A	Immediate	MAX
5	0	1	0	1	Fast PWM, 8-bit	0x00FF	BOTTOM	TOP
6	0	1	1	0	Fast PWM, 9-bit	0x01FF	BOTTOM	TOP
7	0	1	1	1	Fast PWM, 10-bit	0x03FF	BOTTOM	TOP
8	1	0	0	0	PWM, Phase and Frequency Correct	ICR1	BOTTOM	BOTTOM
9	1	0	0	1	PWM, Phase and Frequency Correct	OCR1A	BOTTOM	BOTTOM
10	1	0	1	0	PWM, Phase Correct	ICR1	TOP	BOTTOM
11	1	0	1	1	PWM, Phase Correct	OCR1A	TOP	BOTTOM
12	1	1	0	0	CTC	ICR1	Immediate	MAX
13	1	1	0	1	Reserved	–	–	–
14	1	1	1	0	Fast PWM	ICR1	BOTTOM	TOP
15	1	1	1	1	Fast PWM	OCR1A	BOTTOM	TOP

Timer/Counter1
Control Register B –
TCCR1B

Bit	7	6	5	4	3	2	1	0	
	ICNC1	ICES1	–	WGM13	WGM12	CS12	CS11	CS10	TCCR1B
Read/Write	R/W	R/W	R	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

Bit 7 – ICNC1: Input Capture Noise Canceler
Bit 6 – ICES1: Input Capture Edge Select
Bit 5 – Reserved Bit
Bit 4:3 – WGM13:2: Waveform Generation Mode
Bit 2:0 – CS12:0: Clock Select

CS12	CS11	CS10	Description
0	0	0	No clock source (Timer/Counter stopped).
0	0	1	$clk_{IO}/1$ (No prescaling)
0	1	0	$clk_{IO}/8$ (From prescaler)
0	1	1	$clk_{IO}/64$ (From prescaler)
1	0	0	$clk_{IO}/256$ (From prescaler)
1	0	1	$clk_{IO}/1024$ (From prescaler)
1	1	0	External clock source on T1 pin. Clock on falling edge.
1	1	1	External clock source on T1 pin. Clock on rising edge.

Timer/Counter1 – TCNT1H and TCNT1L

Bit	7	6	5	4	3	2	1	0	
	TCNT1[15:8]								TCNT1H
	TCNT1[7:0]								TCNT1L
Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

Output Compare Register 1 B – OCR1BH and OCR1BL

Bit	7	6	5	4	3	2	1	0	
	OCR1B[15:8]								OCR1BH
	OCR1B[7:0]								OCR1BL
Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

Input Capture Register 1 – ICR1H and ICR1L

Bit	7	6	5	4	3	2	1	0	
	ICR1[15:8]								ICR1H
	ICR1[7:0]								ICR1L
Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

Timer/Counter Interrupt Mask Register – TIMSK⁽¹⁾

Bit	7	6	5	4	3	2	1	0	
	OCIE2	TOIE2	TICIE1	OCIE1A	OCIE1B	TOIE1	OCIE0	TOIE0	TIMSK
Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

- Bit 5 – TICIE1: Timer/Counter1, Input Capture Interrupt Enable
 Bit 4 – OCIE1A: Timer/Counter1, Output Compare A Match Interrupt Enable
 Bit 3 – OCIE1B: Timer/Counter1, Output Compare B Match Interrupt Enable
 Bit 2 – TOIE1: Timer/Counter1, Overflow Interrupt Enable

Timer/Counter Interrupt Flag Register – TIFR

Bit	7	6	5	4	3	2	1	0	
	OCF2	TOV2	ICF1	OCF1A	OCF1B	TOV1	OCF0	TOV0	TIFR
Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

- Bit 5 – ICF1: Timer/Counter1, Input Capture Flag
 Bit 4 – OCF1A: Timer/Counter1, Output Compare A Match Flag
 Bit 3 – OCF1B: Timer/Counter1, Output Compare B Match Flag
 Bit 2 – TOV1: Timer/Counter1, Overflow Flag

USART

Operating Mode	Equation for Calculating Baud Rate ⁽¹⁾	Equation for Calculating UBRR Value
Asynchronous Normal Mode (U2X = 0)	$BAUD = \frac{f_{osc}}{16(UBRR + 1)}$	$UBRR = \frac{f_{osc}}{16BAUD} - 1$
Asynchronous Double Speed Mode (U2X = 1)	$BAUD = \frac{f_{osc}}{8(UBRR + 1)}$	$UBRR = \frac{f_{osc}}{8BAUD} - 1$
Synchronous Master Mode	$BAUD = \frac{f_{osc}}{2(UBRR + 1)}$	$UBRR = \frac{f_{osc}}{2BAUD} - 1$

USART I/O Data Register – UDR

Bit	7	6	5	4	3	2	1	0	
	RXB[7:0]								UDR (Read)
	TXB[7:0]								UDR (Write)
Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

USART Control and Status Register A – UCSRA

Bit	7	6	5	4	3	2	1	0	
	RXC	TXC	UDRE	FE	DOR	PE	U2X	MPCM	UCSRA
Read/Write	R	R/W	R	R	R	R	R/W	R/W	
Initial Value	0	0	1	0	0	0	0	0	

- Bit 7 – RXC: USART Receive Complete
- Bit 6 – TXC: USART Transmit Complete
- Bit 5 – UDRE: USART Data Register Empty
- Bit 4 – FE: Frame Error
- Bit 3 – DOR: Data OverRun
- Bit 2 – PE: Parity Error
- Bit 1 – U2X: Double the USART Transmission Speed
- Bit 0 – MPCM: Multi-processor Communication Mode

USART Control and Status Register B – UCSRB

Bit	7	6	5	4	3	2	1	0	
	RXCIE	TXCIE	UDRIE	RXEN	TXEN	UCSZ2	RXB8	TXB8	UCSRB
Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R	R/W	
Initial Value	0	0	0	0	0	0	0	0	

- Bit 7 – RXCIE: RX Complete Interrupt Enable
- Bit 6 – TXCIE: TX Complete Interrupt Enable
- Bit 5 – UDRIE: USART Data Register Empty Interrupt Enable
- Bit 4 – RXEN: Receiver Enable
- Bit 3 – TXEN: Transmitter Enable
- Bit 2 – UCSZ2: Character Size
- Bit 1 – RXB8: Receive Data Bit 8
- Bit 0 – TXB8: Transmit Data Bit 8

USART Control and Status Register C – UCSRC

Bit	7	6	5	4	3	2	1	0	
	URSEL	UMSEL	UPM1	UPM0	USBS	UCSZ1	UCSZ0	UCPOL	UCSRC
Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	
Initial Value	1	0	0	0	0	1	1	0	

- Bit 7 – URSEL: Register Select
- Bit 6 – UMSEL: USART Mode Select
- Bit 5:4 – UPM1:0: Parity Mode
- Bit 3 – USBS: Stop Bit Select
- Bit 2:1 – UCSZ1:0: Character Size
- Bit 0 – UCPOL: Clock Polarity

UMSEL	Mode
0	Asynchronous Operation
1	Synchronous Operation

USBS	Stop Bit(s)
0	1-bit
1	2-bit

UPM1	UPM0	Parity Mode
0	0	Disabled
0	1	Reserved
1	0	Enabled, Even Parity
1	1	Enabled, Odd Parity

UCPOL	Transmitted Data Changed (Output of Tx D Pin)	Received Data Sampled (Input on Rx D Pin)
0	Rising XCK Edge	Falling XCK Edge
1	Falling XCK Edge	Rising XCK Edge

Table 66. UCSZ Bits Settings

UCSZ2	UCSZ1	UCSZ0	Character Size
0	0	0	5-bit
0	0	1	6-bit
0	1	0	7-bit
0	1	1	8-bit
1	0	0	Reserved
1	0	1	Reserved
1	1	0	Reserved
1	1	1	9-bit

USART Baud Rate Registers – UBRRL and UBRRH

Bit	15	14	13	12	11	10	9	8	
	URSEL	-	-	-	-	UBRR[11:9]	-	-	UBRRH
	-	-	-	-	-	UBRR[7:0]	-	-	UBRRH
	-	-	-	-	-	-	-	-	UBRRH
Read/Write	R/W	R	R	R	R/W	R/W	R/W	R/W	
	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	



Operation Research326 R

11-5-2018

Third Level: Computer Science Section

Time: 3 hours

Total Degree (50 marks)

Science Faculty

Mathematical Department

Answer the following Questions:

1-Use the Simplex method to solve the following linear programming

Maximize $Z = 10x_1 + 11x_2$

Subject to $x_1 + 2x_2 \leq 150$, $3x_1 + 4x_2 \leq 200$, $6x_1 + x_2 \leq 175$

and $x_1, x_2 \geq 0$

(10 marks)

2) Use the graphical and the algebraic method to solve the problem

Max $f(\underline{x}) = 5x_1 + 7x_2$ Subject to $5x_1 + 8x_2 \leq 24$, $x_1 + x_2 \leq 4$,

$10x_1 + 7x_2 \leq 35$ and $x_1, x_2 \geq 0$

(12.5marks)

3) Use the Lagrange multiplier method to find the extreme points of the problem

Minimize $f(\underline{x}) = x_1^2 + x_2^2 - 3x_1x_2$

Subject to $g(\underline{x}) = x_1^2 + x_2^2 - 8 = 0$.

(12.5marks)

4) Use the Hessian Matrix to find the local points of the problem

$f(\underline{x}) = f(x_1, x_2) = x_1^3 + x_2^3 + 2x_1^2 + 4x_2^2 + 6$

(10marks)

5) Find the local Points

$f(x) = 3x^4 - 20x^3 + 36x^2 + 16$ (5marks)

Best Wishes

Dr. Alaa Fahim



Operation Research326 R

11-5-2018

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Subject to $x_1 + 2x_2 \leq 150$, $3x_1 + 4x_2 \leq 200$, $6x_1 + x_2 \leq 175$

and $x_1, x_2 \geq 0$

(10 marks)

2) Use the graphical and the algebraic method to solve the problem

Max $f(\underline{x}) = 5x_1 + 7x_2$ Subject to $5x_1 + 8x_2 \leq 24$, $x_1 + x_2 \leq 4$,

$10x_1 + 7x_2 \leq 35$ and $x_1, x_2 \geq 0$

(12.5marks)

3) Use the Lagrange multiplier method to find the extreme points of the problem

Minimize $f(\underline{x}) = x_1^2 + x_2^2 - 3x_1x_2$

Subject to $g(\underline{x}) = x_1^2 + x_2^2 - 8 = 0$.

(12.5marks)

4) Use the Hessian Matrix to find the local points of the problem

$f(\underline{x}) = f(x_1, x_2) = x_1^3 + x_2^3 + 2x_1^2 + 4x_2^2 + 6$

(10marks)

5) Find the local Points

$f(x) = 3x^4 - 20x^3 + 36x^2 + 16$ (5marks)

Best Wishes

Dr. Alaa Fahim

اجب عن خمسة فقط من الاسئلة الاتية :- (10 درجات لكل سؤال : بواقع 5 درجات لكل فقرة)

(1) (i) اوجد الحل العام للمعادلة : $p_1 + 3p_2 + 2p_3(1 + \sqrt{x_1 + x_2 + x_3 - u}) = 6$
(ii) اوجد الحل الخاص للمعادلة : $(y - z)[2xyp + (x^2 - y^2)q] + z(x^2 - y^2) = 0$
الذي يمر خلال المنحنى $y = 0, x^3 = z^2$

(2) اوجد الحل العام لكل من المعادلتين التفاضليتين الجزئيتين الاتيتين :-
(i) $(D_1^3 - D_1^2 D_2 - D_1 D_2^2 + D_2^3)z = \log(x + y)$
(ii) $(D_1^2 - a^2 D_2^2)z = x^2 + y^2$, ثابت مطلق a

(3) اوجد الحل العام لكل من المعادلتين التفاضليتين الجزئيتين الاتيتين :-
(i) $(D_1^2 D_2 + D_2^2 - 2)z = e^{2y} \sin 3x - e^x \cos 2y$
(ii) $(D_1^2 - D_2^2 - D_1 - 3D_2 - 2)z = e^{2x-3y} + x + y + 1$

(4) (i) احسب التكاملات الاتية :-
(a) $\int_0^{\infty} x^{-\frac{1}{3}}(1 + 2x)^{-3} dx$ (b) $\int_0^1 \sqrt{\log \frac{1}{x}} dx$

(ii) اثبت ان :-
(a) $\tan^{-1} x = x {}_2F_1(1, \frac{1}{2}; \frac{3}{2}; -x^2)$
(b) $(a - b) {}_2F_1(a, b; c; x) = a {}_2F_1(a + 1, b; c; x) - b {}_2F_1(a, b + 1; c; x)$

(5) اثبت ان دوال بسل من النوع الاول $J_n(x)$ تحقق الاتي :-
(i) $J_{-\frac{1}{2}}(x) = \sqrt{\frac{2}{\pi x}} \cos x$, (ii) $\int x^n J_{n-1}(x) dx = x^n J_n(x) + c$

(6) (i) اثبت ان كثيرات حدود لجندر $P_n(x)$ تحقق :-
(ii) احسب التكاملات الاتية :-
(a) $\int_{-1}^1 x P_n(x) P_{n+1}(x) dx$, (b) $\int_{-1}^1 x^2 P_n(x) P_{n+1}(x) dx$, (c) $\int_{-1}^1 x^2 P_n(x) dx$



أجب عن أسئلة الآتية :- (كل سؤال ١٠ درجات)

(١) (أ) أثبت قاعدة التضعيف لدالة جاما $\sqrt{\pi} \Gamma(2x) = 2^{2x-1} \Gamma(x) \Gamma\left(x + \frac{1}{2}\right), x > 0$

ثم استخدمها فى إثبات أن: $\Gamma\left(\frac{5}{6}\right) \left[\Gamma\left(\frac{1}{3}\right)\right]^2 = 2 \sqrt[3]{2} \sqrt{\frac{\pi^3}{3}}$

(ب) باستخدام دوال جاما و بيتا أوجد التكاملات الآتية: (i) $\int_0^{\frac{\pi}{2}} \sqrt{\tan \theta} d\theta$ (ii) $\int_0^{\infty} \frac{\sqrt{x}}{e^{x^3}} dx$

(٢) (أ) أثبت أن: $\Gamma(x) \Gamma(1-x) = \frac{\pi}{\sin \pi x}, 0 < x < 1$ ومن ثم أثبت أن

$\Gamma\left(x + \frac{1}{2}\right) \Gamma\left(\frac{1}{2} - x\right) = \frac{\pi}{\cos \pi x}$

(ب) أثبت أن:

(i) $\sqrt{1-x^2} T_n(x) = U_{n+1}(x) - x U_n(x),$

(ii) $(1-x^2) U'_n(x) = -n x U_n(x) + n U_{n-1}(x)$

(٣) أثبت أن:

(i) ${}_2F_1(\alpha, \beta; \gamma, x) = (1-x)^{-\beta} {}_2F_1\left(\gamma - \alpha, \beta; \gamma, \frac{x}{x-1}\right)$

(ii) ${}_1F_1\left(\frac{1}{2}; \frac{3}{2}, -x^2\right) = \frac{\sqrt{\pi}}{2x} \operatorname{erf}(x)$ حيث أن: $\operatorname{erf}(x) = \frac{2}{\sqrt{\pi}} \int_0^x e^{-t^2} dt$ هى دالة الخطأ

(iii) ${}_1F_1(\alpha + 1; \gamma, x) - {}_1F_1(\alpha; \gamma, x) - \frac{x}{\gamma} {}_1F_1(\alpha + 1; \gamma + 1, x) = 0$

(٤) (أ) أوجد مفكوك ليجندر للدالة: $f(x) = x^3$

(ب) أثبت أن: $H_n(x) = (-1)^n e^{x^2} \frac{d^n}{dx^n} (e^{-x^2})$ حيث $H_n(x)$ كثيرة حدود هيرميت.

(ج) أثبت أن: $J_{\frac{1}{2}}(x) = \sqrt{\frac{2}{\pi}} \frac{\sin x}{\sqrt{x}}$

(٥) (أ) باستخدام الصيغة التكاملية لدوال بسل أثبت أن: $\int_0^{\infty} e^{-3x} J_0(4x) dx = \frac{1}{5}$

(ب) أوجد الحل العام لمعادلة بسل التفاضلية:

$x^2 \frac{d^2 y}{dx^2} + x \frac{dy}{dx} + (x^2 - n^2)y = 0$



Question 1: Put True or False for each of the following items (30 marks)

1. To enter a formula into a cell, begin by typing an equal sign.
2. Functions are pre-defined worksheet formulas.
3. Formulas in Excel must be written in a very specific format, referred to as syntax.
4. The second order of precedence is for exponentiation.
5. When the formula in cell **B7 =B4+B5+B6** is copied into cell **C7** the formula will be changed to **= C4+C5+C6**.
6. The error "#####" means Data being referenced is not available.
7. The range **B2:B7** is a range down a column.
8. To keep things clear and simple only add an absolute (\$) cell reference if absolutely necessary.
9. The formula **=ROUND(78.686788,-1)** results in the value 80 .
10. Placing an absolute sign in front of a ranged name (**\$budget**) is incorrect syntax.
11. The columns of the worksheet are named with Numbers.
12. Cells may contain only Labels and Values.
13. The cell address first lists the row name and then the column name.
14. This selected cell is referred to as the **active cell**.
15. The contents of the active cell will also be displayed on the **formula bar**.
16. A cell that is on sheet 3, in the second column third row would be referred to as **Sheet3@B3**.
17. Formatted Display is the number of decimal places that appear in a cell.
18. Formulas can be copied to perform different operations on a corresponding set of data.
19. The function **COUNT(value1,[value2],...)** counts non-blank cells.
20. The Average function ignore the blank cells.
21. TRUE and FALSE are called Boolean Values.
22. SPSS stands for Statistical Package for the Social Sciences.
23. SPSS is capable of handling large amounts of data.
24. SPSS has only two windows Data view and Output view.
25. **Transform** menu includes several options to change current variables.
26. In SPSS, Each column typically represents the data from 1 case.
27. In SPSS, The first column of variable view is Name.
28. In SPSS, you can sort data from **Transform** menu then **Sort Cases**.
29. Descriptive statistics are calculated using the **Analyze** menu.
30. Correlation is used to test the degree of association between variables.

Answer Sheet		
	True	False
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Question 2: (10 marks)

	A	B	C	D	E	F	G
1		MT1	MT2	Final	Total	Honors	Passed
2	Possible points	100	100	200	400		320
3							
4	Blue	79	89	169	337	FALSE	TRUE
5	Jones	85	65	195	345	FALSE	TRUE
6	Grey	60	97	187	344	TRUE	TRUE
7	Mary	10	30	50	90	TRUE	FALSE
8							

Write the following Boolean functions

1. Blue's total and Jones' total are greater than Grey's:
2. Grey's total is not the maximum grade:
3. None of the students passed the course
4. Blue is not an Honors student
5. Blue didn't get a passing grade (320)

Question 3: (10 marks)

1. What are the difference between Data View, Variable View and Output View in SPSS?
2. Some significance tests are very restrictive about the form of data they can accept. What are the different types of measurement?
3. Describe how to test the degree of association between variables by SPSS.
4. Explain how to use SPSS to calculate the frequency and percent of females and males who did and did not have social problems.

Q2.

- a. Maintain two different Algorithm of crossover process with mention the probability of crossover (5 marks)
- b. Maintain two different Algorithm of mutation process with mention the probability of mutation. (5 marks)

Q3. a. Maintain tree type representation of solutions in genetic algorithm. (3 marks)

b. Using genetic algorithm to find the maximum value of the function $(15x - x^2)$ where parameter x varies between 0 and 15. For simplicity, we may assume that x takes only integer values. Using the genetic algorithm procedure in one step and begin with four solutions in initial solutions. (10 marks)

Q4. Discuss the internal structure of Taxi driver Robot. (7 marks)

Q5. Discuss the Tabu search method and maintain the type of memory using in this method and maintain the Tabu search algorithm. (10 marks)

==best wishes==

Dr. Alaa F. Mohamed

Answer the following questions: (50 Marks)

Question 1: Answer the following points (10 Marks)

- 1- Explain the internet "nuts and bolts"?
- 2- Explain the sources of packet delay?
- 3- What are protocols?
- 4- Explain Access network: digital subscriber line (DSL)?

Question 2: Answer the following points (10 Marks)

- 1- What is the network core?
- 2- Explain Packet Switching: queueing delay, loss?
- 3- Define throughput?
- 4- Define and explain traffic intensity?

Question 3: Answer the following points (10 Marks)

- 1- Explain the Internet protocol stack?
- 2- Mention some network applications?
- 3- Explain the application client-server architecture?
- 4- Explain P2P architecture?

Question 4: Answer the following points (10 Marks)

- 1- HTTP is "stateless". What does that mean?
- 2- Compare between persistent HTTP and non-persistent HTTP?
- 3- Give examples of HTTP response status codes?
- 4- Explain the term (web caches) and how it is useful?

Question 5: Answer the following points (10 Marks)

- 1- Give a DNS name resolution example?
- 2- Compare between multiplexing and demultiplexing? Support your answer with a diagram?
- 3- Define and explain the use of ACKs and NAKs?
- 4- Define and explain HOL? Support your answer with a diagram?

جامعة أسيوط	مايو 2018	كود المقرر: 356 رك
كلية العلوم		المقرر : مقدمة فى الحسابات العلمية
قسم الرياضيات		الزمن : ساعتان

Answer the following questions by using MATLAB language: (50 marks)

1- Using Newton's forward difference formula, find $y(0.1)$ using the table below:

x	0.0	0.2	0.4	0.6	0.8
y	1.000	1.22140	1.49182	1.82212	2.22554

2- Solve the differential equation by Adams method (without using nested for loops) at $x=0.2$:

$$\frac{dy}{dt} = t^2 - y, \quad y(0) = 1, \quad h = 0.05.$$

and compare it with the analytic solution $y = -e^{-t} + t^2 - 2t + 2$.

3- Solve the following initial value problem:

$$\frac{d^2u}{dt^2} + 4\frac{du}{dt} + 3u = 0, \quad u(0) = 1, \quad \frac{du}{dt}(0) = 0.$$

4- Let $f(x) = \cos 2x$ and $x_0 = 0$. Determine

- The third Taylor polynomial for f about x_0 .
- Find error bound at $x = 0.2$ and compare it to the actual error.

5- For the well-known Chua's circuit equation in chaotic studies that

$$\dot{x} = \alpha[y - x - f(x)], \quad \dot{y} = x - y + z, \quad \dot{z} = -\beta y - \gamma z, \quad t \in (0, 10),$$

where the nonlinear function $f(x)$ is described by

$$f(x) = bx + 0.5(a-b)(|x+1| - |x-1|) \text{ and } a < b < 0.$$

Write an M-function to describe the equation, and draw the phase trajectory for the parameters $\alpha = 9$, $\beta = 100/7$, $\gamma = 0$, $a = -8/7$, $b = -5/7$, and initial conditions

$$x(0) = -2.121304, \quad y(0) = -0.066170, \quad z(0) = 2.881090.$$

Good Luck

Dr. Tarek Aboelenen



امتحان الفرقة الثالثة شعبة الرياضيات

الزمن : ثلاث ساعات

رقم المقرر ورمزه : ١٣٤٦

المقرر : عمليات عشوائية وتطبيقاتها

أجب عن خمسة أسئلة فقط مما يأتي :- درجة جزء كل سؤال (خمس درجات)

١- (أ) لمجموعة المتغيرات العشوائية المستقلة $X_1, X_2, X_3, \dots$ بفرض أن التوقع الرياضي $E(X_i) = m$ والتباين $V(X_i)$ لكل منها محدود عرف كل من التقارب عن طريق الإحتمال وقانون الأعداد الكبرى (الضعيف).
(ب) بفرض أن $f f s s f s f f s s s f f s f f s$ هي إحدى النتائج الممكنة في محاولات برنولي العشوائية المستقلة بحيث أن $P(s) = p, P(f) = q, p + q = 1$ عرف عملية عشوائية في الفراغ R^2 موضحا ذلك بيانيا .

٢- (أ) في عملية برنولي العشوائية $\{X_n; n > 0\}$ بالإحتمال $p = 0.6$ إذا كان $X = X_1 + X_2$ ، $Y = X_1 + X_3$ احسب الإحتمالات الآتية : $P(X < 2, Y \leq 1)$ ، $P(2X < 3Y)$ ، $P(Y = X)$.
(ب) في السؤال (٢-أ) أوجد العزم الارتباطي بين X ، Y موضحا العلاقة بينهما .

٣- (أ) وضح العلاقة بين عملية برنولي العشوائية $\{X_n; n > 0\}$ و العملية العشوائية $\{Y_n; n \geq 0\}$ حيث أن المتغير Y_n يخضع لتوزيع ذي الحدين واذكر صفات كل منهما ثم عبر مع الإستنتاج عن إحتمال الحادث $(Y_{n+1} = k)$ من خلال إحتمالات الحوادث : $(Y_n = k)$ ، $(Y_n = k - 1)$ لأي عدد صحيح $k > 0$.
(ب) في العملية العشوائية $\{Y_n; n \geq 0\}$ أوجد كل من $E(Y_5)$ ، $E(Y_4^2)$ ، $P(Y_5 = 3, Y_7 = 4, Y_{14} = 9)$.

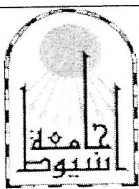
٤- (أ) عرف أزمنة النجاح T_k كعملية عشوائية موضحا العلاقة بينها وبين العملية العشوائية $\{Y_n; n \geq 0\}$ ثم اذكر فقط توزيع المتغير العشوائي T_k .
(ب) - في عملية بواسون العشوائية $\{N_t; t \geq 0\}$ بالمعدل $\lambda = 4$ احسب كل من الإحتمالات الآتية :
 $P(N_{1.5} = 2, N_4 = 5, N_{6.8} = 9)$ ، $P(N_3 = 5, N_7 = 9)$

٥- (أ) في عملية بواسون أو عملية الوصول المعودة $\{N_t; t \geq 0\}$ بالمعدل λ إثبت أن الإحتمال المشروط لعدد الوصول N_t بالنسبة إلى عدد الوصول N_{t+s} لكل $t > 0, s > 0$ يمثل توزيع ذي الحدين .
(ب) عرف العمليات العشوائية المستقلة ثم اثبت أن أي عمليتين مستقلتين لبواسون هو أيضا عملية بواسون .

٦- (أ) في عملية التجديد العشوائية $R = \{R_n; n \in N\}$ حيث N هي فئة الأعداد الصحيحة غير السالبة عرف دالة التجديد ثم عبر عنها من خلال توزيع المتغير R_n مع الإستنتاج .

(ب) في سلسلة ماركوف العشوائية المتقطعة $\{X_n; n \geq 0\}$ عرف مصفوفة الإحتمالات الإنتقالية بصفاتها المعروفة ثم احسب الإحتمال : $P(X_0 = 1, X_1 = 1, X_2 = 0, X_3 = 1, X_4 = 0, X_6 = 0)$ بفرض أن حالات الفراغ $(0, 1)$ والمصفوفة العشوائية

$$P = \begin{pmatrix} 1/2 & 1/2 \\ 1/3 & 2/3 \end{pmatrix} , \text{ ومنتجه الإحتمالات الابتدائية } \pi_0 = (2/5 \quad 3/5)$$

	المقرر: تحليل عددي (٣٢٣) الفرقة: المستوى الثالث الدرجة: ٥٠ درجة التاريخ: ٢٠١٨/٥/٢٩ الزمن: ثلاث ساعات	جامعة أسيوط كلية العلوم - قسم الرياضيات امتحان نهائي الفصل الدراسي الثاني للعام الجامعي ٢٠١٧/٢٠١٨
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Answer five questions only :- (10 marks for every question)

1-a) If the function $g \in C[a, b]$ and $g(x) \in [a, b] \forall x \in [a, b]$ and $g'(x)$ exist with $|g'(x)| \leq k < 1 \forall x \in [a, b]$ prove that the sequence defined by $P_n = g(P_{n-1}), n \geq 1$ will converge to the unique fixed point P and also $|P_{n+1} - P_n| \leq k^n |P_1 - P_0|$.

1-b) Verify that when Newton's method is used to compute $\sqrt{A}, A > 0$ (By solving the equation : $f(x) = x^2 - A$). The sequence of iterates is defined by : $x_{n+1} = (x_n + \frac{A}{x_n})/2$, and show that if the sequence $\{x_n\}$ is defined as the previous problem, then this method is quadratically convergence.

2-a) Derive Lagrange interpolation formula of degree n and write the error of the method.

2-b) For the given function $f(x) = \cos \pi x$ let $x_0 = -1, x_1 = 0, x_2 = 1$ construct the suitable interpolation polynomial and find the actual error.

3) Derive the formula of the Newton's interpolatory divided difference method and use this formula to obtain a polynomial of least degree that fits the values shown:

x	0	1	2	4	6
$f(x)$	1	9	23	93	259

من فضلك انظر خلف الورقة

السؤال الرابع :-

أ) يعرف الطي للدالتين $f(x)$, $g(x)$ كالآتي

$$f * g = \int_{-\infty}^{\infty} f(u) g(x-u) du$$

برهن علي أن تحويل فوريير للطرف الأيمن هو حاصل ضرب تحويل فوريير للدالتين $f(x)$, $g(x)$

ب) أوجد تحويل فوريير للدالة $f(x) = \begin{cases} 1 & |x| < a \\ 0 & |x| > a \end{cases}$ وأرسم $f(x)$ كذلك تحويلها عند $a = 3$ وأوجد

$$\int_{-\infty}^{\infty} \frac{\sin u}{u} du \quad \text{كذلك} \quad \int_{-\infty}^{\infty} \frac{\sin \alpha a \cos \alpha x}{\alpha} d\alpha$$

ج) ترك خيط لانهائي من السكون وكانت أزاحته الابتدائية عن محور x هي $f(x)$ أوجد الإزاحه عند أي زمن .

انتهت الأسئلة مع تمنياتنا بالتوفيق ،،،،

لجنة الممتحنين :- أ.د/ نجاه عبد الرحمن حسين ، أ.د/ فاروق علي السيد



الامتحان النهائي للفصل الدراسي الثاني للعام الجامعي ٢٠١٧/٢٠١٨ م
 للفرقة : الثالثة
 الشعبة : الرياضيات
 التاريخ : ٢٠١٨/٥/٢٤ م

الزمن : ساعتان

الدرجة الكلية : ٥٠ درجة

درجة كل سؤال : ١٧ درجة

أسم المقرر : الطرق الرياضية
 رقم المقرر ورمزه : ٣٣٤ ر

أجب عن ثلاثة أسئلة فقط مما يأتي :-

السؤال الأول :-

أوجد تحويل لابلاس للمشتقة التفاضلية للدالة $F(t)$ عند نقط الاتصال والانفصال للدالة .

أبرهن علي أن

$$\lim_{t \rightarrow 0} F(t) = \lim_{s \rightarrow \infty} s f(s)$$

$$\lim_{t \rightarrow \infty} F(t) = \lim_{s \rightarrow 0} s f(s)$$

$$\Gamma\left(\frac{1}{2}\right) = \sqrt{\pi}, \quad \int_0^{\infty} \delta(t) dt = 1, \quad L \sin \sqrt{t} = \frac{\sqrt{\pi}}{3} e^{-\frac{1}{4s}} s^{\frac{3}{2}}$$

السؤال الثاني :-

حل المعادلات الآتية :

$$t Y''(t) + Y'(t) + 4t Y(t) = 0, \quad y(0) = 3, y'(0) = 0$$

$$\frac{\partial U}{\partial x} = 2 \frac{\partial U}{\partial t} + U, \quad x > 0, t > 0, \quad U(x, 0) = 6 e^{-3x}$$

$$\int_0^t Y(u) Y(t-u) du = 16 \sin 4t$$

السؤال الثالث :-

(أ) فك الدالة $f(x) = x^2$, $0 < x < 2\pi$ بدلالة متسلسلة فوريير ثم أحسب المجموع

$$1 + \frac{1}{2^2} + \frac{1}{3^2} + \frac{1}{4^2} + \dots$$

(ب) صفيحة علي شكل دائري نصف قطرها الوحدة ووجهيها معزولين ونصف محيطها محفوظ عند درجة حرارة u_1

والآخر عند u_2 أوجد حالة الأتزان الحراري .

من فضلك أنظر بقية الأسئلة خلف الورقة ،،،،،



Answer the following questions (50 marks)

Q1.	Complete the following: (1)..... is a representation of a two-dimensional image as a finite set of digital values, called picture elements or pixels - Common image formats include.....(2).... ,(3)..... ,(4)..... (5)..... creates a Distance tool a draggable, resizable line that measures the distance between its endpoints. (6)..... These are the result of objects that are self-luminous, such as stars and light bulbs. (7).....the resulting output pixel is computed as a sum of products of the pixel values and mask coefficients in the pixel's neighborhood in the original image. - The Sobel operators used to compute edges are(8)..... ,(9)..... - Edge detector should have:(10)..... ,(11)..... - Types of noise are(12)..... ,(13)....	(13 marks)
Q2.	a) Compute Z from the following matlab script (6 marks) <pre> x = [150 10 90;80 50 60;121 160 20] y = [-1 0 1;-2 0 2;-1 0 1] z = imfilter(x,y,'corr') </pre> b) What is the Delta compression and compute the compressed data of the data (6 marks) 220 321 335 211 250 200 233 214 232 212	(12 marks)
Q3.	a) Write the MATLAB code used to: (4 marks) - Read any image then use affine transformation matrix for each of the operations below: - Flip the image right to left - Translation by [25, 15] pixels b) What are the main differences between: (8 marks) - Global thresholding and optimal thresholding. - Raster and vector image . - Interpixel redundancy and Psychovisual redundancy	(12 marks)

(Q5) (i) Assume that U, V are open intervals and let $f : U \rightarrow \mathbb{R}$ and $g : V \rightarrow \mathbb{R}$ be two differentiable functions such that $f(U) \subset V$. Prove that $g \circ f$ is differentiable on U and that $(g \circ f)' = (g' \circ f) \cdot f'$ [5 marks]

(ii) Prove that the function $f(x) := \frac{1}{x}$ is differentiable on $]0, \infty[$ but not uniformly continuous therein. [5 marks]

(Q6) (i) State and prove Rolle's theorem then use it to prove the mean value theorem. [6 marks]

(ii) Let I be an open interval. Apply the mean value theorem to prove that a function differentiable on I is

1. increasing if and only if $f' \geq 0$ on I ,

2. decreasing if and only if $f' \leq 0$ on I .

[4 marks]

With the best of luck,

Prof. Rashwan A. Rashwan,

Dr. Ahmed A. Abdelhakim



Time: 3 hours

Total mark: 50

Answer *only five* of the following questions:

(Q1) (i) Suppose that O_i , $i \geq 1$, are open subsets of $\mathbb{R}$. Prove that $\cup_{i \geq 1} O_i$ is also open in $\mathbb{R}$. [5 marks]

(ii) Let $S \subset \mathbb{R}$. Show that S is closed if and only if S contains the limit point of every convergent sequence of elements of S . [5 marks]

(Q2) (i) Prove that a sequence of real numbers converges if and only if it is a Cauchy sequence. [6 marks]

(ii) Show that if $(x_n)_{n \geq 1} \subset \mathbb{R}$ is a monotonically increasing sequence that is bounded above, then $x_n \rightarrow \sup_{n \geq 1} x_n$, as $n \rightarrow \infty$. [4 marks]

(Q3) (i) Show that $f : D \subset \mathbb{R} \rightarrow \mathbb{R}$ is continuous at $x_0 \in D$ if and only if the sequence $(f(x_n))_{n \geq 1}$ converges to $f(x_0)$ whenever $(x_n)_{n \geq 1}$ is a sequence in D that converges to x_0 . [6 marks]

(ii) Use the characterization given in (i) to prove the discontinuity at the origin of the function $f(x) = \begin{cases} \cos \frac{1}{x}, & x \neq 0; \\ 0, & x = 0. \end{cases}$ [4 marks]

(Q4) (i) Assume that D is a closed bounded subset of $\mathbb{R}$. Prove that if $f : D \rightarrow \mathbb{R}$ is continuous then f is bounded on D , and there exist $\alpha, \beta \in D$ such that $f(\alpha) = \max_{x \in D} f(x)$ and $f(\beta) = \min_{x \in D} f(x)$. [5 marks]

(ii) Argue by contradiction to demonstrate that if $f : [a, b] \rightarrow \mathbb{R}$ is continuous then it is uniformly continuous on $[a, b]$. [5 marks]

Please Turn over the page

اجب عن خمسة فقط من الاسئلة الاتية :- (10 درجات لكل سؤال : بواقع 5 درجات لكل فقرة)

(1) (i) اوجد الحل العام للمعادلة : $p_1 + 3p_2 + 2p_3(1 + \sqrt{x_1 + x_2 + x_3 - u}) = 6$
(ii) اوجد الحل الخاص للمعادلة : $(y - z)[2xyp + (x^2 - y^2)q] + z(x^2 - y^2) = 0$
الذي يمر خلال المنحنى $y = 0, x^3 = z^2$

(2) اوجد الحل العام لكل من المعادلتين التفاضليتين الجزئيتين الاتيتين :-
(i) $(D_1^3 - D_1^2 D_2 - D_1 D_2^2 + D_2^3)z = \log(x + y)$
(ii) $(D_1^2 - a^2 D_2^2)z = x^2 + y^2$, ثابت مطلق a

(3) اوجد الحل العام لكل من المعادلتين التفاضليتين الجزئيتين الاتيتين :-
(i) $(D_1^2 D_2 + D_2^2 - 2)z = e^{2y} \sin 3x - e^x \cos 2y$
(ii) $(D_1^2 - D_2^2 - D_1 - 3D_2 - 2)z = e^{2x-3y} + x + y + 1$

(4) (i) احسب التكاملات الاتية :-
(a) $\int_0^{\infty} x^{-\frac{1}{3}}(1 + 2x)^{-3} dx$ (b) $\int_0^1 \sqrt{\log \frac{1}{x}} dx$

(ii) اثبت ان :-
(a) $\tan^{-1} x = x {}_2F_1(1, \frac{1}{2}; \frac{3}{2}; -x^2)$
(b) $(a - b) {}_2F_1(a, b; c; x) = a {}_2F_1(a + 1, b; c; x) - b {}_2F_1(a, b + 1; c; x)$

(5) اثبت ان دوال بسل من النوع الاول $J_n(x)$ تحقق الاتي :-
(i) $J_{-\frac{1}{2}}(x) = \sqrt{\frac{2}{\pi x}} \cos x$, (ii) $\int x^n J_{n-1}(x) dx = x^n J_n(x) + c$

(6) (i) اثبت ان كثيرات حدود لجندر $P_n(x)$ تحقق :-
(ii) احسب التكاملات الاتية :-
(a) $\int_{-1}^1 x P_n(x) P_{n+1}(x) dx$, (b) $\int_{-1}^1 x^2 P_n(x) P_{n+1}(x) dx$, (c) $\int_{-1}^1 x^2 P_n(x) dx$



أجب عن أسئلة الآتية :- (كل سؤال ١٠ درجات)

(١) (أ) أثبت قاعدة التضعيف لدالة جاما $\sqrt{\pi} \Gamma(2x) = 2^{2x-1} \Gamma(x) \Gamma\left(x + \frac{1}{2}\right), x > 0$

ثم استخدمها فى إثبات أن: $\Gamma\left(\frac{5}{6}\right) \left[\Gamma\left(\frac{1}{3}\right)\right]^2 = 2 \sqrt[3]{2} \sqrt{\frac{\pi^3}{3}}$

(ب) باستخدام دوال جاما و بيتا أوجد التكاملات الآتية: (i) $\int_0^{\frac{\pi}{2}} \sqrt{\tan \theta} d\theta$ (ii) $\int_0^{\infty} \frac{\sqrt{x}}{e^{x^3}} dx$

(٢) (أ) أثبت أن: $\Gamma(x) \Gamma(1-x) = \frac{\pi}{\sin \pi x}, 0 < x < 1$ ومن ثم أثبت أن

$$\Gamma\left(x + \frac{1}{2}\right) \Gamma\left(\frac{1}{2} - x\right) = \frac{\pi}{\cos \pi x}$$

(ب) أثبت أن:

(i) $\sqrt{1-x^2} T_n(x) = U_{n+1}(x) - x U_n(x),$

(ii) $(1-x^2) U'_n(x) = -n x U_n(x) + n U_{n-1}(x)$

(٣) أثبت أن:

(i) ${}_2F_1(\alpha, \beta; \gamma, x) = (1-x)^{-\beta} {}_2F_1\left(\gamma - \alpha, \beta; \gamma, \frac{x}{x-1}\right)$

(ii) ${}_1F_1\left(\frac{1}{2}; \frac{3}{2}, -x^2\right) = \frac{\sqrt{\pi}}{2x} \operatorname{erf}(x)$ حيث أن: $\operatorname{erf}(x) = \frac{2}{\sqrt{\pi}} \int_0^x e^{-t^2} dt$ هى دالة الخطأ

(iii) ${}_1F_1(\alpha + 1; \gamma, x) - {}_1F_1(\alpha; \gamma, x) - \frac{x}{\gamma} {}_1F_1(\alpha + 1; \gamma + 1, x) = 0$

(٤) (أ) أوجد مفكوك ليجندر للدالة: $f(x) = x^3$

(ب) أثبت أن: $H_n(x) = (-1)^n e^{x^2} \frac{d^n}{dx^n} (e^{-x^2})$ حيث $H_n(x)$ كثيرة حدود هيرميت.

(ج) أثبت أن: $J_{\frac{1}{2}}(x) = \sqrt{\frac{2}{\pi}} \frac{\sin x}{\sqrt{x}}$

(٥) (أ) باستخدام الصيغة التكاملية لدوال بسل أثبت أن: $\int_0^{\infty} e^{-3x} J_0(4x) dx = \frac{1}{5}$

(ب) أوجد الحل العام لمعادلة بسل التفاضلية:

$$x^2 \frac{d^2 y}{dx^2} + x \frac{dy}{dx} + (x^2 - n^2)y = 0$$



Question 1: Put *True* or *False* for each of the following items (30 marks)

1. To enter a formula into a cell, begin by typing an equal sign.
2. Functions are pre-defined worksheet formulas.
3. Formulas in Excel must be written in a very specific format, referred to as syntax.
4. The second order of precedence is for exponentiation.
5. When the formula in cell **B7 =B4+B5+B6** is copied into cell **C7** the formula will be changed to **= C4+C5+C6**.
6. The error "#####" means Data being referenced is not available.
7. The range **B2:B7** is a range down a column.
8. To keep things clear and simple only add an absolute (\$) cell reference if absolutely necessary.
9. The formula **=ROUND(78.686788,-1)** results in the value 80 .
10. Placing an absolute sign in front of a ranged name (**\$budget**) is incorrect syntax.
11. The columns of the worksheet are named with Numbers.
12. Cells may contain only Labels and Values.
13. The cell address first lists the row name and then the column name.
14. This selected cell is referred to as the **active cell**.
15. The contents of the active cell will also be displayed on the **formula bar**.
16. A cell that is on sheet 3, in the second column third row would be referred to as **Sheet3@B3**.
17. Formatted Display is the number of decimal places that appear in a cell.
18. Formulas can be copied to perform different operations on a corresponding set of data.
19. The function **COUNT(value1,[value2],...)** counts non-blank cells.
20. The Average function ignore the blank cells.
21. TRUE and FALSE are called Boolean Values.
22. SPSS stands for Statistical Package for the Social Sciences.
23. SPSS is capable of handling large amounts of data.
24. SPSS has only two windows Data view and Output view.
25. **Transform** menu includes several options to change current variables.
26. In SPSS, Each column typically represents the data from 1 case.
27. In SPSS, The first column of variable view is Name.
28. In SPSS, you can sort data from **Transform** menu then **Sort Cases**.
29. Descriptive statistics are calculated using the **Analyze** menu.
30. Correlation is used to test the degree of association between variables.

Answer Sheet		
	True	False
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Question 2: (10 marks)

	A	B	C	D	E	F	G
1		MT1	MT2	Final	Total	Honors	Passed
2	Possible points	100	100	200	400		320
3							
4	Blue	79	89	169	337	FALSE	TRUE
5	Jones	85	65	195	345	FALSE	TRUE
6	Grey	60	97	187	344	TRUE	TRUE
7	Mary	10	30	50	90	TRUE	FALSE
8							

Write the following Boolean functions

1. Blue's total and Jones' total are greater than Grey's:
2. Grey's total is not the maximum grade:
3. None of the students passed the course
4. Blue is not an Honors student
5. Blue didn't get a passing grade (320)

Question 3: (10 marks)

1. What are the difference between Data View, Variable View and Output View in SPSS?
2. Some significance tests are very restrictive about the form of data they can accept. What are the different types of measurement?
3. Describe how to test the degree of association between variables by SPSS.
4. Explain how to use SPSS to calculate the frequency and percent of females and males who did and did not have social problems.

Q2.

- a. Maintain two different Algorithm of crossover process with mention the probability of crossover (5 marks)
- b. Maintain two different Algorithm of mutation process with mention the probability of mutation. (5 marks)

Q3. a. Maintain tree type representation of solutions in genetic algorithm. (3 marks)

b. Using genetic algorithm to find the maximum value of the function $(15x - x^2)$ where parameter x varies between 0 and 15. For simplicity, we may assume that x takes only integer values. Using the genetic algorithm procedure in one step and begin with four solutions in initial solutions. (10 marks)

Q4. Discuss the internal structure of Taxi driver Robot. (7 marks)

Q5. Discuss the Tabu search method and maintain the type of memory using in this method and maintain the Tabu search algorithm. (10 marks)

==best wishes==

Dr. Alaa F. Mohamed

Answer the following questions: (50 Marks)

Question 1: Answer the following points (10 Marks)

- 1- Explain the internet "nuts and bolts"?
- 2- Explain the sources of packet delay?
- 3- What are protocols?
- 4- Explain Access network: digital subscriber line (DSL)?

Question 2: Answer the following points (10 Marks)

- 1- What is the network core?
- 2- Explain Packet Switching: queueing delay, loss?
- 3- Define throughput?
- 4- Define and explain traffic intensity?

Question 3: Answer the following points (10 Marks)

- 1- Explain the Internet protocol stack?
- 2- Mention some network applications?
- 3- Explain the application client-server architecture?
- 4- Explain P2P architecture?

Question 4: Answer the following points (10 Marks)

- 1- HTTP is "stateless". What does that mean?
- 2- Compare between persistent HTTP and non-persistent HTTP?
- 3- Give examples of HTTP response status codes?
- 4- Explain the term (web caches) and how it is useful?

Question 5: Answer the following points (10 Marks)

- 1- Give a DNS name resolution example?
- 2- Compare between multiplexing and demultiplexing? Support your answer with a diagram?
- 3- Define and explain the use of ACKs and NAKs?
- 4- Define and explain HOL? Support your answer with a diagram?

جامعة أسيوط	مايو 2018	كود المقرر: 356 رك
كلية العلوم		المقرر : مقدمة فى الحسابات العلمية
قسم الرياضيات		الزمن : ساعتان

Answer the following questions by using MATLAB language: (50 marks)

1- Using Newton's forward difference formula, find $y(0.1)$ using the table below:

x	0.0	0.2	0.4	0.6	0.8
y	1.000	1.22140	1.49182	1.82212	2.22554

2- Solve the differential equation by Adams method (without using nested for loops) at $x=0.2$:

$$\frac{dy}{dt} = t^2 - y, \quad y(0) = 1, \quad h = 0.05.$$

and compare it with the analytic solution $y = -e^{-t} + t^2 - 2t + 2$.

3- Solve the following initial value problem:

$$\frac{d^2u}{dt^2} + 4\frac{du}{dt} + 3u = 0, \quad u(0) = 1, \quad \frac{du}{dt}(0) = 0.$$

4- Let $f(x) = \cos 2x$ and $x_0 = 0$. Determine

a) The third Taylor polynomial for f about x_0 .

b) Find error bound at $x = 0.2$ and compare it to the actual error.

5- For the well-known Chua's circuit equation in chaotic studies that

$$\dot{x} = \alpha[y - x - f(x)], \quad \dot{y} = x - y + z, \quad \dot{z} = -\beta y - \gamma z, \quad t \in (0, 10),$$

where the nonlinear function $f(x)$ is described by

$$f(x) = bx + 0.5(a-b)(|x+1| - |x-1|) \text{ and } a < b < 0.$$

Write an M-function to describe the equation, and draw the phase trajectory for the parameters $\alpha = 9$, $\beta = 100/7$, $\gamma = 0$, $a = -8/7$, $b = -5/7$, and initial conditions

$$x(0) = -2.121304, \quad y(0) = -0.066170, \quad z(0) = 2.881090.$$

Good Luck

Dr. Tarek Aboelenen



امتحان الفرقة الثالثة شعبة الرياضيات

الزمن : ثلاث ساعات

رقم المقرر ورمزه : ١٣٤٦

المقرر : عمليات عشوائية وتطبيقاتها

أجب عن خمسة أسئلة فقط مما يأتي :- درجة جزء كل سؤال (خمس درجات)

١- (أ) لمجموعة المتغيرات العشوائية المستقلة $X_1, X_2, X_3, \dots$ بفرض أن التوقع الرياضي $E(X_i) = m$ والتباين $V(X_i)$ لكل منها محدود عرف كل من التقارب عن طريق الإحتمال وقانون الأعداد الكبرى (الضعيف).
(ب) بفرض أن $f f s s f s f f s s s f f s f f s$ هي إحدى النتائج الممكنة في محاولات برنولي العشوائية المستقلة بحيث أن $P(s) = p, P(f) = q, p + q = 1$ عرف عملية عشوائية في الفراغ R^2 موضحا ذلك بيانيا .

٢- (أ) في عملية برنولي العشوائية $\{X_n; n > 0\}$ بالإحتمال $p = 0.6$ إذا كان $X = X_1 + X_2$ ، $Y = X_1 + X_3$ احسب الإحتمالات الآتية : $P(X < 2, Y \leq 1)$ ، $P(2X < 3Y)$ ، $P(Y = X)$.
(ب) في السؤال (٢-أ) أوجد العزم الارتباطي بين X ، Y موضحا العلاقة بينهما .

٣- (أ) وضح العلاقة بين عملية برنولي العشوائية $\{X_n; n > 0\}$ و العملية العشوائية $\{Y_n; n \geq 0\}$ حيث أن المتغير Y_n يخضع لتوزيع ذي الحدين واذكر صفات كل منهما ثم عبر مع الإستنتاج عن إحتمال الحادث $(Y_{n+1} = k)$ من خلال إحتمالات الحوادث : $(Y_n = k)$ ، $(Y_n = k - 1)$ لأي عدد صحيح $k > 0$.
(ب) في العملية العشوائية $\{Y_n; n \geq 0\}$ أوجد كل من $E(Y_5)$ ، $E(Y_4^2)$ ، $P(Y_5 = 3, Y_7 = 4, Y_{14} = 9)$.

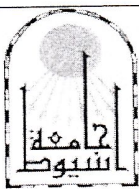
٤- (أ) عرف أزمنة النجاح T_k كعملية عشوائية موضحا العلاقة بينها وبين العملية العشوائية $\{Y_n; n \geq 0\}$ ثم اذكر فقط توزيع المتغير العشوائي T_k .
(ب) - في عملية بواسون العشوائية $\{N_t; t \geq 0\}$ بالمعدل $\lambda = 4$ احسب كل من الإحتمالات الآتية :
 $P(N_{1.5} = 2, N_4 = 5, N_{6.8} = 9)$ ، $P(N_3 = 5, N_7 = 9)$

٥- (أ) في عملية بواسون أو عملية الوصول المعودة $\{N_t; t \geq 0\}$ بالمعدل λ إثبت أن الإحتمال المشروط لعدد الوصول N_t بالنسبة إلى عدد الوصول N_{t+s} لكل $t > 0, s > 0$ يمثل توزيع ذي الحدين.
(ب) عرف العمليات العشوائية المستقلة ثم اثبت أن أي عمليتين مستقلتين لبواسون هو أيضا عملية بواسون .

٦- (أ) في عملية التجديد العشوائية $R = \{R_n; n \in N\}$ حيث N هي فئة الأعداد الصحيحة غير السالبة عرف دالة التجديد ثم عبر عنها من خلال توزيع المتغير R_n مع الإستنتاج .

(ب) في سلسلة ماركوف العشوائية المتقطعة $\{X_n; n \geq 0\}$ عرف مصفوفة الإحتمالات الإنتقالية بصفاتها المعروفة ثم احسب الإحتمال : $P(X_0 = 1, X_1 = 1, X_2 = 0, X_3 = 1, X_4 = 0, X_6 = 0)$ بفرض أن حالات الفراغ $(0, 1)$ والمصفوفة العشوائية

$$P = \begin{pmatrix} 1/2 & 1/2 \\ 1/3 & 2/3 \end{pmatrix} , \text{ ومنتجه الإحتمالات الابتدائية } \pi_0 = (2/5 \quad 3/5)$$

	المقرر: تحليل عددي (٣٢٣) الفرقة: المستوى الثالث الدرجة: ٥٠ درجة التاريخ: ٢٠١٨/٥/٢٩ الزمن: ثلاث ساعات	جامعة أسيوط كلية العلوم - قسم الرياضيات امتحان نهائي الفصل الدراسي الثاني للعام الجامعي ٢٠١٧/٢٠١٨
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Answer five questions only :- (10 marks for every question)

1-a) If the function $g \in C[a, b]$ and $g(x) \in [a, b] \forall x \in [a, b]$ and $g'(x)$ exist with $|g'(x)| \leq k < 1 \forall x \in [a, b]$ prove that the sequence defined by $P_n = g(P_{n-1}), n \geq 1$ will converge to the unique fixed point P and also $|P_{n+1} - P_n| \leq k^n |P_1 - P_0|$.

1-b) Verify that when Newton's method is used to compute $\sqrt{A}, A > 0$ (By solving the equation : $f(x) = x^2 - A$). The sequence of iterates is defined by : $x_{n+1} = (x_n + \frac{A}{x_n})/2$, and show that if the sequence $\{x_n\}$ is defined as the previous problem, then this method is quadratically convergence.

2-a) Derive Lagrange interpolation formula of degree n and write the error of the method.

2-b) For the given function $f(x) = \cos \pi x$ let $x_0 = -1, x_1 = 0, x_2 = 1$ construct the suitable interpolation polynomial and find the actual error.

3) Derive the formula of the Newton's interpolatory divided difference method and use this formula to obtain a polynomial of least degree that fits the values shown:

x	0	1	2	4	6
$f(x)$	1	9	23	93	259

من فضلك انظر خلف الورقة

السؤال الرابع :-

أ) يعرف الطي للدالتين $f(x)$, $g(x)$ كالآتي

$$f * g = \int_{-\infty}^{\infty} f(u) g(x-u) du$$

برهن علي أن تحويل فوريير للطرف الأيمن هو حاصل ضرب تحويلي فوريير للدالتين $f(x)$, $g(x)$

ب) أوجد تحويل فوريير للدالة $f(x) = \begin{cases} 1 & |x| < a \\ 0 & |x| > a \end{cases}$ وأرسم $f(x)$ كذلك تحويلها عند $a = 3$ وأوجد

$$\int_{-\infty}^{\infty} \frac{\sin u}{u} du \quad \text{كذلك} \quad \int_{-\infty}^{\infty} \frac{\sin \alpha a \cos \alpha x}{\alpha} d\alpha$$

ج) ترك خيط لانهائي من السكون وكانت أزاحته الابتدائية عن محور x هي $f(x)$ أوجد الإزاحه عند أي زمن .

انتهت الأسئلة مع تمنياتنا بالتوفيق ،،،،

لجنة الممتحنين :- أ.د/ نجاه عبد الرحمن حسين ، أ.د/ فاروق علي السيد



الامتحان النهائي للفصل الدراسي الثاني للعام الجامعي ٢٠١٧/٢٠١٨ م
 للفرقة : الثالثة
 الشعبة : الرياضيات
 التاريخ : ٢٠١٨/٥/٢٤ م

الزمن : ساعتان

الدرجة الكلية : ٥٠ درجة

درجة كل سؤال : ١٧ درجة

أسم المقرر : الطرق الرياضية
 رقم المقرر ورمزه : ٣٣٤ ر

أجب عن ثلاثة أسئلة فقط مما يأتي :-

السؤال الأول :-

أوجد تحويل لابلاس للمشتقة التفاضلية للدالة $F(t)$ عند نقط الاتصال والانفصال للدالة .

أبرهن علي أن

$$\lim_{t \rightarrow 0} F(t) = \lim_{s \rightarrow \infty} s f(s)$$

$$\lim_{t \rightarrow \infty} F(t) = \lim_{s \rightarrow 0} s f(s)$$

$$\Gamma\left(\frac{1}{2}\right) = \sqrt{\pi}, \quad \int_0^{\infty} \delta(t) dt = 1, \quad L \sin \sqrt{t} = \frac{\sqrt{\pi}}{3} e^{-\frac{1}{4s}} s^{\frac{3}{2}}$$

السؤال الثاني :-

حل المعادلات الآتية :

$$t Y''(t) + Y'(t) + 4t Y(t) = 0, \quad y(0) = 3, y'(0) = 0$$

$$\frac{\partial U}{\partial x} = 2 \frac{\partial U}{\partial t} + U, \quad x > 0, t > 0 \quad U(x, 0) = 6 e^{-3x}$$

$$\int_0^t Y(u) Y(t-u) du = 16 \sin 4t$$

السؤال الثالث :-

(أ) فك الدالة $f(x) = x^2$, $0 < x < 2\pi$ بدلالة متسلسلة فوريير ثم أحسب المجموع

$$1 + \frac{1}{2^2} + \frac{1}{3^2} + \frac{1}{4^2} + \dots$$

(ب) صفيحة علي شكل دائري نصف قطرها الوحدة ووجهيها معزولين ونصف محيطها محفوظ عند درجة حرارة u_1

والآخر عند u_2 أوجد حالة الأتزان الحراري .

من فضلك أنظر بقية الأسئلة خلف الورقة ،،،،،



Answer the following questions (50 marks)

Q1.	Complete the following: (1)..... is a representation of a two-dimensional image as a finite set of digital values, called picture elements or pixels - Common image formats include.....(2).... ,(3)..... ,(4)..... (5)..... creates a Distance tool a draggable, resizable line that measures the distance between its endpoints. (6)..... These are the result of objects that are self-luminous, such as stars and light bulbs. (7).....the resulting output pixel is computed as a sum of products of the pixel values and mask coefficients in the pixel's neighborhood in the original image. - The Sobel operators used to compute edges are(8)..... ,(9)..... - Edge detector should have:(10)..... ,(11)..... - Types of noise are(12)..... ,(13)....	(13 marks)
Q2.	a) Compute Z from the following matlab script (6 marks) <pre> x = [150 10 90;80 50 60;121 160 20] y = [-1 0 1;-2 0 2;-1 0 1] z = imfilter(x,y,'corr') </pre> b) What is the Delta compression and compute the compressed data of the data (6 marks) 220 321 335 211 250 200 233 214 232 212	(12 marks)
Q3.	a) Write the MATLAB code used to: (4 marks) - Read any image then use affine transformation matrix for each of the operations below: - Flip the image right to left - Translation by [25, 15] pixels b) What are the main differences between: (8 marks) - Global thresholding and optimal thresholding. - Raster and vector image . - Interpixel redundancy and Psychovisual redundancy	(12 marks)

(Q5) (i) Assume that U, V are open intervals and let $f : U \rightarrow \mathbb{R}$ and $g : V \rightarrow \mathbb{R}$ be two differentiable functions such that $f(U) \subset V$. Prove that $g \circ f$ is differentiable on U and that $(g \circ f)' = (g' \circ f) \cdot f'$ [5 marks]

(ii) Prove that the function $f(x) := \frac{1}{x}$ is differentiable on $]0, \infty[$ but not uniformly continuous therein. [5 marks]

(Q6) (i) State and prove Rolle's theorem then use it to prove the mean value theorem. [6 marks]

(ii) Let I be an open interval. Apply the mean value theorem to prove that a function differentiable on I is

1. increasing if and only if $f' \geq 0$ on I ,

2. decreasing if and only if $f' \leq 0$ on I .

[4 marks]

With the best of luck,

Prof. Rashwan A. Rashwan,

Dr. Ahmed A. Abdelhakim



Time: 3 hours

Total mark: 50

Answer *only five* of the following questions:

(Q1) (i) Suppose that O_i , $i \geq 1$, are open subsets of $\mathbb{R}$. Prove that $\cup_{i \geq 1} O_i$ is also open in $\mathbb{R}$. [5 marks]

(ii) Let $S \subset \mathbb{R}$. Show that S is closed if and only if S contains the limit point of every convergent sequence of elements of S . [5 marks]

(Q2) (i) Prove that a sequence of real numbers converges if and only if it is a Cauchy sequence. [6 marks]

(ii) Show that if $(x_n)_{n \geq 1} \subset \mathbb{R}$ is a monotonically increasing sequence that is bounded above, then $x_n \rightarrow \sup_{n \geq 1} x_n$, as $n \rightarrow \infty$. [4 marks]

(Q3) (i) Show that $f : D \subset \mathbb{R} \rightarrow \mathbb{R}$ is continuous at $x_0 \in D$ if and only if the sequence $(f(x_n))_{n \geq 1}$ converges to $f(x_0)$ whenever $(x_n)_{n \geq 1}$ is a sequence in D that converges to x_0 . [6 marks]

(ii) Use the characterization given in (i) to prove the discontinuity at the origin of the function $f(x) = \begin{cases} \cos \frac{1}{x}, & x \neq 0; \\ 0, & x = 0. \end{cases}$ [4 marks]

(Q4) (i) Assume that D is a closed bounded subset of $\mathbb{R}$. Prove that if $f : D \rightarrow \mathbb{R}$ is continuous then f is bounded on D , and there exist $\alpha, \beta \in D$ such that $f(\alpha) = \max_{x \in D} f(x)$ and $f(\beta) = \min_{x \in D} f(x)$. [5 marks]

(ii) Argue by contradiction to demonstrate that if $f : [a, b] \rightarrow \mathbb{R}$ is continuous then it is uniformly continuous on $[a, b]$. [5 marks]

Please Turn over the page



Operation Research326 R

11-5-2018

Third Level: Computer Science Section

Time: 3 hours

Total Degree (50 marks)

Science Faculty

Mathematical Department

Answer the following Questions:

1-Use the Simplex method to solve the following linear programming

Maximize $Z = 10x_1 + 11x_2$

Subject to $x_1 + 2x_2 \leq 150$, $3x_1 + 4x_2 \leq 200$, $6x_1 + x_2 \leq 175$

and $x_1, x_2 \geq 0$

(10 marks)

2) Use the graphical and the algebraic method to solve the problem

Max $f(\underline{x}) = 5x_1 + 7x_2$ Subject to $5x_1 + 8x_2 \leq 24$, $x_1 + x_2 \leq 4$,

$10x_1 + 7x_2 \leq 35$ and $x_1, x_2 \geq 0$

(12.5marks)

3) Use the Lagrange multiplier method to find the extreme points of the problem

Minimize $f(\underline{x}) = x_1^2 + x_2^2 - 3x_1x_2$

Subject to $g(\underline{x}) = x_1^2 + x_2^2 - 8 = 0$.

(12.5marks)

4) Use the Hessian Matrix to find the local points of the problem

$f(\underline{x}) = f(x_1, x_2) = x_1^3 + x_2^3 + 2x_1^2 + 4x_2^2 + 6$

(10marks)

5) Find the local Points

$f(x) = 3x^4 - 20x^3 + 36x^2 + 16$ (5marks)

Best Wishes

Dr. Alaa Fahim

اجب عن خمسة فقط من الاسئلة الاتية :- (10 درجات لكل سؤال : بواقع 5 درجات لكل فقرة)

(1) (i) اوجد الحل العام للمعادلة : $p_1 + 3p_2 + 2p_3(1 + \sqrt{x_1 + x_2 + x_3 - u}) = 6$
(ii) اوجد الحل الخاص للمعادلة : $(y - z)[2xyp + (x^2 - y^2)q] + z(x^2 - y^2) = 0$
الذي يمر خلال المنحنى $y = 0, x^3 = z^2$

(2) اوجد الحل العام لكل من المعادلتين التفاضليتين الجزئيتين الاتيتين :-
(i) $(D_1^3 - D_1^2 D_2 - D_1 D_2^2 + D_2^3)z = \log(x + y)$
(ii) $(D_1^2 - a^2 D_2^2)z = x^2 + y^2$, ثابت مطلق a

(3) اوجد الحل العام لكل من المعادلتين التفاضليتين الجزئيتين الاتيتين :-
(i) $(D_1^2 D_2 + D_2^2 - 2)z = e^{2y} \sin 3x - e^x \cos 2y$
(ii) $(D_1^2 - D_2^2 - D_1 - 3D_2 - 2)z = e^{2x-3y} + x + y + 1$

(4) (i) احسب التكاملات الاتية :-
(a) $\int_0^{\infty} x^{-\frac{1}{3}}(1 + 2x)^{-3} dx$ (b) $\int_0^1 \sqrt{\log \frac{1}{x}} dx$

(ii) اثبت ان :-
(a) $\tan^{-1} x = x {}_2F_1(1, \frac{1}{2}; \frac{3}{2}; -x^2)$
(b) $(a - b) {}_2F_1(a, b; c; x) = a {}_2F_1(a + 1, b; c; x) - b {}_2F_1(a, b + 1; c; x)$

(5) اثبت ان دوال بسل من النوع الاول $J_n(x)$ تحقق الاتي :-
(i) $J_{-\frac{1}{2}}(x) = \sqrt{\frac{2}{\pi x}} \cos x$, (ii) $\int x^n J_{n-1}(x) dx = x^n J_n(x) + c$

(6) (i) اثبت ان كثيرات حدود لجندر $P_n(x)$ تحقق :-
(ii) احسب التكاملات الاتية :-
(a) $\int_{-1}^1 x P_n(x) P_{n+1}(x) dx$, (b) $\int_{-1}^1 x^2 P_n(x) P_{n+1}(x) dx$, (c) $\int_{-1}^1 x^2 P_n(x) dx$



أجب عن أسئلة الآتية :- (كل سؤال ١٠ درجات)

(١) (أ) أثبت قاعدة التضعيف لدالة جاما $\sqrt{\pi} \Gamma(2x) = 2^{2x-1} \Gamma(x) \Gamma\left(x + \frac{1}{2}\right)$, $x > 0$

ثم استخدمها فى إثبات أن: $\Gamma\left(\frac{5}{6}\right) \left[\Gamma\left(\frac{1}{3}\right)\right]^2 = 2 \sqrt[3]{2} \sqrt{\frac{\pi^3}{3}}$

(ب) باستخدام دوال جاما و بيتا أوجد التكاملات الآتية: (i) $\int_0^{\frac{\pi}{2}} \sqrt{\tan \theta} d\theta$ (ii) $\int_0^{\infty} \frac{\sqrt{x}}{e^{x^3}} dx$

(٢) (أ) أثبت أن: $\Gamma(x) \Gamma(1-x) = \frac{\pi}{\sin \pi x}$, $0 < x < 1$ ومن ثم أثبت أن

$\Gamma\left(x + \frac{1}{2}\right) \Gamma\left(\frac{1}{2} - x\right) = \frac{\pi}{\cos \pi x}$

(ب) أثبت أن:

(i) $\sqrt{1-x^2} T_n(x) = U_{n+1}(x) - x U_n(x)$,

(ii) $(1-x^2) U'_n(x) = -n x U_n(x) + n U_{n-1}(x)$

(٣) أثبت أن:

(i) ${}_2F_1(\alpha, \beta; \gamma, x) = (1-x)^{-\beta} {}_2F_1\left(\gamma - \alpha, \beta; \gamma, \frac{x}{x-1}\right)$

(ii) ${}_1F_1\left(\frac{1}{2}; \frac{3}{2}, -x^2\right) = \frac{\sqrt{\pi}}{2x} \operatorname{erf}(x)$ حيث أن: $\operatorname{erf}(x) = \frac{2}{\sqrt{\pi}} \int_0^x e^{-t^2} dt$ هى دالة الخطأ

(iii) ${}_1F_1(\alpha + 1; \gamma, x) - {}_1F_1(\alpha; \gamma, x) - \frac{x}{\gamma} {}_1F_1(\alpha + 1; \gamma + 1, x) = 0$

(٤) (أ) أوجد مفكوك ليجندر للدالة: $f(x) = x^3$

(ب) أثبت أن: $H_n(x) = (-1)^n e^{x^2} \frac{d^n}{dx^n} (e^{-x^2})$ حيث $H_n(x)$ كثيرة حدود هيرميت.

(ج) أثبت أن: $J_{\frac{1}{2}}(x) = \sqrt{\frac{2}{\pi}} \frac{\sin x}{\sqrt{x}}$

(٥) (أ) باستخدام الصيغة التكاملية لدوال بسل أثبت أن: $\int_0^{\infty} e^{-3x} J_0(4x) dx = \frac{1}{5}$

(ب) أوجد الحل العام لمعادلة بسل التفاضلية:

$x^2 \frac{d^2 y}{dx^2} + x \frac{dy}{dx} + (x^2 - n^2)y = 0$



Question 1: Put True or False for each of the following items (30 marks)

1. To enter a formula into a cell, begin by typing an equal sign.
2. Functions are pre-defined worksheet formulas.
3. Formulas in Excel must be written in a very specific format, referred to as syntax.
4. The second order of precedence is for exponentiation.
5. When the formula in cell **B7 =B4+B5+B6** is copied into cell **C7** the formula will be changed to **= C4+C5+C6**.
6. The error "#####" means Data being referenced is not available.
7. The range **B2:B7** is a range down a column.
8. To keep things clear and simple only add an absolute (\$) cell reference if absolutely necessary.
9. The formula **=ROUND(78.686788,-1)** results in the value 80 .
10. Placing an absolute sign in front of a ranged name (**\$budget**) is incorrect syntax.
11. The columns of the worksheet are named with Numbers.
12. Cells may contain only Labels and Values.
13. The cell address first lists the row name and then the column name.
14. This selected cell is referred to as the **active cell**.
15. The contents of the active cell will also be displayed on the **formula bar**.
16. A cell that is on sheet 3, in the second column third row would be referred to as **Sheet3@B3**.
17. Formatted Display is the number of decimal places that appear in a cell.
18. Formulas can be copied to perform different operations on a corresponding set of data.
19. The function **COUNT(value1,[value2],...)** counts non-blank cells.
20. The Average function ignore the blank cells.
21. TRUE and FALSE are called Boolean Values.
22. SPSS stands for Statistical Package for the Social Sciences.
23. SPSS is capable of handling large amounts of data.
24. SPSS has only two windows Data view and Output view.
25. **Transform** menu includes several options to change current variables.
26. In SPSS, Each column typically represents the data from 1 case.
27. In SPSS, The first column of variable view is Name.
28. In SPSS, you can sort data from **Transform** menu then **Sort Cases**.
29. Descriptive statistics are calculated using the **Analyze** menu.
30. Correlation is used to test the degree of association between variables.

Answer Sheet		
	True	False
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Question 2: (10 marks)

	A	B	C	D	E	F	G
1		MT1	MT2	Final	Total	Honors	Passed
2	Possible points	100	100	200	400		320
3							
4	Blue	79	89	169	337	FALSE	TRUE
5	Jones	85	65	195	345	FALSE	TRUE
6	Grey	60	97	187	344	TRUE	TRUE
7	Mary	10	30	50	90	TRUE	FALSE
8							

Write the following Boolean functions

1. Blue's total and Jones' total are greater than Grey's:
2. Grey's total is not the maximum grade:
3. None of the students passed the course
4. Blue is not an Honors student
5. Blue didn't get a passing grade (320)

Question 3: (10 marks)

1. What are the difference between Data View, Variable View and Output View in SPSS?
2. Some significance tests are very restrictive about the form of data they can accept. What are the different types of measurement?
3. Describe how to test the degree of association between variables by SPSS.
4. Explain how to use SPSS to calculate the frequency and percent of females and males who did and did not have social problems.

Q2.

- a. Maintain two different Algorithm of crossover process with mention the probability of crossover (5 marks)
- b. Maintain two different Algorithm of mutation process with mention the probability of mutation. (5 marks)

Q3. a. Maintain tree type representation of solutions in genetic algorithm. (3 marks)

b. Using genetic algorithm to find the maximum value of the function $(15x - x^2)$ where parameter x varies between 0 and 15. For simplicity, we may assume that x takes only integer values. Using the genetic algorithm procedure in one step and begin with four solutions in initial solutions. (10 marks)

Q4. Discuss the internal structure of Taxi driver Robot. (7 marks)

Q5. Discuss the Tabu search method and maintain the type of memory using in this method and maintain the Tabu search algorithm. (10 marks)

==best wishes==

Dr. Alaa F. Mohamed

Answer the following questions: (50 Marks)

Question 1: Answer the following points (10 Marks)

- 1- Explain the internet "nuts and bolts"?
- 2- Explain the sources of packet delay?
- 3- What are protocols?
- 4- Explain Access network: digital subscriber line (DSL)?

Question 2: Answer the following points (10 Marks)

- 1- What is the network core?
- 2- Explain Packet Switching: queueing delay, loss?
- 3- Define throughput?
- 4- Define and explain traffic intensity?

Question 3: Answer the following points (10 Marks)

- 1- Explain the Internet protocol stack?
- 2- Mention some network applications?
- 3- Explain the application client-server architecture?
- 4- Explain P2P architecture?

Question 4: Answer the following points (10 Marks)

- 1- HTTP is "stateless". What does that mean?
- 2- Compare between persistent HTTP and non-persistent HTTP?
- 3- Give examples of HTTP response status codes?
- 4- Explain the term (web caches) and how it is useful?

Question 5: Answer the following points (10 Marks)

- 1- Give a DNS name resolution example?
- 2- Compare between multiplexing and demultiplexing? Support your answer with a diagram?
- 3- Define and explain the use of ACKs and NAKs?
- 4- Define and explain HOL? Support your answer with a diagram?

جامعة أسيوط	مايو 2018	كود المقرر: 356 رك
كلية العلوم		المقرر : مقدمة فى الحسابات العلمية
قسم الرياضيات		الزمن : ساعتان

Answer the following questions by using MATLAB language: (50 marks)

1- Using Newton's forward difference formula, find $y(0.1)$ using the table below:

x	0.0	0.2	0.4	0.6	0.8
y	1.000	1.22140	1.49182	1.82212	2.22554

2- Solve the differential equation by Adams method (without using nested for loops) at $x=0.2$:

$$\frac{dy}{dt} = t^2 - y, \quad y(0) = 1, \quad h = 0.05.$$

and compare it with the analytic solution $y = -e^{-t} + t^2 - 2t + 2$.

3- Solve the following initial value problem:

$$\frac{d^2u}{dt^2} + 4\frac{du}{dt} + 3u = 0, \quad u(0) = 1, \quad \frac{du}{dt}(0) = 0.$$

4- Let $f(x) = \cos 2x$ and $x_0 = 0$. Determine

- The third Taylor polynomial for f about x_0 .
- Find error bound at $x = 0.2$ and compare it to the actual error.

5- For the well-known Chua's circuit equation in chaotic studies that

$$\dot{x} = \alpha[y - x - f(x)], \quad \dot{y} = x - y + z, \quad \dot{z} = -\beta y - \gamma z, \quad t \in (0, 10),$$

where the nonlinear function $f(x)$ is described by

$$f(x) = bx + 0.5(a-b)(|x+1| - |x-1|) \text{ and } a < b < 0.$$

Write an M-function to describe the equation, and draw the phase trajectory for the parameters $\alpha = 9$, $\beta = 100/7$, $\gamma = 0$, $a = -8/7$, $b = -5/7$, and initial conditions

$$x(0) = -2.121304, \quad y(0) = -0.066170, \quad z(0) = 2.881090.$$

Good Luck

Dr. Tarek Aboelenen



امتحان الفرقة الثالثة شعبة الرياضيات

الزمن : ثلاث ساعات

رقم المقرر ورمزه : ١٣٤٦

المقرر : عمليات عشوائية وتطبيقاتها

أجب عن خمسة أسئلة فقط مما يأتي :- درجة جزء كل سؤال (خمس درجات)

١- (أ) لمجموعة المتغيرات العشوائية المستقلة $X_1, X_2, X_3, \dots$ بفرض أن التوقع الرياضي $E(X_i) = m$ والتباين $V(X_i)$ لكل منها محدود عرف كل من التقارب عن طريق الإحتمال وقانون الأعداد الكبرى (الضعيف).
(ب) بفرض أن $f f s s f s f f s s s f f s f f s$ هي إحدى النتائج الممكنة في محاولات برنولي العشوائية المستقلة بحيث أن $P(s) = p, P(f) = q, p + q = 1$ عرف عملية عشوائية في الفراغ R^2 موضحا ذلك بيانيا .

٢- (أ) في عملية برنولي العشوائية $\{X_n; n > 0\}$ بالإحتمال $p = 0.6$ إذا كان $X = X_1 + X_2$ ، $Y = X_1 + X_3$ احسب الإحتمالات الآتية : $P(X < 2, Y \leq 1)$ ، $P(2X < 3Y)$ ، $P(Y = X)$.
(ب) في السؤال (٢-أ) أوجد العزم الارتباطي بين X ، Y موضحا العلاقة بينهما .

٣- (أ) وضح العلاقة بين عملية برنولي العشوائية $\{X_n; n > 0\}$ و العملية العشوائية $\{Y_n; n \geq 0\}$ حيث أن المتغير Y_n يخضع لتوزيع ذي الحدين واذكر صفات كل منهما ثم عبر مع الاستنتاج عن إحتمال الحادث $(Y_{n+1} = k)$ من خلال إحتمالات الحوادث : $(Y_n = k)$ ، $(Y_n = k - 1)$ لأي عدد صحيح $k > 0$.
(ب) في العملية العشوائية $\{Y_n; n \geq 0\}$ أوجد كل من $E(Y_5)$ ، $E(Y_4^2)$ ، $P(Y_5 = 3, Y_7 = 4, Y_{14} = 9)$.

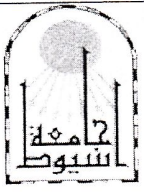
٤- (أ) عرف أزمنة النجاح T_k كعملية عشوائية موضحا العلاقة بينها وبين العملية العشوائية $\{Y_n; n \geq 0\}$ ثم اذكر فقط توزيع المتغير العشوائي T_k .
(ب) - في عملية بواسون العشوائية $\{N_t; t \geq 0\}$ بالمعدل $\lambda = 4$ احسب كل من الإحتمالات الآتية :
 $P(N_{1.5} = 2, N_4 = 5, N_{6.8} = 9)$ ، $P(N_3 = 5, N_7 = 9)$

٥- (أ) في عملية بواسون أو عملية الوصول المعودة $\{N_t; t \geq 0\}$ بالمعدل λ إثبت أن الإحتمال المشروط لعدد الوصول N_t بالنسبة إلى عدد الوصول N_{t+s} لكل $t > 0, s > 0$ يمثل توزيع ذي الحدين .
(ب) عرف العمليات العشوائية المستقلة ثم اثبت أن أي عمليتين مستقلتين لبواسون هو أيضا عملية بواسون .

٦- (أ) في عملية التجديد العشوائية $R = \{R_n; n \in N\}$ حيث N هي فئة الأعداد الصحيحة غير السالبة عرف دالة التجديد ثم عبر عنها من خلال توزيع المتغير R_n مع الاستنتاج .

(ب) في سلسلة ماركوف العشوائية المتقطعة $\{X_n; n \geq 0\}$ عرف مصفوفة الإحتمالات الإنتقالية بصفاتها المعروفة ثم احسب الإحتمال : $P(X_0 = 1, X_1 = 1, X_2 = 0, X_3 = 1, X_4 = 0, X_6 = 0)$ بفرض أن حالات الفراغ $(0, 1)$ والمصفوفة العشوائية

$$P = \begin{pmatrix} 1/2 & 1/2 \\ 1/3 & 2/3 \end{pmatrix} , \text{ ومنتجه الإحتمالات الابتدائية } \pi_0 = (2/5 \quad 3/5)$$

	المقرر: تحليل عددي (٣٢٣) الفرقة: المستوى الثالث الدرجة: ٥٠ درجة التاريخ: ٢٠١٨/٥/٢٩ الزمن: ثلاث ساعات	جامعة أسيوط كلية العلوم - قسم الرياضيات امتحان نهائي الفصل الدراسي الثاني للعام الجامعي ٢٠١٧/٢٠١٨
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Answer five questions only :- (10 marks for every question)

1-a) If the function $g \in C[a, b]$ and $g(x) \in [a, b] \forall x \in [a, b]$ and $g'(x)$ exist with $|g'(x)| \leq k < 1 \forall x \in [a, b]$ prove that the sequence defined by $P_n = g(P_{n-1}), n \geq 1$ will converge to the unique fixed point P and also $|P_{n+1} - P_n| \leq k^n |P_1 - P_0|$.

1-b) Verify that when Newton's method is used to compute $\sqrt{A}, A > 0$ (By solving the equation : $f(x) = x^2 - A$). The sequence of iterates is defined by : $x_{n+1} = (x_n + \frac{A}{x_n})/2$, and show that if the sequence $\{x_n\}$ is defined as the previous problem, then this method is quadratically convergence.

2-a) Derive Lagrange interpolation formula of degree n and write the error of the method.

2-b) For the given function $f(x) = \cos \pi x$ let $x_0 = -1, x_1 = 0, x_2 = 1$ construct the suitable interpolation polynomial and find the actual error.

3) Derive the formula of the Newton's interpolatory divided difference method and use this formula to obtain a polynomial of least degree that fits the values shown:

x	0	1	2	4	6
$f(x)$	1	9	23	93	259

من فضلك انظر خلف الورقة

السؤال الرابع :-

أ) يعرف الطي للدالتين $f(x)$, $g(x)$ كالآتي

$$f * g = \int_{-\infty}^{\infty} f(u) g(x-u) du$$

برهن علي أن تحويل فوريير للطرف الأيمن هو حاصل ضرب تحويل فوريير للدالتين $f(x)$, $g(x)$

ب) أوجد تحويل فوريير للدالة $f(x) = \begin{cases} 1 & |x| < a \\ 0 & |x| > a \end{cases}$ وأرسم $f(x)$ كذلك تحويلها عند $a = 3$ وأوجد

$$\int_{-\infty}^{\infty} \frac{\sin u}{u} du \quad \text{كذلك} \quad \int_{-\infty}^{\infty} \frac{\sin \alpha a \cos \alpha x}{\alpha} d\alpha$$

ج) ترك خيط لانهائي من السكون وكانت أزاحته الابتدائية عن محور x هي $f(x)$ أوجد الإزاحه عند أي زمن .

انتهت الأسئلة مع تمنياتنا بالتوفيق ،،،،

لجنة الممتحنين :- أ. د/ نجاه عبد الرحمن حسين ، أ. د/ فاروق علي السيد



الامتحان النهائي للفصل الدراسي الثاني للعام الجامعي ٢٠١٧/٢٠١٨ م
 للفرقة : الثالثة : الشعبة : الرياضيات التاريخ : ٢٠١٨/٥/٢٤ م

الزمن : ساعتان

الدرجة الكلية : ٥٠ درجة

أسم المقرر : الطرق الرياضية
 رقم المقرر ورمزه : ٣٣٤ ر

درجة كل سؤال : ١٧ درجة

أجب عن ثلاثة أسئلة فقط مما يأتي :-

السؤال الأول :-

أوجد تحويل لابلاس للمشتقة التفاضلية للدالة $F(t)$ عند نقط الاتصال والانفصال للدالة .

أبرهن علي أن

$$\lim_{t \rightarrow 0} F(t) = \lim_{s \rightarrow \infty} s f(s)$$

$$\lim_{t \rightarrow \infty} F(t) = \lim_{s \rightarrow 0} s f(s)$$

$$\Gamma\left(\frac{1}{2}\right) = \sqrt{\pi}, \quad \int_0^{\infty} \delta(t) dt = 1, \quad L \sin \sqrt{t} = \frac{\sqrt{\pi}}{3} e^{-\frac{1}{4s}} s^{\frac{3}{2}}$$

السؤال الثاني :-

حل المعادلات الآتية :

$$t Y''(t) + Y'(t) + 4t Y(t) = 0, \quad y(0) = 3, y'(0) = 0$$

$$\frac{\partial U}{\partial x} = 2 \frac{\partial U}{\partial t} + U, \quad x > 0, t > 0 \quad U(x, 0) = 6 e^{-3x}$$

$$\int_0^t Y(u) Y(t-u) du = 16 \sin 4t$$

السؤال الثالث :-

(أ) فك الدالة $f(x) = x^2$, $0 < x < 2\pi$ بدلالة متسلسلة فوريير ثم أحسب المجموع

$$1 + \frac{1}{2^2} + \frac{1}{3^2} + \frac{1}{4^2} + \dots$$

(ب) صفيحة علي شكل دائري نصف قطرها الوحدة ووجهيها معزولين ونصف محيطها محفوظ عند درجة حرارة u_1

والآخر عند u_2 أوجد حالة الأتزان الحراري .

من فضلك أنظر بقية الأسئلة خلف الورقة ،،،،،



Answer the following questions (50 marks)

Q1.	Complete the following: (1)..... is a representation of a two-dimensional image as a finite set of digital values, called picture elements or pixels - Common image formats include.....(2).... ,(3)..... ,(4)..... (5)..... creates a Distance tool a draggable, resizable line that measures the distance between its endpoints. (6)..... These are the result of objects that are self-luminous, such as stars and light bulbs. (7).....the resulting output pixel is computed as a sum of products of the pixel values and mask coefficients in the pixel's neighborhood in the original image. - The Sobel operators used to compute edges are(8)..... ,(9)..... - Edge detector should have:(10)..... ,(11)..... - Types of noise are(12)..... ,(13)....	(13 marks)
Q2.	a) Compute Z from the following matlab script (6 marks) <pre> x = [150 10 90;80 50 60;121 160 20] y = [-1 0 1;-2 0 2;-1 0 1] z = imfilter(x,y,'corr') </pre> b) What is the Delta compression and compute the compressed data of the data (6 marks) 220 321 335 211 250 200 233 214 232 212	(12 marks)
Q3.	a) Write the MATLAB code used to: (4 marks) - Read any image then use affine transformation matrix for each of the operations below: - Flip the image right to left - Translation by [25, 15] pixels b) What are the main differences between: (8 marks) - Global thresholding and optimal thresholding. - Raster and vector image . - Interpixel redundancy and Psychovisual redundancy	(12 marks)

(Q5) (i) Assume that U, V are open intervals and let $f : U \rightarrow \mathbb{R}$ and $g : V \rightarrow \mathbb{R}$ be two differentiable functions such that $f(U) \subset V$. Prove that $g \circ f$ is differentiable on U and that $(g \circ f)' = (g' \circ f) \cdot f'$ [5 marks]

(ii) Prove that the function $f(x) := \frac{1}{x}$ is differentiable on $]0, \infty[$ but not uniformly continuous therein. [5 marks]

(Q6) (i) State and prove Rolle's theorem then use it to prove the mean value theorem. [6 marks]

(ii) Let I be an open interval. Apply the mean value theorem to prove that a function differentiable on I is

1. increasing if and only if $f' \geq 0$ on I ,

2. decreasing if and only if $f' \leq 0$ on I .

[4 marks]

With the best of luck,

Prof. Rashwan A. Rashwan,

Dr. Ahmed A. Abdelhakim



Time: 3 hours

Total mark: 50

Answer *only five* of the following questions:

(Q1) (i) Suppose that O_i , $i \geq 1$, are open subsets of $\mathbb{R}$. Prove that $\cup_{i \geq 1} O_i$ is also open in $\mathbb{R}$. [5 marks]

(ii) Let $S \subset \mathbb{R}$. Show that S is closed if and only if S contains the limit point of every convergent sequence of elements of S . [5 marks]

(Q2) (i) Prove that a sequence of real numbers converges if and only if it is a Cauchy sequence. [6 marks]

(ii) Show that if $(x_n)_{n \geq 1} \subset \mathbb{R}$ is a monotonically increasing sequence that is bounded above, then $x_n \rightarrow \sup_{n \geq 1} x_n$, as $n \rightarrow \infty$. [4 marks]

(Q3) (i) Show that $f : D \subset \mathbb{R} \rightarrow \mathbb{R}$ is continuous at $x_0 \in D$ if and only if the sequence $(f(x_n))_{n \geq 1}$ converges to $f(x_0)$ whenever $(x_n)_{n \geq 1}$ is a sequence in D that converges to x_0 . [6 marks]

(ii) Use the characterization given in (i) to prove the discontinuity at the origin of the function $f(x) = \begin{cases} \cos \frac{1}{x}, & x \neq 0; \\ 0, & x = 0. \end{cases}$ [4 marks]

(Q4) (i) Assume that D is a closed bounded subset of $\mathbb{R}$. Prove that if $f : D \rightarrow \mathbb{R}$ is continuous then f is bounded on D , and there exist $\alpha, \beta \in D$ such that $f(\alpha) = \max_{x \in D} f(x)$ and $f(\beta) = \min_{x \in D} f(x)$. [5 marks]

(ii) Argue by contradiction to demonstrate that if $f : [a, b] \rightarrow \mathbb{R}$ is continuous then it is uniformly continuous on $[a, b]$. [5 marks]

Please Turn over the page

CS12	CS11	CS10	Description
0	0	0	No clock source (Timer/Counter stopped).
0	0	1	$clk_{IO}/1$ (No prescaling)
0	1	0	$clk_{IO}/8$ (From prescaler)
0	1	1	$clk_{IO}/64$ (From prescaler)
1	0	0	$clk_{IO}/256$ (From prescaler)
1	0	1	$clk_{IO}/1024$ (From prescaler)
1	1	0	External clock source on T1 pin. Clock on falling edge.
1	1	1	External clock source on T1 pin. Clock on rising edge.

Timer/Counter1 – TCNT1H and TCNT1L

Bit	7	6	5	4	3	2	1	0	
	TCNT1[15:8]								TCNT1H
	TCNT1[7:0]								TCNT1L
Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

Output Compare Register 1 B – OCR1BH and OCR1BL

Bit	7	6	5	4	3	2	1	0	
	OCR1B[15:8]								OCR1BH
	OCR1B[7:0]								OCR1BL
Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

Input Capture Register 1 – ICR1H and ICR1L

Bit	7	6	5	4	3	2	1	0	
	ICR1[15:8]								ICR1H
	ICR1[7:0]								ICR1L
Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

Timer/Counter Interrupt Mask Register – TIMSK⁽¹⁾

Bit	7	6	5	4	3	2	1	0	
	OCIE2	TOIE2	TICIE1	OCIE1A	OCIE1B	TOIE1	OCIE0	TOIE0	TIMSK
Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

- Bit 5 – TICIE1: Timer/Counter1, Input Capture Interrupt Enable
 Bit 4 – OCIE1A: Timer/Counter1, Output Compare A Match Interrupt Enable
 Bit 3 – OCIE1B: Timer/Counter1, Output Compare B Match Interrupt Enable
 Bit 2 – TOIE1: Timer/Counter1, Overflow Interrupt Enable

Timer/Counter Interrupt Flag Register – TIFR

Bit	7	6	5	4	3	2	1	0	
	OCF2	TOV2	ICF1	OCF1A	OCF1B	TOV1	OCF0	TOV0	TIFR
Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

- Bit 5 – ICF1: Timer/Counter1, Input Capture Flag
 Bit 4 – OCF1A: Timer/Counter1, Output Compare A Match Flag
 Bit 3 – OCF1B: Timer/Counter1, Output Compare B Match Flag
 Bit 2 – TOV1: Timer/Counter1, Overflow Flag

USART

Operating Mode	Equation for Calculating Baud Rate ⁽¹⁾	Equation for Calculating UBRR Value
Asynchronous Normal Mode (U2X = 0)	$BAUD = \frac{f_{osc}}{16(UBRR + 1)}$	$UBRR = \frac{f_{osc}}{16BAUD} - 1$
Asynchronous Double Speed Mode (U2X = 1)	$BAUD = \frac{f_{osc}}{8(UBRR + 1)}$	$UBRR = \frac{f_{osc}}{8BAUD} - 1$
Synchronous Master Mode	$BAUD = \frac{f_{osc}}{2(UBRR + 1)}$	$UBRR = \frac{f_{osc}}{2BAUD} - 1$

USART I/O Data Register – UDR

Bit	7	6	5	4	3	2	1	0	
	RXB[7:0]								UDR (Read)
	TXB[7:0]								UDR (Write)
Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

USART Control and Status Register A – UCSRA

Bit	7	6	5	4	3	2	1	0	
	RXC	TXC	UDRE	FE	DOR	PE	U2X	MPCM	UCSRA
Read/Write	R	R/W	R	R	R	R	R/W	R/W	
Initial Value	0	0	1	0	0	0	0	0	

- Bit 7 – RXC: USART Receive Complete
- Bit 6 – TXC: USART Transmit Complete
- Bit 5 – UDRE: USART Data Register Empty
- Bit 4 – FE: Frame Error
- Bit 3 – DOR: Data OverRun
- Bit 2 – PE: Parity Error
- Bit 1 – U2X: Double the USART Transmission Speed
- Bit 0 – MPCM: Multi-processor Communication Mode

USART Control and Status Register B – UCSRB

Bit	7	6	5	4	3	2	1	0	
	RXCIE	TXCIE	UDRIE	RXEN	TXEN	UCSZ2	RXB8	TXB8	UCSRB
Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R	R/W	
Initial Value	0	0	0	0	0	0	0	0	

- Bit 7 – RXCIE: RX Complete Interrupt Enable
- Bit 6 – TXCIE: TX Complete Interrupt Enable
- Bit 5 – UDRIE: USART Data Register Empty Interrupt Enable
- Bit 4 – RXEN: Receiver Enable
- Bit 3 – TXEN: Transmitter Enable
- Bit 2 – UCSZ2: Character Size
- Bit 1 – RXB8: Receive Data Bit 8
- Bit 0 – TXB8: Transmit Data Bit 8

USART Control and Status Register C – UCSRC

Bit	7	6	5	4	3	2	1	0	
	URSEL	UMSEL	UPM1	UPM0	USBS	UCSZ1	UCSZ0	UCPOL	UCSRC
Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	
Initial Value	1	0	0	0	0	1	1	0	

- Bit 7 – URSEL: Register Select
- Bit 6 – UMSEL: USART Mode Select
- Bit 5:4 – UPM1:0: Parity Mode
- Bit 3 – USBS: Stop Bit Select
- Bit 2:1 – UCSZ1:0: Character Size
- Bit 0 – UCPOL: Clock Polarity

UMSEL	Mode
0	Asynchronous Operation
1	Synchronous Operation

USBS	Stop Bit(s)
0	1-bit
1	2-bit

UPM1	UPM0	Parity Mode
0	0	Disabled
0	1	Reserved
1	0	Enabled, Even Parity
1	1	Enabled, Odd Parity

UCPOL	Transmitted Data Changed (Output of Tx D Pin)	Received Data Sampled (Input on Rx D Pin)
0	Rising XCK Edge	Falling XCK Edge
1	Falling XCK Edge	Rising XCK Edge

Table 66. UCSZ Bits Settings

UCSZ2	UCSZ1	UCSZ0	Character Size
0	0	0	5-bit
0	0	1	6-bit
0	1	0	7-bit
0	1	1	8-bit
1	0	0	Reserved
1	0	1	Reserved
1	1	0	Reserved
1	1	1	9-bit

USART Baud Rate Registers – UBRRL and UBRRH

Bit	15	14	13	12	11	10	9	8	
	URSEL	-	-	-	-	UBRR[11:9]	-	-	UBRRH
	-	-	-	-	-	UBRR[7:0]	-	-	UBRRL
Read/Write	R/W	R	R	R	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	



Operation Research326 R

11-5-2018

Third Level: Computer Science Section

Time: 3 hours

Total Degree (50 marks)

Science Faculty

Mathematical Department

Answer the following Questions:

1-Use the Simplex method to solve the following linear programming

Maximize $Z = 10x_1 + 11x_2$

Subject to $x_1 + 2x_2 \leq 150$, $3x_1 + 4x_2 \leq 200$, $6x_1 + x_2 \leq 175$

and $x_1, x_2 \geq 0$

(10 marks)

2) Use the graphical and the algebraic method to solve the problem

Max $f(\underline{x}) = 5x_1 + 7x_2$ Subject to $5x_1 + 8x_2 \leq 24$, $x_1 + x_2 \leq 4$,

$10x_1 + 7x_2 \leq 35$ and $x_1, x_2 \geq 0$

(12.5marks)

3) Use the Lagrange multiplier method to find the extreme points of the problem

Minimize $f(\underline{x}) = x_1^2 + x_2^2 - 3x_1x_2$

Subject to $g(\underline{x}) = x_1^2 + x_2^2 - 8 = 0$.

(12.5marks)

4) Use the Hessian Matrix to find the local points of the problem

$f(\underline{x}) = f(x_1, x_2) = x_1^3 + x_2^3 + 2x_1^2 + 4x_2^2 + 6$

(10marks)

5) Find the local Points

$f(x) = 3x^4 - 20x^3 + 36x^2 + 16$ (5marks)

Best Wishes

Dr. Alaa Fahim



Operation Research326 R

11-5-2018

Third Level: Computer Science Section

Time: 3 hours

Total Degree (50 marks)

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Answer the following Questions:

1-Use the Simplex method to solve the following linear programming

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Subject to $x_1 + 2x_2 \leq 150$, $3x_1 + 4x_2 \leq 200$, $6x_1 + x_2 \leq 175$

and $x_1, x_2 \geq 0$

(10 marks)

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Max $f(\underline{x}) = 5x_1 + 7x_2$ Subject to $5x_1 + 8x_2 \leq 24$, $x_1 + x_2 \leq 4$,

$10x_1 + 7x_2 \leq 35$ and $x_1, x_2 \geq 0$

(12.5marks)

3) Use the Lagrange multiplier method to find the extreme points of the problem

Minimize $f(\underline{x}) = x_1^2 + x_2^2 - 3x_1x_2$

Subject to $g(\underline{x}) = x_1^2 + x_2^2 - 8 = 0$.

(12.5marks)

4) Use the Hessian Matrix to find the local points of the problem

$f(\underline{x}) = f(x_1, x_2) = x_1^3 + x_2^3 + 2x_1^2 + 4x_2^2 + 6$

(10marks)

5) Find the local Points

$f(x) = 3x^4 - 20x^3 + 36x^2 + 16$ (5marks)

Best Wishes

Dr. Alaa Fahim

اجب عن خمسة فقط من الاسئلة الاتية :- (10 درجات لكل سؤال : بواقع 5 درجات لكل فقرة)

(1) (i) اوجد الحل العام للمعادلة : $p_1 + 3p_2 + 2p_3(1 + \sqrt{x_1 + x_2 + x_3 - u}) = 6$
(ii) اوجد الحل الخاص للمعادلة : $(y - z)[2xyp + (x^2 - y^2)q] + z(x^2 - y^2) = 0$
الذي يمر خلال المنحنى $y = 0, x^3 = z^2$

(2) اوجد الحل العام لكل من المعادلتين التفاضليتين الجزئيتين الاتيتين :-
(i) $(D_1^3 - D_1^2 D_2 - D_1 D_2^2 + D_2^3)z = \log(x + y)$
(ii) $(D_1^2 - a^2 D_2^2)z = x^2 + y^2$, ثابت مطلق a

(3) اوجد الحل العام لكل من المعادلتين التفاضليتين الجزئيتين الاتيتين :-
(i) $(D_1^2 D_2 + D_2^2 - 2)z = e^{2y} \sin 3x - e^x \cos 2y$
(ii) $(D_1^2 - D_2^2 - D_1 - 3D_2 - 2)z = e^{2x-3y} + x + y + 1$

(4) (i) احسب التكاملات الاتية :-
(a) $\int_0^{\infty} x^{-\frac{1}{3}}(1 + 2x)^{-3} dx$ (b) $\int_0^1 \sqrt{\log \frac{1}{x}} dx$

(ii) اثبت ان :-
(a) $\tan^{-1} x = x {}_2F_1(1, \frac{1}{2}; \frac{3}{2}; -x^2)$
(b) $(a - b) {}_2F_1(a, b; c; x) = a {}_2F_1(a + 1, b; c; x) - b {}_2F_1(a, b + 1; c; x)$

(5) اثبت ان دوال بسل من النوع الاول $J_n(x)$ تحقق الاتي :-
(i) $J_{-\frac{1}{2}}(x) = \sqrt{\frac{2}{\pi x}} \cos x$, (ii) $\int x^n J_{n-1}(x) dx = x^n J_n(x) + c$

(6) (i) اثبت ان كثيرات حدود لجندر $P_n(x)$ تحقق :-
(ii) احسب التكاملات الاتية :-
(a) $\int_{-1}^1 x P_n(x) P_{n+1}(x) dx$, (b) $\int_{-1}^1 x^2 P_n(x) P_{n+1}(x) dx$, (c) $\int_{-1}^1 x^2 P_n(x) dx$



أجب عن أسئلة الآتية :- (كل سؤال ١٠ درجات)

(١) (أ) أثبت قاعدة التضعيف لدالة جاما $\sqrt{\pi} \Gamma(2x) = 2^{2x-1} \Gamma(x) \Gamma\left(x + \frac{1}{2}\right)$, $x > 0$

ثم استخدمها فى إثبات أن: $\Gamma\left(\frac{5}{6}\right) \left[\Gamma\left(\frac{1}{3}\right)\right]^2 = 2 \sqrt[3]{2} \sqrt{\frac{\pi^3}{3}}$

(ب) باستخدام دوال جاما و بيتا أوجد التكاملات الآتية: (i) $\int_0^{\frac{\pi}{2}} \sqrt{\tan \theta} d\theta$ (ii) $\int_0^{\infty} \frac{\sqrt{x}}{e^{x^3}} dx$

(٢) (أ) أثبت أن: $\Gamma(x) \Gamma(1-x) = \frac{\pi}{\sin \pi x}$, $0 < x < 1$ ومن ثم أثبت أن

$\Gamma\left(x + \frac{1}{2}\right) \Gamma\left(\frac{1}{2} - x\right) = \frac{\pi}{\cos \pi x}$

(ب) أثبت أن:

(i) $\sqrt{1-x^2} T_n(x) = U_{n+1}(x) - x U_n(x)$,

(ii) $(1-x^2) U'_n(x) = -n x U_n(x) + n U_{n-1}(x)$

(٣) أثبت أن:

(i) ${}_2F_1(\alpha, \beta; \gamma, x) = (1-x)^{-\beta} {}_2F_1\left(\gamma - \alpha, \beta; \gamma, \frac{x}{x-1}\right)$

(ii) ${}_1F_1\left(\frac{1}{2}; \frac{3}{2}, -x^2\right) = \frac{\sqrt{\pi}}{2x} \operatorname{erf}(x)$ حيث أن: $\operatorname{erf}(x) = \frac{2}{\sqrt{\pi}} \int_0^x e^{-t^2} dt$ هى دالة الخطأ

(iii) ${}_1F_1(\alpha + 1; \gamma, x) - {}_1F_1(\alpha; \gamma, x) - \frac{x}{\gamma} {}_1F_1(\alpha + 1; \gamma + 1, x) = 0$

(٤) (أ) أوجد مفكوك ليجندر للدالة: $f(x) = x^3$

(ب) أثبت أن: $H_n(x) = (-1)^n e^{x^2} \frac{d^n}{dx^n} (e^{-x^2})$ حيث $H_n(x)$ كثيرة حدود هيرميت.

(ج) أثبت أن: $J_{\frac{1}{2}}(x) = \sqrt{\frac{2}{\pi}} \frac{\sin x}{\sqrt{x}}$

(٥) (أ) باستخدام الصيغة التكاملية لدوال بسل أثبت أن: $\int_0^{\infty} e^{-3x} J_0(4x) dx = \frac{1}{5}$

(ب) أوجد الحل العام لمعادلة بسل التفاضلية:

$x^2 \frac{d^2 y}{dx^2} + x \frac{dy}{dx} + (x^2 - n^2)y = 0$

	Assiut University Faculty of Science Mathematics Dept.	Final Exam 2017-2018 Course: Mathematical and Statistical Packages Course code: MC300	Date: 14/5/2018 Level: Three Time: 2 Hours	
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Question 1: Put True or False for each of the following items (30 marks)

1. To enter a formula into a cell, begin by typing an equal sign.
2. Functions are pre-defined worksheet formulas.
3. Formulas in Excel must be written in a very specific format, referred to as syntax.
4. The second order of precedence is for exponentiation.
5. When the formula in cell **B7 =B4+B5+B6** is copied into cell **C7** the formula will be changed to **= C4+C5+C6**.
6. The error "#####" means Data being referenced is not available.
7. The range **B2:B7** is a range down a column.
8. To keep things clear and simple only add an absolute (\$) cell reference if absolutely necessary.
9. The formula **=ROUND(78.686788,-1)** results in the value 80 .
10. Placing an absolute sign in front of a ranged name (**\$budget**) is incorrect syntax.
11. The columns of the worksheet are named with Numbers.
12. Cells may contain only Labels and Values.
13. The cell address first lists the row name and then the column name.
14. This selected cell is referred to as the **active cell**.
15. The contents of the active cell will also be displayed on the **formula bar**.
16. A cell that is on sheet 3, in the second column third row would be referred to as **Sheet3@B3**.
17. Formatted Display is the number of decimal places that appear in a cell.
18. Formulas can be copied to perform different operations on a corresponding set of data.
19. The function **COUNT(value1,[value2],...)** counts non-blank cells.
20. The Average function ignore the blank cells.
21. TRUE and FALSE are called Boolean Values.
22. SPSS stands for Statistical Package for the Social Sciences.
23. SPSS is capable of handling large amounts of data.
24. SPSS has only two windows Data view and Output view.
25. **Transform** menu includes several options to change current variables.
26. In SPSS, Each column typically represents the data from 1 case.
27. In SPSS, The first column of variable view is Name.
28. In SPSS, you can sort data from **Transform** menu then **Sort Cases**.
29. Descriptive statistics are calculated using the **Analyze** menu.
30. Correlation is used to test the degree of association between variables.

Answer Sheet		
	True	False
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		
11		
12		
13		
14		
15		
16		
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22		
23		
24		
25		
26		
27		
28		
29		
30		

Question 2: (10 marks)

	A	B	C	D	E	F	G
1		MT1	MT2	Final	Total	Honors	Passed
2	Possible points	100	100	200	400		320
3							
4	Blue	79	89	169	337	FALSE	TRUE
5	Jones	85	65	195	345	FALSE	TRUE
6	Grey	60	97	187	344	TRUE	TRUE
7	Mary	10	30	50	90	TRUE	FALSE
8							

Write the following Boolean functions

1. Blue's total and Jones' total are greater than Grey's:
2. Grey's total is not the maximum grade:
3. None of the students passed the course
4. Blue is not an Honors student
5. Blue didn't get a passing grade (320)

Question 3: (10 marks)

1. What are the difference between Data View, Variable View and Output View in SPSS?
2. Some significance tests are very restrictive about the form of data they can accept. What are the different types of measurement?
3. Describe how to test the degree of association between variables by SPSS.
4. Explain how to use SPSS to calculate the frequency and percent of females and males who did and did not have social problems.

Q2.

- a. Maintain two different Algorithm of crossover process with mention the probability of crossover (5 marks)
- b. Maintain two different Algorithm of mutation process with mention the probability of mutation. (5 marks)

Q3. a. Maintain tree type representation of solutions in genetic algorithm. (3 marks)

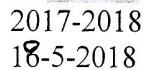
b. Using genetic algorithm to find the maximum value of the function $(15x - x^2)$ where parameter x varies between 0 and 15. For simplicity, we may assume that x takes only integer values. Using the genetic algorithm procedure in one step and begin with four solutions in initial solutions. (10 marks)

Q4. Discuss the internal structure of Taxi driver Robot. (7 marks)

Q5. Discuss the Tabu search method and maintain the type of memory using in this method and maintain the Tabu search algorithm. (10 marks)

==best wishes==

Dr. Alaa F. Mohamed

**Time: 2 Hours**

Mathematics Dept.
Faculty of Science
Assiut University

(10 marks)

- ,

Answer the following questions: (50 Marks)

Question 1: Answer the following points (10 Marks)

- 1- Explain the internet "nuts and bolts"?
- 2- Explain the sources of packet delay?
- 3- What are protocols?
- 4- Explain Access network: digital subscriber line (DSL)?

Question 2: Answer the following points (10 Marks)

- 1- What is the network core?
- 2- Explain Packet Switching: queueing delay, loss?
- 3- Define throughput?
- 4- Define and explain traffic intensity?

Question 3: Answer the following points (10 Marks)

- 1- Explain the Internet protocol stack?
- 2- Mention some network applications?
- 3- Explain the application client-server architecture?
- 4- Explain P2P architecture?

Question 4: Answer the following points (10 Marks)

- 1- HTTP is "stateless". What does that mean?
- 2- Compare between persistent HTTP and non-persistent HTTP?
- 3- Give examples of HTTP response status codes?
- 4- Explain the term (web caches) and how it is useful?

Question 5: Answer the following points (10 Marks)

- 1- Give a DNS name resolution example?
- 2- Compare between multiplexing and demultiplexing? Support your answer with a diagram?
- 3- Define and explain the use of ACKs and NAKs?
- 4- Define and explain HOL? Support your answer with a diagram?

جامعة أسيوط	مايو 2018	كود المقرر: 356 رك
كلية العلوم		المقرر : مقدمة فى الحسابات العلمية
قسم الرياضيات		الزمن : ساعتان

Answer the following questions by using MATLAB language: (50 marks)

1- Using Newton's forward difference formula, find $y(0.1)$ using the table below:

x	0.0	0.2	0.4	0.6	0.8
y	1.000	1.22140	1.49182	1.82212	2.22554

2- Solve the differential equation by Adams method (without using nested for loops) at $x=0.2$:

$$\frac{dy}{dt} = t^2 - y, \quad y(0) = 1, \quad h = 0.05.$$

and compare it with the analytic solution $y = -e^{-t} + t^2 - 2t + 2$.

3- Solve the following initial value problem:

$$\frac{d^2u}{dt^2} + 4\frac{du}{dt} + 3u = 0, \quad u(0) = 1, \quad \frac{du}{dt}(0) = 0.$$

4- Let $f(x) = \cos 2x$ and $x_0 = 0$. Determine

- The third Taylor polynomial for f about x_0 .
- Find error bound at $x = 0.2$ and compare it to the actual error.

5- For the well-known Chua's circuit equation in chaotic studies that

$$\dot{x} = \alpha[y - x - f(x)], \quad \dot{y} = x - y + z, \quad \dot{z} = -\beta y - \gamma z, \quad t \in (0, 10),$$

where the nonlinear function $f(x)$ is described by

$$f(x) = bx + 0.5(a-b)(|x+1| - |x-1|) \text{ and } a < b < 0.$$

Write an M-function to describe the equation, and draw the phase trajectory for the parameters $\alpha = 9$, $\beta = 100/7$, $\gamma = 0$, $a = -8/7$, $b = -5/7$, and initial conditions

$$x(0) = -2.121304, \quad y(0) = -0.066170, \quad z(0) = 2.881090.$$

Good Luck

Dr. Tarek Aboelenen



امتحان الفرقة الثالثة شعبة الرياضيات

الزمن : ثلاث ساعات

رقم المقرر ورمزه : ١٣٤٦

المقرر : عمليات عشوائية وتطبيقاتها

أجب عن خمسة أسئلة فقط مما يأتي :- درجة جزء كل سؤال (خمس درجات)

١- (أ) لمجموعة المتغيرات العشوائية المستقلة $X_1, X_2, X_3, \dots$ بفرض أن التوقع الرياضي $E(X_i) = m$ والتباين $V(X_i)$ لكل منها محدود عرف كل من التقارب عن طريق الإحتمال وقانون الأعداد الكبرى (الضعيف).
(ب) بفرض أن $f f s s f s f f s s s f f s f f s$ هي إحدى النتائج الممكنة في محاولات برنولي العشوائية المستقلة بحيث أن $P(s) = p, P(f) = q, p + q = 1$ عرف عملية عشوائية في الفراغ R^2 موضحا ذلك بيانيا .

٢- (أ) في عملية برنولي العشوائية $\{X_n; n > 0\}$ بالإحتمال $p = 0.6$ إذا كان $X = X_1 + X_2$ ، $Y = X_1 + X_3$ احسب الإحتمالات الآتية : $P(X < 2, Y \leq 1)$ ، $P(2X < 3Y)$ ، $P(Y = X)$.
(ب) في السؤال (٢-أ) أوجد العزم الارتباطي بين X ، Y موضحا العلاقة بينهما .

٣- (أ) وضح العلاقة بين عملية برنولي العشوائية $\{X_n; n > 0\}$ و العملية العشوائية $\{Y_n; n \geq 0\}$ حيث أن المتغير Y_n يخضع لتوزيع ذي الحدين واذكر صفات كل منهما ثم عبر مع الاستنتاج عن إحتمال الحادث $(Y_{n+1} = k)$ من خلال إحتمالات الحوادث : $(Y_n = k)$ ، $(Y_n = k - 1)$ لأي عدد صحيح $k > 0$.
(ب) في العملية العشوائية $\{Y_n; n \geq 0\}$ أوجد كل من $E(Y_5)$ ، $E(Y_4^2)$ ، $P(Y_5 = 3, Y_7 = 4, Y_{14} = 9)$.

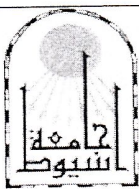
٤- (أ) عرف أزمنة النجاح T_k كعملية عشوائية موضحا العلاقة بينها وبين العملية العشوائية $\{Y_n; n \geq 0\}$ ثم اذكر فقط توزيع المتغير العشوائي T_k .
(ب) - في عملية بواسون العشوائية $\{N_t; t \geq 0\}$ بالمعدل $\lambda = 4$ احسب كل من الإحتمالات الآتية :
 $P(N_{1.5} = 2, N_4 = 5, N_{6.8} = 9)$ ، $P(N_3 = 5, N_7 = 9)$

٥- (أ) في عملية بواسون أو عملية الوصول المعودة $\{N_t; t \geq 0\}$ بالمعدل λ إثبت أن الإحتمال المشروط لعدد الوصول N_t بالنسبة إلى عدد الوصول N_{t+s} لكل $t > 0, s > 0$ يمثل توزيع ذي الحدين .
(ب) عرف العمليات العشوائية المستقلة ثم اثبت أن أي عمليتين مستقلتين لبواسون هو أيضا عملية بواسون .

٦- (أ) في عملية التجديد العشوائية $R = \{R_n; n \in N\}$ حيث N هي فئة الأعداد الصحيحة غير السالبة عرف دالة التجديد ثم عبر عنها من خلال توزيع المتغير R_n مع الاستنتاج .

(ب) في سلسلة ماركوف العشوائية المتقطعة $\{X_n; n \geq 0\}$ عرف مصفوفة الإحتمالات الإنتقالية بصفاتها المعروفة ثم احسب الإحتمال : $P(X_0 = 1, X_1 = 1, X_2 = 0, X_3 = 1, X_4 = 0, X_6 = 0)$ بفرض أن حالات الفراغ $(0, 1)$ والمصفوفة العشوائية

$$P = \begin{pmatrix} 1/2 & 1/2 \\ 1/3 & 2/3 \end{pmatrix} , \text{ ومنتجه الإحتمالات الابتدائية } \pi_0 = (2/5 \quad 3/5)$$

	المقرر: تحليل عددي (٣٢٣) الفرقة: المستوى الثالث الدرجة: ٥٠ درجة التاريخ: ٢٠١٨/٥/٢٩ الزمن: ثلاث ساعات	جامعة أسيوط كلية العلوم - قسم الرياضيات امتحان نهائي الفصل الدراسي الثاني للعام الجامعي ٢٠١٧/٢٠١٨
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Answer five questions only :- (10 marks for every question)

1-a) If the function $g \in C[a, b]$ and $g(x) \in [a, b] \forall x \in [a, b]$ and $g'(x)$ exist with $|g'(x)| \leq k < 1 \forall x \in [a, b]$ prove that the sequence defined by $P_n = g(P_{n-1}), n \geq 1$ will converge to the unique fixed point P and also $|P_{n+1} - P_n| \leq k^n |P_1 - P_0|$.

1-b) Verify that when Newton's method is used to compute $\sqrt{A}, A > 0$ (By solving the equation : $f(x) = x^2 - A$). The sequence of iterates is defined by : $x_{n+1} = (x_n + \frac{A}{x_n})/2$, and show that if the sequence $\{x_n\}$ is defined as the previous problem, then this method is quadratically convergence.

2-a) Derive Lagrange interpolation formula of degree n and write the error of the method.

2-b) For the given function $f(x) = \cos \pi x$ let $x_0 = -1, x_1 = 0, x_2 = 1$ construct the suitable interpolation polynomial and find the actual error.

3) Derive the formula of the Newton's interpolatory divided difference method and use this formula to obtain a polynomial of least degree that fits the values shown:

x	0	1	2	4	6
$f(x)$	1	9	23	93	259

من فضلك انظر خلف الورقة

السؤال الرابع :-

أ) يعرف الطي للدالتين $f(x)$, $g(x)$ كالآتي

$$f * g = \int_{-\infty}^{\infty} f(u) g(x-u) du$$

برهن علي أن تحويل فوريير للطرف الأيمن هو حاصل ضرب تحويل فوريير للدالتين $f(x)$, $g(x)$

ب) أوجد تحويل فوريير للدالة $f(x) = \begin{cases} 1 & |x| < a \\ 0 & |x| > a \end{cases}$ وأرسم $f(x)$ كذلك تحويلها عند $a = 3$ وأوجد

$$\int_{-\infty}^{\infty} \frac{\sin u}{u} du \quad \text{كذلك} \quad \int_{-\infty}^{\infty} \frac{\sin \alpha a \cos \alpha x}{\alpha} d\alpha$$

ج) ترك خيط لانهائي من السكون وكانت أزاحته الابتدائية عن محور x هي $f(x)$ أوجد الإزاحه عند أي زمن .

انتهت الأسئلة مع تمنياتنا بالتوفيق ،،،،

لجنة الممتحنين :- أ.د/ نجاه عبد الرحمن حسين ، أ.د/ فاروق علي السيد



الامتحان النهائي للفصل الدراسي الثاني للعام الجامعي ٢٠١٧/٢٠١٨ م
 للفرقة : الثالثة
 الشعبة : الرياضيات
 التاريخ : ٢٠١٨/٥/٢٤ م

الزمن : ساعتان

الدرجة الكلية : ٥٠ درجة

درجة كل سؤال : ١٧ درجة

أسم المقرر : الطرق الرياضية
 رقم المقرر ورمزه : ٣٣٤ ر

أجب عن ثلاثة أسئلة فقط مما يأتي :-

السؤال الأول :-

أوجد تحويل لابلاس للمشتقة التفاضلية للدالة $F(t)$ عند نقط الاتصال والانفصال للدالة .

أبرهن علي أن

$$\lim_{t \rightarrow 0} F(t) = \lim_{s \rightarrow \infty} s f(s)$$

$$\lim_{t \rightarrow \infty} F(t) = \lim_{s \rightarrow 0} s f(s)$$

$$\Gamma\left(\frac{1}{2}\right) = \sqrt{\pi}, \quad \int_0^{\infty} \delta(t) dt = 1, \quad L \sin \sqrt{t} = \frac{\sqrt{\pi}}{3} e^{-\frac{1}{4s}} s^{\frac{3}{2}}$$

السؤال الثاني :-

حل المعادلات الآتية :

$$t Y''(t) + Y'(t) + 4t Y(t) = 0, \quad y(0) = 3, y'(0) = 0$$

$$\frac{\partial U}{\partial x} = 2 \frac{\partial U}{\partial t} + U, \quad x > 0, t > 0, \quad U(x, 0) = 6 e^{-3x}$$

$$\int_0^t Y(u) Y(t-u) du = 16 \sin 4t$$

السؤال الثالث :-

(أ) فك الدالة $f(x) = x^2$, $0 < x < 2\pi$ بدلالة متسلسلة فوريير ثم أحسب المجموع

$$1 + \frac{1}{2^2} + \frac{1}{3^2} + \frac{1}{4^2} + \dots$$

(ب) صفيحة علي شكل دائري نصف قطرها الوحدة ووجهيها معزولين ونصف محيطها محفوظ عند درجة حرارة u_1

والآخر عند u_2 أوجد حالة الأتزان الحراري .

من فضلك أنظر بقية الأسئلة خلف الورقة ،،،،،



Answer the following questions (50 marks)

Q1.	Complete the following: (1)..... is a representation of a two-dimensional image as a finite set of digital values, called picture elements or pixels - Common image formats include.....(2).... ,(3)..... ,(4)..... (5)..... creates a Distance tool a draggable, resizable line that measures the distance between its endpoints. (6)..... These are the result of objects that are self-luminous, such as stars and light bulbs. (7).....the resulting output pixel is computed as a sum of products of the pixel values and mask coefficients in the pixel's neighborhood in the original image. - The Sobel operators used to compute edges are(8)..... ,(9)..... - Edge detector should have:(10)..... ,(11)..... - Types of noise are(12)..... ,(13)....	(13 marks)
Q2.	a) Compute Z from the following matlab script (6 marks) <pre> x = [150 10 90;80 50 60;121 160 20] y = [-1 0 1;-2 0 2;-1 0 1] z = imfilter(x,y,'corr') </pre> b) What is the Delta compression and compute the compressed data of the data (6 marks) 220 321 335 211 250 200 233 214 232 212	(12 marks)
Q3.	a) Write the MATLAB code used to: (4 marks) - Read any image then use affine transformation matrix for each of the operations below: - Flip the image right to left - Translation by [25, 15] pixels b) What are the main differences between: (8 marks) - Global thresholding and optimal thresholding. - Raster and vector image . - Interpixel redundancy and Psychovisual redundancy	(12 marks)

(Q5) (i) Assume that U, V are open intervals and let $f : U \rightarrow \mathbb{R}$ and $g : V \rightarrow \mathbb{R}$ be two differentiable functions such that $f(U) \subset V$. Prove that $g \circ f$ is differentiable on U and that $(g \circ f)' = (g' \circ f) \cdot f'$ [5 marks]

(ii) Prove that the function $f(x) := \frac{1}{x}$ is differentiable on $]0, \infty[$ but not uniformly continuous therein. [5 marks]

(Q6) (i) State and prove Rolle's theorem then use it to prove the mean value theorem. [6 marks]

(ii) Let I be an open interval. Apply the mean value theorem to prove that a function differentiable on I is

1. increasing if and only if $f' \geq 0$ on I ,

2. decreasing if and only if $f' \leq 0$ on I .

[4 marks]

With the best of luck,

Prof. Rashwan A. Rashwan,

Dr. Ahmed A. Abdelhakim



Time: 3 hours

Total mark: 50

Answer *only five* of the following questions:

(Q1) (i) Suppose that O_i , $i \geq 1$, are open subsets of $\mathbb{R}$. Prove that $\cup_{i \geq 1} O_i$ is also open in $\mathbb{R}$. [5 marks]

(ii) Let $S \subset \mathbb{R}$. Show that S is closed if and only if S contains the limit point of every convergent sequence of elements of S . [5 marks]

(Q2) (i) Prove that a sequence of real numbers converges if and only if it is a Cauchy sequence. [6 marks]

(ii) Show that if $(x_n)_{n \geq 1} \subset \mathbb{R}$ is a monotonically increasing sequence that is bounded above, then $x_n \rightarrow \sup_{n \geq 1} x_n$, as $n \rightarrow \infty$. [4 marks]

(Q3) (i) Show that $f : D \subset \mathbb{R} \rightarrow \mathbb{R}$ is continuous at $x_0 \in D$ if and only if the sequence $(f(x_n))_{n \geq 1}$ converges to $f(x_0)$ whenever $(x_n)_{n \geq 1}$ is a sequence in D that converges to x_0 . [6 marks]

(ii) Use the characterization given in (i) to prove the discontinuity at the origin of the function $f(x) = \begin{cases} \cos \frac{1}{x}, & x \neq 0; \\ 0, & x = 0. \end{cases}$ [4 marks]

(Q4) (i) Assume that D is a closed bounded subset of $\mathbb{R}$. Prove that if $f : D \rightarrow \mathbb{R}$ is continuous then f is bounded on D , and there exist $\alpha, \beta \in D$ such that $f(\alpha) = \max_{x \in D} f(x)$ and $f(\beta) = \min_{x \in D} f(x)$. [5 marks]

(ii) Argue by contradiction to demonstrate that if $f : [a, b] \rightarrow \mathbb{R}$ is continuous then it is uniformly continuous on $[a, b]$. [5 marks]

Please Turn over the page



Operation Research326 R

11-5-2018

Third Level: Computer Science Section

Time: 3 hours

Total Degree (50 marks)

Science Faculty

Mathematical Department

Answer the following Questions:

1-Use the Simplex method to solve the following linear programming

Maximize $Z = 10x_1 + 11x_2$

Subject to $x_1 + 2x_2 \leq 150$, $3x_1 + 4x_2 \leq 200$, $6x_1 + x_2 \leq 175$

and $x_1, x_2 \geq 0$

(10 marks)

2) Use the graphical and the algebraic method to solve the problem

Max $f(\underline{x}) = 5x_1 + 7x_2$ Subject to $5x_1 + 8x_2 \leq 24$, $x_1 + x_2 \leq 4$,

$10x_1 + 7x_2 \leq 35$ and $x_1, x_2 \geq 0$

(12.5marks)

3) Use the Lagrange multiplier method to find the extreme points of the problem

Minimize $f(\underline{x}) = x_1^2 + x_2^2 - 3x_1x_2$

Subject to $g(\underline{x}) = x_1^2 + x_2^2 - 8 = 0$.

(12.5marks)

4) Use the Hessian Matrix to find the local points of the problem

$f(\underline{x}) = f(x_1, x_2) = x_1^3 + x_2^3 + 2x_1^2 + 4x_2^2 + 6$

(10marks)

5) Find the local Points

$f(x) = 3x^4 - 20x^3 + 36x^2 + 16$ (5marks)

Best Wishes

Dr. Alaa Fahim



Operation Research326 R

11-5-2018

Third Level: Computer Science Section

Time: 3 hours

Total Degree (50 marks)

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Mathematical Department

Answer the following Questions:

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(12.5marks)

4) Use the Hessian Matrix to find the local points of the problem

$f(\underline{x}) = f(x_1, x_2) = x_1^3 + x_2^3 + 2x_1^2 + 4x_2^2 + 6$

(10marks)

5) Find the local Points

$f(x) = 3x^4 - 20x^3 + 36x^2 + 16$ (5marks)

Best Wishes

Dr. Alaa Fahim

اجب عن خمسة فقط من الاسئلة الاتية :- (10 درجات لكل سؤال : بواقع 5 درجات لكل فقرة)

(1) (i) اوجد الحل العام للمعادلة : $p_1 + 3p_2 + 2p_3(1 + \sqrt{x_1 + x_2 + x_3 - u}) = 6$
(ii) اوجد الحل الخاص للمعادلة : $(y - z)[2xyp + (x^2 - y^2)q] + z(x^2 - y^2) = 0$
الذي يمر خلال المنحنى $y = 0, x^3 = z^2$

(2) اوجد الحل العام لكل من المعادلتين التفاضليتين الجزئيتين الاتيتين :-
(i) $(D_1^3 - D_1^2 D_2 - D_1 D_2^2 + D_2^3)z = \log(x + y)$
(ii) $(D_1^2 - a^2 D_2^2)z = x^2 + y^2$, ثابت مطلق a

(3) اوجد الحل العام لكل من المعادلتين التفاضليتين الجزئيتين الاتيتين :-
(i) $(D_1^2 D_2 + D_2^2 - 2)z = e^{2y} \sin 3x - e^x \cos 2y$
(ii) $(D_1^2 - D_2^2 - D_1 - 3D_2 - 2)z = e^{2x-3y} + x + y + 1$

(4) (i) احسب التكاملات الاتية :-
(a) $\int_0^{\infty} x^{-\frac{1}{3}}(1 + 2x)^{-3} dx$ (b) $\int_0^1 \sqrt{\log \frac{1}{x}} dx$

(ii) اثبت ان :-
(a) $\tan^{-1} x = x {}_2F_1(1, \frac{1}{2}; \frac{3}{2}; -x^2)$
(b) $(a - b) {}_2F_1(a, b; c; x) = a {}_2F_1(a + 1, b; c; x) - b {}_2F_1(a, b + 1; c; x)$

(5) اثبت ان دوال بسل من النوع الاول $J_n(x)$ تحقق الاتي :-
(i) $J_{-\frac{1}{2}}(x) = \sqrt{\frac{2}{\pi x}} \cos x$, (ii) $\int x^n J_{n-1}(x) dx = x^n J_n(x) + c$

(6) (i) اثبت ان كثيرات حدود لجندر $P_n(x)$ تحقق :-
(ii) احسب التكاملات الاتية :-
(a) $\int_{-1}^1 x P_n(x) P_{n+1}(x) dx$, (b) $\int_{-1}^1 x^2 P_n(x) P_{n+1}(x) dx$, (c) $\int_{-1}^1 x^2 P_n(x) dx$



أجب عن أسئلة الآتية :- (كل سؤال ١٠ درجات)

(١) (أ) أثبت قاعدة التضعيف لدالة جاما $\sqrt{\pi} \Gamma(2x) = 2^{2x-1} \Gamma(x) \Gamma\left(x + \frac{1}{2}\right)$, $x > 0$

ثم استخدمها فى إثبات أن: $\Gamma\left(\frac{5}{6}\right) \left[\Gamma\left(\frac{1}{3}\right)\right]^2 = 2 \sqrt[3]{2} \sqrt{\frac{\pi^3}{3}}$

(ب) باستخدام دوال جاما و بيتا أوجد التكاملات الآتية: (i) $\int_0^{\frac{\pi}{2}} \sqrt{\tan \theta} d\theta$ (ii) $\int_0^{\infty} \frac{\sqrt{x}}{e^{x^3}} dx$

(٢) (أ) أثبت أن: $\Gamma(x) \Gamma(1-x) = \frac{\pi}{\sin \pi x}$, $0 < x < 1$ ومن ثم أثبت أن

$\Gamma\left(x + \frac{1}{2}\right) \Gamma\left(\frac{1}{2} - x\right) = \frac{\pi}{\cos \pi x}$

(ب) أثبت أن:

(i) $\sqrt{1-x^2} T_n(x) = U_{n+1}(x) - x U_n(x)$,

(ii) $(1-x^2) U'_n(x) = -n x U_n(x) + n U_{n-1}(x)$

(٣) أثبت أن:

(i) ${}_2F_1(\alpha, \beta; \gamma, x) = (1-x)^{-\beta} {}_2F_1\left(\gamma-\alpha, \beta; \gamma, \frac{x}{x-1}\right)$

(ii) ${}_1F_1\left(\frac{1}{2}; \frac{3}{2}, -x^2\right) = \frac{\sqrt{\pi}}{2x} \operatorname{erf}(x)$ حيث أن: $\operatorname{erf}(x) = \frac{2}{\sqrt{\pi}} \int_0^x e^{-t^2} dt$ هى دالة الخطأ

(iii) ${}_1F_1(\alpha+1; \gamma, x) - {}_1F_1(\alpha; \gamma, x) - \frac{x}{\gamma} {}_1F_1(\alpha+1; \gamma+1, x) = 0$

(٤) (أ) أوجد مفكوك ليجندر للدالة: $f(x) = x^3$

(ب) أثبت أن: $H_n(x) = (-1)^n e^{x^2} \frac{d^n}{dx^n} (e^{-x^2})$ حيث $H_n(x)$ كثيرة حدود هيرميت.

(ج) أثبت أن: $J_{\frac{1}{2}}(x) = \sqrt{\frac{2}{\pi}} \frac{\sin x}{\sqrt{x}}$

(٥) (أ) باستخدام الصيغة التكاملية لدوال بسل أثبت أن: $\int_0^{\infty} e^{-3x} J_0(4x) dx = \frac{1}{5}$

(ب) أوجد الحل العام لمعادلة بسل التفاضلية:

$x^2 \frac{d^2 y}{dx^2} + x \frac{dy}{dx} + (x^2 - n^2)y = 0$



Question 1: Put True or False for each of the following items (30 marks)

1. To enter a formula into a cell, begin by typing an equal sign.
2. Functions are pre-defined worksheet formulas.
3. Formulas in Excel must be written in a very specific format, referred to as syntax.
4. The second order of precedence is for exponentiation.
5. When the formula in cell **B7 =B4+B5+B6** is copied into cell **C7** the formula will be changed to **= C4+C5+C6**.
6. The error "#####" means Data being referenced is not available.
7. The range **B2:B7** is a range down a column.
8. To keep things clear and simple only add an absolute (\$) cell reference if absolutely necessary.
9. The formula **=ROUND(78.686788,-1)** results in the value 80 .
10. Placing an absolute sign in front of a ranged name (**\$budget**) is incorrect syntax.
11. The columns of the worksheet are named with Numbers.
12. Cells may contain only Labels and Values.
13. The cell address first lists the row name and then the column name.
14. This selected cell is referred to as the **active cell**.
15. The contents of the active cell will also be displayed on the **formula bar**.
16. A cell that is on sheet 3, in the second column third row would be referred to as **Sheet3@B3**.
17. Formatted Display is the number of decimal places that appear in a cell.
18. Formulas can be copied to perform different operations on a corresponding set of data.
19. The function **COUNT(value1,[value2],...)** counts non-blank cells.
20. The Average function ignore the blank cells.
21. TRUE and FALSE are called Boolean Values.
22. SPSS stands for Statistical Package for the Social Sciences.
23. SPSS is capable of handling large amounts of data.
24. SPSS has only two windows Data view and Output view.
25. **Transform** menu includes several options to change current variables.
26. In SPSS, Each column typically represents the data from 1 case.
27. In SPSS, The first column of variable view is Name.
28. In SPSS, you can sort data from **Transform** menu then **Sort Cases**.
29. Descriptive statistics are calculated using the **Analyze** menu.
30. Correlation is used to test the degree of association between variables.

Answer Sheet		
	True	False
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30		

Question 2: (10 marks)

	A	B	C	D	E	F	G
1		MT1	MT2	Final	Total	Honors	Passed
2	Possible points	100	100	200	400		320
3							
4	Blue	79	89	169	337	FALSE	TRUE
5	Jones	85	65	195	345	FALSE	TRUE
6	Grey	60	97	187	344	TRUE	TRUE
7	Mary	10	30	50	90	TRUE	FALSE
8							

Write the following Boolean functions

1. Blue's total and Jones' total are greater than Grey's:
2. Grey's total is not the maximum grade:
3. None of the students passed the course
4. Blue is not an Honors student
5. Blue didn't get a passing grade (320)

Question 3: (10 marks)

1. What are the difference between Data View, Variable View and Output View in SPSS?
2. Some significance tests are very restrictive about the form of data they can accept. What are the different types of measurement?
3. Describe how to test the degree of association between variables by SPSS.
4. Explain how to use SPSS to calculate the frequency and percent of females and males who did and did not have social problems.

Q2.

- a. Maintain two different Algorithm of crossover process with mention the probability of crossover (5 marks)
- b. Maintain two different Algorithm of mutation process with mention the probability of mutation. (5 marks)

Q3. a. Maintain tree type representation of solutions in genetic algorithm. (3 marks)

b. Using genetic algorithm to find the maximum value of the function $(15x - x^2)$ where parameter x varies between 0 and 15. For simplicity, we may assume that x takes only integer values. Using the genetic algorithm procedure in one step and begin with four solutions in initial solutions. (10 marks)

Q4. Discuss the internal structure of Taxi driver Robot. (7 marks)

Q5. Discuss the Tabu search method and maintain the type of memory using in this method and maintain the Tabu search algorithm. (10 marks)

==best wishes==

Dr. Alaa F. Mohamed



2017-2018
18-5-2018

Final Exam for Level 3
Subject: Artificial Intelligent
MC352
Time: 2 Hours

Mathematics Dept.
Faculty of Science
Assiut University

Q1. Choose the correct answer. (10 marks)

1.is the right action is the one that will cause the agent to be most successful
a) rationality b) Omniscience c) Perfection
2. Motors, files and body parts are considered as
a) effector b) sensor c) agents
3. Speaker, monitor and body part are considered as.....
a) effector b) sensor c) agents
4. The environment of part parking rebort is.....
a) Dynamics b) statistic c) semi
5. The environment of cross puzzle is considered as
a) squential b) eposidic c) mixed
6. The environment of backgammon game is considered as.....
a) Stochastic b) deterministic c) mixed
7. The accessibility of cross-word puzzle
a) partially b) fully c) statistic
8. Simulated annealing is considered as
a) informed search b) blind search c) agents
9. The is a metaheuristic begin with some of solution and make some operators
a) A* search b) Tabu search c) genetic algorithm
10. Theis a metaheuristic using memory that guides a local search procedure to explore the solution space.
a) A* search b) Tabu search c) genetic algorithm

Answer the following questions: (50 Marks)

Question 1: Answer the following points (10 Marks)

- 1- Explain the internet "nuts and bolts"?
- 2- Explain the sources of packet delay?
- 3- What are protocols?
- 4- Explain Access network: digital subscriber line (DSL)?

Question 2: Answer the following points (10 Marks)

- 1- What is the network core?
- 2- Explain Packet Switching: queueing delay, loss?
- 3- Define throughput?
- 4- Define and explain traffic intensity?

Question 3: Answer the following points (10 Marks)

- 1- Explain the Internet protocol stack?
- 2- Mention some network applications?
- 3- Explain the application client-server architecture?
- 4- Explain P2P architecture?

Question 4: Answer the following points (10 Marks)

- 1- HTTP is "stateless". What does that mean?
- 2- Compare between persistent HTTP and non-persistent HTTP?
- 3- Give examples of HTTP response status codes?
- 4- Explain the term (web caches) and how it is useful?

Question 5: Answer the following points (10 Marks)

- 1- Give a DNS name resolution example?
- 2- Compare between multiplexing and demultiplexing? Support your answer with a diagram?
- 3- Define and explain the use of ACKs and NAKs?
- 4- Define and explain HOL? Support your answer with a diagram?

جامعة أسيوط	مايو 2018	كود المقرر: 356 رك
كلية العلوم		المقرر : مقدمة فى الحسابات العلمية
قسم الرياضيات		الزمن : ساعتان

Answer the following questions by using MATLAB language: (50 marks)

1- Using Newton's forward difference formula, find $y(0.1)$ using the table below:

x	0.0	0.2	0.4	0.6	0.8
y	1.000	1.22140	1.49182	1.82212	2.22554

2- Solve the differential equation by Adams method (without using nested for loops) at $x=0.2$:

$$\frac{dy}{dt} = t^2 - y, \quad y(0) = 1, \quad h = 0.05.$$

and compare it with the analytic solution $y = -e^{-t} + t^2 - 2t + 2$.

3- Solve the following initial value problem:

$$\frac{d^2u}{dt^2} + 4\frac{du}{dt} + 3u = 0, \quad u(0) = 1, \quad \frac{du}{dt}(0) = 0.$$

4- Let $f(x) = \cos 2x$ and $x_0 = 0$. Determine

a) The third Taylor polynomial for f about x_0 .

b) Find error bound at $x = 0.2$ and compare it to the actual error.

5- For the well-known Chua's circuit equation in chaotic studies that

$$\dot{x} = \alpha[y - x - f(x)], \quad \dot{y} = x - y + z, \quad \dot{z} = -\beta y - \gamma z, \quad t \in (0, 10),$$

where the nonlinear function $f(x)$ is described by

$$f(x) = bx + 0.5(a-b)(|x+1| - |x-1|) \text{ and } a < b < 0.$$

Write an M-function to describe the equation, and draw the phase trajectory for the parameters $\alpha = 9$, $\beta = 100/7$, $\gamma = 0$, $a = -8/7$, $b = -5/7$, and initial conditions

$$x(0) = -2.121304, \quad y(0) = -0.066170, \quad z(0) = 2.881090.$$

Good Luck

Dr. Tarek Aboelenen



امتحان الفرقة الثالثة شعبة الرياضيات

الزمن : ثلاث ساعات

رقم المقرر ورمزه : ١٣٤٦

المقرر : عمليات عشوائية وتطبيقاتها

أجب عن خمسة أسئلة فقط مما يأتي :- درجة جزء كل سؤال (خمس درجات)

١- (أ) لمجموعة المتغيرات العشوائية المستقلة $X_1, X_2, X_3, \dots$ بفرض أن التوقع الرياضي $E(X_i) = m$ والتباين $V(X_i)$ لكل منها محدود عرف كل من التقارب عن طريق الإحتمال وقانون الأعداد الكبرى (الضعيف).
(ب) بفرض أن $f f s s f s f f s s s f f s f f s$ هي إحدى النتائج الممكنة في محاولات برنولي العشوائية المستقلة بحيث أن $P(s) = p, P(f) = q, p + q = 1$ عرف عملية عشوائية في الفراغ R^2 موضحا ذلك بيانيا .

٢- (أ) في عملية برنولي العشوائية $\{X_n; n > 0\}$ بالإحتمال $p = 0.6$ إذا كان $X = X_1 + X_2$ ، $Y = X_1 + X_3$ احسب الإحتمالات الآتية : $P(X < 2, Y \leq 1)$ ، $P(2X < 3Y)$ ، $P(Y = X)$.
(ب) في السؤال (٢-أ) أوجد العزم الارتباطي بين X ، Y موضحا العلاقة بينهما .

٣- (أ) وضح العلاقة بين عملية برنولي العشوائية $\{X_n; n > 0\}$ و العملية العشوائية $\{Y_n; n \geq 0\}$ حيث أن المتغير Y_n يخضع لتوزيع ذي الحدين واذكر صفات كل منهما ثم عبر مع الإستنتاج عن إحتمال الحادث $(Y_{n+1} = k)$ من خلال إحتمالات الحوادث : $(Y_n = k)$ ، $(Y_n = k - 1)$ لأي عدد صحيح $k > 0$.
(ب) في العملية العشوائية $\{Y_n; n \geq 0\}$ أوجد كل من $E(Y_5)$ ، $E(Y_4^2)$ ، $P(Y_5 = 3, Y_7 = 4, Y_{14} = 9)$.

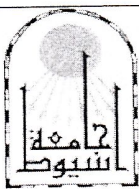
٤- (أ) عرف أزمنة النجاح T_k كعملية عشوائية موضحا العلاقة بينها وبين العملية العشوائية $\{Y_n; n \geq 0\}$ ثم اذكر فقط توزيع المتغير العشوائي T_k .
(ب) - في عملية بواسون العشوائية $\{N_t; t \geq 0\}$ بالمعدل $\lambda = 4$ احسب كل من الإحتمالات الآتية :
 $P(N_{1.5} = 2, N_4 = 5, N_{6.8} = 9)$ ، $P(N_3 = 5, N_7 = 9)$

٥- (أ) في عملية بواسون أو عملية الوصول المعودة $\{N_t; t \geq 0\}$ بالمعدل λ إثبت أن الإحتمال المشروط لعدد الوصول N_t بالنسبة إلى عدد الوصول N_{t+s} لكل $t > 0, s > 0$ يمثل توزيع ذي الحدين.
(ب) عرف العمليات العشوائية المستقلة ثم اثبت أن أي عمليتين مستقلتين لبواسون هو أيضا عملية بواسون .

٦- (أ) في عملية التجديد العشوائية $R = \{R_n; n \in N\}$ حيث N هي فئة الأعداد الصحيحة غير السالبة عرف دالة التجديد ثم عبر عنها من خلال توزيع المتغير R_n مع الإستنتاج .

(ب) في سلسلة ماركوف العشوائية المتقطعة $\{X_n; n \geq 0\}$ عرف مصفوفة الإحتمالات الإنتقالية بصفاتها المعروفة ثم احسب الإحتمال : $P(X_0 = 1, X_1 = 1, X_2 = 0, X_3 = 1, X_4 = 0, X_6 = 0)$ بفرض أن حالات الفراغ $(0, 1)$ والمصفوفة العشوائية

$$P = \begin{pmatrix} 1/2 & 1/2 \\ 1/3 & 2/3 \end{pmatrix} , \text{ ومنتجه الإحتمالات الابتدائية } \pi_0 = (2/5 \quad 3/5)$$

	المقرر: تحليل عددي (٣٢٣) الفرقة: المستوى الثالث الدرجة: ٥٠ درجة التاريخ: ٢٠١٨/٥/٢٩ الزمن: ثلاث ساعات	جامعة أسيوط كلية العلوم - قسم الرياضيات امتحان نهائي الفصل الدراسي الثاني للعام الجامعي ٢٠١٧/٢٠١٨
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Answer five questions only :- (10 marks for every question)

1-a) If the function $g \in C[a, b]$ and $g(x) \in [a, b] \forall x \in [a, b]$ and $g'(x)$ exist with $|g'(x)| \leq k < 1 \forall x \in [a, b]$ prove that the sequence defined by $P_n = g(P_{n-1}), n \geq 1$ will converge to the unique fixed point P and also $|P_{n+1} - P_n| \leq k^n |P_1 - P_0|$.

1-b) Verify that when Newton's method is used to compute $\sqrt{A}, A > 0$ (By solving the equation : $f(x) = x^2 - A$). The sequence of iterates is defined by : $x_{n+1} = (x_n + \frac{A}{x_n})/2$, and show that if the sequence $\{x_n\}$ is defined as the previous problem, then this method is quadratically convergence.

2-a) Derive Lagrange interpolation formula of degree n and write the error of the method.

2-b) For the given function $f(x) = \cos \pi x$ let $x_0 = -1, x_1 = 0, x_2 = 1$ construct the suitable interpolation polynomial and find the actual error.

3) Derive the formula of the Newton's interpolatory divided difference method and use this formula to obtain a polynomial of least degree that fits the values shown:

x	0	1	2	4	6
$f(x)$	1	9	23	93	259

من فضلك انظر خلف الورقة

السؤال الرابع :-

أ) يعرف الطي للدالتين $f(x)$, $g(x)$ كالآتي

$$f * g = \int_{-\infty}^{\infty} f(u) g(x-u) du$$

برهن علي أن تحويل فوريير للطرف الأيمن هو حاصل ضرب تحويل فوريير للدالتين $f(x)$, $g(x)$

ب) أوجد تحويل فوريير للدالة $f(x) = \begin{cases} 1 & |x| < a \\ 0 & |x| > a \end{cases}$ وأرسم $f(x)$ كذلك تحويلها عند $a = 3$ وأوجد

$$\int_{-\infty}^{\infty} \frac{\sin u}{u} du \quad \text{كذلك} \quad \int_{-\infty}^{\infty} \frac{\sin \alpha a \cos \alpha x}{\alpha} d\alpha$$

ج) ترك خيط لانهائي من السكون وكانت أزاحته الابتدائية عن محور x هي $f(x)$ أوجد الإزاحه عند أي زمن .

انتهت الأسئلة مع تمنياتنا بالتوفيق ،،،،

لجنة الممتحنين :- أ. د/ نجاه عبد الرحمن حسين ، أ. د/ فاروق علي السيد



الامتحان النهائي للفصل الدراسي الثاني للعام الجامعي ٢٠١٧/٢٠١٨ م
 للفرقة : الثالثة شعبة : الرياضيات التاريخ : ٢٠١٨/٥/٢٤ م

الزمن : ساعتان

الدرجة الكلية : ٥٠ درجة

أسم المقرر : الطرق الرياضية
 رقم المقرر ورمزه : ٣٣٤ ر

درجة كل سؤال : ١٧ درجة

أجب عن ثلاثة أسئلة فقط مما يأتي :-

السؤال الأول :-

أوجد تحويل لابلاس للمشتقة التفاضلية للدالة $F(t)$ عند نقط الاتصال والانفصال للدالة .

أبرهن علي أن

$$\lim_{t \rightarrow 0} F(t) = \lim_{s \rightarrow \infty} s f(s)$$

$$\lim_{t \rightarrow \infty} F(t) = \lim_{s \rightarrow 0} s f(s)$$

$$\Gamma\left(\frac{1}{2}\right) = \sqrt{\pi}, \quad \int_0^{\infty} \delta(t) dt = 1, \quad L \sin \sqrt{t} = \frac{\sqrt{\pi}}{3} e^{-\frac{1}{4s}} s^{\frac{3}{2}}$$

السؤال الثاني :-

حل المعادلات الآتية :

$$t Y''(t) + Y'(t) + 4t Y(t) = 0, \quad y(0) = 3, y'(0) = 0$$

$$\frac{\partial U}{\partial x} = 2 \frac{\partial U}{\partial t} + U, \quad x > 0, t > 0 \quad U(x, 0) = 6 e^{-3x}$$

$$\int_0^t Y(u) Y(t-u) du = 16 \sin 4t$$

السؤال الثالث :-

(أ) فك الدالة $f(x) = x^2$, $0 < x < 2\pi$ بدلالة متسلسلة فوريير ثم أحسب المجموع

$$1 + \frac{1}{2^2} + \frac{1}{3^2} + \frac{1}{4^2} + \dots$$

(ب) صفيحة علي شكل دائري نصف قطرها الوحدة ووجهيها معزولين ونصف محيطها محفوظ عند درجة حرارة u_1

والآخر عند u_2 أوجد حالة الأتزان الحراري .

من فضلك أنظر بقية الأسئلة خلف الورقة ،،،،،



Answer the following questions (50 marks)

Q1.	Complete the following: (1)..... is a representation of a two-dimensional image as a finite set of digital values, called picture elements or pixels - Common image formats include.....(2).... ,(3)..... ,(4)..... (5)..... creates a Distance tool a draggable, resizable line that measures the distance between its endpoints. (6)..... These are the result of objects that are self-luminous, such as stars and light bulbs. (7).....the resulting output pixel is computed as a sum of products of the pixel values and mask coefficients in the pixel's neighborhood in the original image. - The Sobel operators used to compute edges are(8)..... ,(9)..... - Edge detector should have:(10)..... ,(11)..... - Types of noise are(12)..... ,(13)....	(13 marks)
Q2.	a) Compute Z from the following matlab script (6 marks) <pre> x = [150 10 90;80 50 60;121 160 20] y = [-1 0 1;-2 0 2;-1 0 1] z = imfilter(x,y,'corr') </pre> b) What is the Delta compression and compute the compressed data of the data (6 marks) 220 321 335 211 250 200 233 214 232 212	(12 marks)
Q3.	a) Write the MATLAB code used to: (4 marks) - Read any image then use affine transformation matrix for each of the operations below: - Flip the image right to left - Translation by [25, 15] pixels b) What are the main differences between: (8 marks) - Global thresholding and optimal thresholding. - Raster and vector image . - Interpixel redundancy and Psychovisual redundancy	(12 marks)

(Q5) (i) Assume that U, V are open intervals and let $f : U \rightarrow \mathbb{R}$ and $g : V \rightarrow \mathbb{R}$ be two differentiable functions such that $f(U) \subset V$. Prove that $g \circ f$ is differentiable on U and that $(g \circ f)' = (g' \circ f) \cdot f'$ [5 marks]

(ii) Prove that the function $f(x) := \frac{1}{x}$ is differentiable on $]0, \infty[$ but not uniformly continuous therein. [5 marks]

(Q6) (i) State and prove Rolle's theorem then use it to prove the mean value theorem. [6 marks]

(ii) Let I be an open interval. Apply the mean value theorem to prove that a function differentiable on I is

1. increasing if and only if $f' \geq 0$ on I ,

2. decreasing if and only if $f' \leq 0$ on I .

[4 marks]

With the best of luck,

Prof. Rashwan A. Rashwan,

Dr. Ahmed A. Abdelhakim



Time: 3 hours

Total mark: 50

Answer *only five* of the following questions:

(Q1) (i) Suppose that O_i , $i \geq 1$, are open subsets of $\mathbb{R}$. Prove that $\cup_{i \geq 1} O_i$ is also open in $\mathbb{R}$. [5 marks]

(ii) Let $S \subset \mathbb{R}$. Show that S is closed if and only if S contains the limit point of every convergent sequence of elements of S . [5 marks]

(Q2) (i) Prove that a sequence of real numbers converges if and only if it is a Cauchy sequence. [6 marks]

(ii) Show that if $(x_n)_{n \geq 1} \subset \mathbb{R}$ is a monotonically increasing sequence that is bounded above, then $x_n \rightarrow \sup_{n \geq 1} x_n$, as $n \rightarrow \infty$. [4 marks]

(Q3) (i) Show that $f : D \subset \mathbb{R} \rightarrow \mathbb{R}$ is continuous at $x_0 \in D$ if and only if the sequence $(f(x_n))_{n \geq 1}$ converges to $f(x_0)$ whenever $(x_n)_{n \geq 1}$ is a sequence in D that converges to x_0 . [6 marks]

(ii) Use the characterization given in (i) to prove the discontinuity at the origin of the function $f(x) = \begin{cases} \cos \frac{1}{x}, & x \neq 0; \\ 0, & x = 0. \end{cases}$ [4 marks]

(Q4) (i) Assume that D is a closed bounded subset of $\mathbb{R}$. Prove that if $f : D \rightarrow \mathbb{R}$ is continuous then f is bounded on D , and there exist $\alpha, \beta \in D$ such that $f(\alpha) = \max_{x \in D} f(x)$ and $f(\beta) = \min_{x \in D} f(x)$. [5 marks]

(ii) Argue by contradiction to demonstrate that if $f : [a, b] \rightarrow \mathbb{R}$ is continuous then it is uniformly continuous on $[a, b]$. [5 marks]

Please Turn over the page



أجب عن أسئلة الآتية :- (كل سؤال ١٠ درجات)

(١) (أ) أثبت قاعدة التضعيف لدالة جاما $\sqrt{\pi} \Gamma(2x) = 2^{2x-1} \Gamma(x) \Gamma\left(x + \frac{1}{2}\right), x > 0$

ثم استخدمها فى إثبات أن: $\Gamma\left(\frac{5}{6}\right) \left[\Gamma\left(\frac{1}{3}\right)\right]^2 = 2 \sqrt[3]{2} \sqrt{\frac{\pi^3}{3}}$

(ب) باستخدام دوال جاما و بيتا أوجد التكاملات الآتية: (i) $\int_0^{\frac{\pi}{2}} \sqrt{\tan \theta} d\theta$ (ii) $\int_0^{\infty} \frac{\sqrt{x}}{e^{x^3}} dx$

(٢) (أ) أثبت أن: $\Gamma(x) \Gamma(1-x) = \frac{\pi}{\sin \pi x}, 0 < x < 1$ ومن ثم أثبت أن

$$\Gamma\left(x + \frac{1}{2}\right) \Gamma\left(\frac{1}{2} - x\right) = \frac{\pi}{\cos \pi x}$$

(ب) أثبت أن:

(i) $\sqrt{1-x^2} T_n(x) = U_{n+1}(x) - x U_n(x),$

(ii) $(1-x^2) U'_n(x) = -n x U_n(x) + n U_{n-1}(x)$

(٣) أثبت أن:

(i) ${}_2F_1(\alpha, \beta; \gamma, x) = (1-x)^{-\beta} {}_2F_1\left(\gamma - \alpha, \beta; \gamma, \frac{x}{x-1}\right)$

(ii) ${}_1F_1\left(\frac{1}{2}; \frac{3}{2}, -x^2\right) = \frac{\sqrt{\pi}}{2x} \operatorname{erf}(x)$ حيث أن: $\operatorname{erf}(x) = \frac{2}{\sqrt{\pi}} \int_0^x e^{-t^2} dt$ هى دالة الخطأ

(iii) ${}_1F_1(\alpha + 1; \gamma, x) - {}_1F_1(\alpha; \gamma, x) - \frac{x}{\gamma} {}_1F_1(\alpha + 1; \gamma + 1, x) = 0$

(٤) (أ) أوجد مفكوك ليجندر للدالة: $f(x) = x^3$

(ب) أثبت أن: $H_n(x) = (-1)^n e^{x^2} \frac{d^n}{dx^n} (e^{-x^2})$ حيث $H_n(x)$ كثيرة حدود هيرميت.

(ج) أثبت أن: $J_{\frac{1}{2}}(x) = \sqrt{\frac{2}{\pi}} \frac{\sin x}{\sqrt{x}}$

(٥) (أ) باستخدام الصيغة التكاملية لدوال بسل أثبت أن: $\int_0^{\infty} e^{-3x} J_0(4x) dx = \frac{1}{5}$

(ب) أوجد الحل العام لمعادلة بسل التفاضلية:

$$x^2 \frac{d^2 y}{dx^2} + x \frac{dy}{dx} + (x^2 - n^2)y = 0$$

CS12	CS11	CS10	Description
0	0	0	No clock source (Timer/Counter stopped).
0	0	1	clk _{IO} /1 (No prescaling)
0	1	0	clk _{IO} /8 (From prescaler)
0	1	1	clk _{IO} /64 (From prescaler)
1	0	0	clk _{IO} /256 (From prescaler)
1	0	1	clk _{IO} /1024 (From prescaler)
1	1	0	External clock source on T1 pin. Clock on falling edge.
1	1	1	External clock source on T1 pin. Clock on rising edge.

Timer/Counter1 – TCNT1H and TCNT1L

Bit	7	6	5	4	3	2	1	0	
	TCNT1[15:8]								TCNT1H
	TCNT1[7:0]								TCNT1L
Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

Output Compare Register 1 B – OCR1BH and OCR1BL

Bit	7	6	5	4	3	2	1	0	
	OCR1B[15:8]								OCR1BH
	OCR1B[7:0]								OCR1BL
Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

Input Capture Register 1 – ICR1H and ICR1L

Bit	7	6	5	4	3	2	1	0	
	ICR1[15:8]								ICR1H
	ICR1[7:0]								ICR1L
Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

Timer/Counter Interrupt Mask Register – TIMSK⁽¹⁾

Bit	7	6	5	4	3	2	1	0	
	OCIE2	OCIE1	OCIE1A	OCIE1B	TOIE1	OCIE0	TOIE0		TIMSK
Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

- Bit 5 – OCIE1: Timer/Counter1, Input Capture Interrupt Enable
 Bit 4 – OCIE1A: Timer/Counter1, Output Compare A Match Interrupt Enable
 Bit 3 – OCIE1B: Timer/Counter1, Output Compare B Match Interrupt Enable
 Bit 2 – TOIE1: Timer/Counter1, Overflow Interrupt Enable

Timer/Counter Interrupt Flag Register – TIFR

Bit	7	6	5	4	3	2	1	0	
	OCF2	TOV2	ICF1	OCF1A	OCF1B	TOV1	OCF0	TOV0	TIFR
Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

- Bit 5 – ICF1: Timer/Counter1, Input Capture Flag
 Bit 4 – OCF1A: Timer/Counter1, Output Compare A Match Flag
 Bit 3 – OCF1B: Timer/Counter1, Output Compare B Match Flag
 Bit 2 – TOV1: Timer/Counter1, Overflow Flag

USART

Operating Mode	Equation for Calculating Baud Rate ⁽¹⁾	Equation for Calculating UBRR Value
Asynchronous Normal Mode (U2X = 0)	$BAUD = \frac{f_{osc}}{16(UBRR + 1)}$	$UBRR = \frac{f_{osc}}{16BAUD} - 1$
Asynchronous Double Speed Mode (U2X = 1)	$BAUD = \frac{f_{osc}}{8(UBRR + 1)}$	$UBRR = \frac{f_{osc}}{8BAUD} - 1$
Synchronous Master Mode	$BAUD = \frac{f_{osc}}{2(UBRR + 1)}$	$UBRR = \frac{f_{osc}}{2BAUD} - 1$

USART I/O Data Register – UDR

Bit	7	6	5	4	3	2	1	0	
	RXB[7:0]								UDR (Read)
	TXB[7:0]								UDR (Write)
Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

Timer/Counter
Interrupt Mask
Register – TIMSK

Bit	7	6	5	4	3	2	1	0	
	OCIE2	TOIE2	OCIE1	OCIE1A	OCIE1B	TOIE1	OCIE0	TOIE0	TIMSK
Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

Bit 1 – OCIE0: Timer/Counter0 Output Compare Match Interrupt Enable
Bit 0 – TOIE0: Timer/Counter0 Overflow Interrupt Enable

Timer/Counter
Interrupt Flag Register
– TIFR

Bit	7	6	5	4	3	2	1	0	
	OCF2	TOV2	ICF1	OCF1A	OCF1B	TOV1	OCF0	TOV0	TIFR
Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

Bit 1 – OCF0: Output Compare Flag 0
Bit 0 – TOV0: Timer/Counter0 Overflow Flag

Timer/Counter1
Control Register A –
TCCR1A

Bit	7	6	5	4	3	2	1	0	
	COM1A1	COM1A0	COM1B1	COM1B0	FOC1A	FOC1B	WGM11	WGM10	TCCR1A
Read/Write	R/W	R/W	R/W	R/W	W	W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

Bit 7:6 – COM1A1:0: Compare Output Mode for Compare unit A
Bit 5:4 – COM1B1:0: Compare Output Mode for Compare unit B
Bit 3 – FOC1A: Force Output Compare for Compare unit A
Bit 2 – FOC1B: Force Output Compare for Compare unit B
Bit 1:0 – WGM11:0: Waveform Generation Mode

CS02	CS01	CS00	Description
0	0	0	No clock source (Timer/Counter stopped).
0	0	1	$clk_{IO}/1$ (No prescaling)
0	1	0	$clk_{IO}/8$ (From prescaler)
0	1	1	$clk_{IO}/64$ (From prescaler)
1	0	0	$clk_{IO}/256$ (From prescaler)
1	0	1	$clk_{IO}/1024$ (From prescaler)
1	1	0	External clock source on T0 pin, Clock on falling edge.
1	1	1	External clock source on T0 pin, Clock on rising edge.

COM1A1/COM1B1	COM1A0/COM1B0	Description
0	0	Normal port operation, OC1A/OC1B disconnected.
0	1	Toggle OC1A/OC1B on compare match
1	0	Clear OC1A/OC1B on compare match (Set output to low level)
1	1	Set OC1A/OC1B on compare match (Set output to high level)

Mode	WGM13	WGM12 (CTC1)	WGM11 (PWM11)	WGM10 (PWM10)	Timer/Counter Mode of Operation	TOP	Update of OCR1x	TOV1 Flag Set on
0	0	0	0	0	Normal	0xFFFF	Immediate	MAX
1	0	0	0	1	PWM, Phase Correct, 8-bit	0x00FF	TOP	BOTTOM
2	0	0	1	0	PWM, Phase Correct, 9-bit	0x01FF	TOP	BOTTOM
3	0	0	1	1	PWM, Phase Correct, 10-bit	0x03FF	TOP	BOTTOM
4	0	1	0	0	CTC	OCR1A	Immediate	MAX
5	0	1	0	1	Fast PWM, 8-bit	0x00FF	BOTTOM	TOP
6	0	1	1	0	Fast PWM, 9-bit	0x01FF	BOTTOM	TOP
7	0	1	1	1	Fast PWM, 10-bit	0x03FF	BOTTOM	TOP
8	1	0	0	0	PWM, Phase and Frequency Correct	ICR1	BOTTOM	BOTTOM
9	1	0	0	1	PWM, Phase and Frequency Correct	OCR1A	BOTTOM	BOTTOM
10	1	0	1	0	PWM, Phase Correct	ICR1	TOP	BOTTOM
11	1	0	1	1	PWM, Phase Correct	OCR1A	TOP	BOTTOM
12	1	1	0	0	CTC	ICR1	Immediate	MAX
13	1	1	0	1	Reserved	–	–	–
14	1	1	1	0	Fast PWM	ICR1	BOTTOM	TOP
15	1	1	1	1	Fast PWM	OCR1A	BOTTOM	TOP

Timer/Counter1
Control Register B –
TCCR1B

Bit	7	6	5	4	3	2	1	0	
	ICNC1	ICES1	–	WGM13	WGM12	CS12	CS11	CS10	TCCR1B
Read/Write	R/W	R/W	R	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

Bit 7 – ICNC1: Input Capture Noise Canceler
Bit 6 – ICES1: Input Capture Edge Select
Bit 5 – Reserved Bit
Bit 4:3 – WGM13:2: Waveform Generation Mode
Bit 2:0 – CS12:0: Clock Select

CS12	CS11	CS10	Description
0	0	0	No clock source (Timer/Counter stopped).
0	0	1	$clk_{IO}/1$ (No prescaling)
0	1	0	$clk_{IO}/8$ (From prescaler)
0	1	1	$clk_{IO}/64$ (From prescaler)
1	0	0	$clk_{IO}/256$ (From prescaler)
1	0	1	$clk_{IO}/1024$ (From prescaler)
1	1	0	External clock source on T1 pin. Clock on falling edge.
1	1	1	External clock source on T1 pin. Clock on rising edge.

Timer/Counter1 – TCNT1H and TCNT1L

Bit	7	6	5	4	3	2	1	0	
	TCNT1[15:8]								TCNT1H
	TCNT1[7:0]								TCNT1L
Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

Output Compare Register 1 B – OCR1BH and OCR1BL

Bit	7	6	5	4	3	2	1	0	
	OCR1B[15:8]								OCR1BH
	OCR1B[7:0]								OCR1BL
Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

Input Capture Register 1 – ICR1H and ICR1L

Bit	7	6	5	4	3	2	1	0	
	ICR1[15:8]								ICR1H
	ICR1[7:0]								ICR1L
Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

Timer/Counter Interrupt Mask Register – TIMSK⁽¹⁾

Bit	7	6	5	4	3	2	1	0	
	OCIE2	TOIE2	TICIE1	OCIE1A	OCIE1B	TOIE1	OCIE0	TOIE0	TIMSK
Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

- Bit 5 – TICIE1: Timer/Counter1, Input Capture Interrupt Enable
 Bit 4 – OCIE1A: Timer/Counter1, Output Compare A Match Interrupt Enable
 Bit 3 – OCIE1B: Timer/Counter1, Output Compare B Match Interrupt Enable
 Bit 2 – TOIE1: Timer/Counter1, Overflow Interrupt Enable

Timer/Counter Interrupt Flag Register – TIFR

Bit	7	6	5	4	3	2	1	0	
	OCF2	TOV2	ICF1	OCF1A	OCF1B	TOV1	OCF0	TOV0	TIFR
Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

- Bit 5 – ICF1: Timer/Counter1, Input Capture Flag
 Bit 4 – OCF1A: Timer/Counter1, Output Compare A Match Flag
 Bit 3 – OCF1B: Timer/Counter1, Output Compare B Match Flag
 Bit 2 – TOV1: Timer/Counter1, Overflow Flag

USART

Operating Mode	Equation for Calculating Baud Rate ⁽¹⁾	Equation for Calculating UBRR Value
Asynchronous Normal Mode (U2X = 0)	$BAUD = \frac{f_{osc}}{16(UBRR + 1)}$	$UBRR = \frac{f_{osc}}{16BAUD} - 1$
Asynchronous Double Speed Mode (U2X = 1)	$BAUD = \frac{f_{osc}}{8(UBRR + 1)}$	$UBRR = \frac{f_{osc}}{8BAUD} - 1$
Synchronous Master Mode	$BAUD = \frac{f_{osc}}{2(UBRR + 1)}$	$UBRR = \frac{f_{osc}}{2BAUD} - 1$

USART I/O Data Register – UDR

Bit	7	6	5	4	3	2	1	0	
	RXB[7:0]								UDR (Read)
	TXB[7:0]								UDR (Write)
Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

USART Control and Status Register A – UCSRA

Bit	7	6	5	4	3	2	1	0	
	RXC	TXC	UDRE	FE	DOR	PE	U2X	MPCM	UCSRA
Read/Write	R	R/W	R	R	R	R	R/W	R/W	
Initial Value	0	0	1	0	0	0	0	0	

- Bit 7 – RXC: USART Receive Complete
- Bit 6 – TXC: USART Transmit Complete
- Bit 5 – UDRE: USART Data Register Empty
- Bit 4 – FE: Frame Error
- Bit 3 – DOR: Data OverRun
- Bit 2 – PE: Parity Error
- Bit 1 – U2X: Double the USART Transmission Speed
- Bit 0 – MPCM: Multi-processor Communication Mode

USART Control and Status Register B – UCSRB

Bit	7	6	5	4	3	2	1	0	
	RXCIE	TXCIE	UDRIE	RXEN	TXEN	UCSZ2	RXB8	TXB8	UCSRB
Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R	R/W	
Initial Value	0	0	0	0	0	0	0	0	

- Bit 7 – RXCIE: RX Complete Interrupt Enable
- Bit 6 – TXCIE: TX Complete Interrupt Enable
- Bit 5 – UDRIE: USART Data Register Empty Interrupt Enable
- Bit 4 – RXEN: Receiver Enable
- Bit 3 – TXEN: Transmitter Enable
- Bit 2 – UCSZ2: Character Size
- Bit 1 – RXB8: Receive Data Bit 8
- Bit 0 – TXB8: Transmit Data Bit 8

USART Control and Status Register C – UCSRC

Bit	7	6	5	4	3	2	1	0	
	URSEL	UMSEL	UPM1	UPM0	USBS	UCSZ1	UCSZ0	UCPOL	UCSRC
Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	
Initial Value	1	0	0	0	0	1	1	0	

- Bit 7 – URSEL: Register Select
- Bit 6 – UMSEL: USART Mode Select
- Bit 5:4 – UPM1:0: Parity Mode
- Bit 3 – USBS: Stop Bit Select
- Bit 2:1 – UCSZ1:0: Character Size
- Bit 0 – UCPOL: Clock Polarity

UMSEL	Mode
0	Asynchronous Operation
1	Synchronous Operation

USBS	Stop Bit(s)
0	1-bit
1	2-bit

UPM1	UPM0	Parity Mode
0	0	Disabled
0	1	Reserved
1	0	Enabled, Even Parity
1	1	Enabled, Odd Parity

UCPOL	Transmitted Data Changed (Output of TxD Pin)	Received Data Sampled (Input on RxD Pin)
0	Rising XCK Edge	Falling XCK Edge
1	Falling XCK Edge	Rising XCK Edge

Table 66. UCSZ Bits Settings

UCSZ2	UCSZ1	UCSZ0	Character Size
0	0	0	5-bit
0	0	1	6-bit
0	1	0	7-bit
0	1	1	8-bit
1	0	0	Reserved
1	0	1	Reserved
1	1	0	Reserved
1	1	1	9-bit

USART Baud Rate Registers – UBRRL and UBRRH

Bit	15	14	13	12	11	10	9	8	
	URSEL	-	-	-	-	UBRR[11:9]	-	-	UBRRH
	-	-	-	-	-	UBRR[7:0]	-	-	UBRRL
Read/Write	R/W	R	R	R	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	



Operation Research326 R

11-5-2018

Third Level: Computer Science Section

Time: 3 hours

Total Degree (50 marks)

Science Faculty

Mathematical Department

Answer the following Questions:

1-Use the Simplex method to solve the following linear programming

Maximize $Z = 10x_1 + 11x_2$

Subject to $x_1 + 2x_2 \leq 150$, $3x_1 + 4x_2 \leq 200$, $6x_1 + x_2 \leq 175$

and $x_1, x_2 \geq 0$

(10 marks)

2) Use the graphical and the algebraic method to solve the problem

Max $f(\underline{x}) = 5x_1 + 7x_2$ Subject to $5x_1 + 8x_2 \leq 24$, $x_1 + x_2 \leq 4$,

$10x_1 + 7x_2 \leq 35$ and $x_1, x_2 \geq 0$

(12.5marks)

3) Use the Lagrange multiplier method to find the extreme points of the problem

Minimize $f(\underline{x}) = x_1^2 + x_2^2 - 3x_1x_2$

Subject to $g(\underline{x}) = x_1^2 + x_2^2 - 8 = 0$.

(12.5marks)

4) Use the Hessian Matrix to find the local points of the problem

$f(\underline{x}) = f(x_1, x_2) = x_1^3 + x_2^3 + 2x_1^2 + 4x_2^2 + 6$

(10marks)

5) Find the local Points

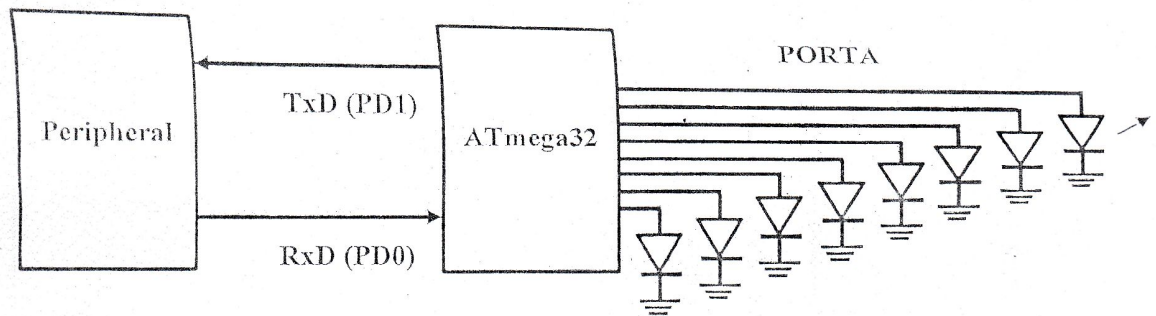
$f(x) = 3x^4 - 20x^3 + 36x^2 + 16$ (5marks)

Best Wishes

Dr. Alaa Fahim

Question No. 4 (5 marks).

Use the UART communication tool to transfer the letter 'Z' serially at 9600 baud, continuously and receive bytes of data serially and put them on Port A. Set the frame format to be 8-bit data, 1 stop bit, no parity bits. Assume XTAL = 8 MHz.



Question No. 5 (10 marks, 2 ½ each part).

Read the following program codes carefully, and write the function of each program code in the blank space provided:

C Program # 1	Function
<pre>#include <avr/io.h> int main (void) { while (EECR & (1 << EEWE)); EEAR = 0x5F; EEDR = 'G'; EECR = (1 << EEMWE); EECR = (1 << EEWE); return 0; }</pre>	

C Program # 2	Function
<pre>#include <avr/io.h> #define LED 7 #define SENSOR 1 int main (void) { DDRB = DDRB & ~(1 << SENSOR); DDRC = DDRC (1 << LED); while (1) { if (PINB & (1 << SENSOR)) PORTC = PORTC (1 << LED); else PORTC = PORTC & ~(1 << LED); } return 0; }</pre>	

C Program # 3	Function
<pre> #include <avr/io.h> int main (void) { DDRB = 0xFF; while (1) { T0Delay (); PORTB = PORTB ^ 0x10; } } void T0Delay () { TCNT0 = 186; TCCR0 = 0x02; while ((TIFR & (1 << TOV0)) == 0); TCCR0 = 0; TIFR = 0x1; } </pre>	

C Program # 4	Function
<pre> #include <avr/io.h> #include <avr/interrupt.h> int main () { DDRC = 0x08; PORTD = 1 << 2; GICR = (1 << INT0); sei (); while (1) { ISR (INT0_vect) { PORTC = ~(1 << 3); } } } </pre>	

Question No. 6 (10 Marks).

It is required to design a sliding door controlled by Atmega32. The store also counts the number of people entered in its EEPROM (\$000) and display it on LCD (PORT A). When user press a push button (ETX INT2), it activate a DC motor to open the door in one direction and increment the number stored in EEPROM. When the door is fully opened, another switch is activated (EXT INT1) to stop the motor for 5 seconds (use TIMER0), then the motor rotate in the reverse direction to close. When the door is fully closed, it activate another switch (EXT INT0) to stop the motor. The motor works according to the below table:

	PORTC.0	PORTC.1
Stop	0	0
Opening the door	1	0
Closing the door	1	1

- a) Draw the general layout of the embedded system. (4 marks)

- b) Write an AVR C program to control the sliding door and, count the number of visitors and display it on LCD. (6 marks)

Best Wishes

----- End of Questions -----

Dr. Osama Haraz

(XCK/T0) PB0	1	40	PA0 (ADC0)
(T1) PB1	2	39	PA1 (ADC1)
(INT2/AIN0) PB2	3	38	PA2 (ADC2)
(OC0/AIN1) PB3	4	37	PA3 (ADC3)
(SS) PB4	5	36	PA4 (ADC4)
(MOSI) PB5	6	35	PA5 (ADC5)
(MISO) PB6	7	34	PA6 (ADC6)
(SCK) PB7	8	33	PA7 (ADC7)
RESET	9	32	AREF
VCC	10	31	GND
GND	11	30	AVCC
XTAL2	12	29	PC7 (TOSC2)
XTAL1	13	28	PC6 (TOSC1)
(RXD) PD0	14	27	PC5 (TDI)
(TXD) PD1	15	26	PC4 (TDO)
(INT0) PD2	16	25	PC3 (TMS)
(INT1) PD3	17	24	PC2 (TCK)
(OC1B) PD4	18	23	PC1 (SDA)
(OC1A) PD5	19	22	PC0 (SCL)
(ICP1) PD6	20	21	PD7 (OC2)

Status Register

Bit	7	6	5	4	3	2	1	0	
	I	T	H	S	V	N	Z	C	SREG
Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

Bit 7 – I: Global Interrupt Enable
 Bit 6 – T: Bit Copy Storage
 Bit 5 – H: Half Carry Flag
 Bit 4 – S: Sign Bit, $S = N \oplus V$

Bit 3 – V: Two's Complement Overflow Flag
 Bit 2 – N: Negative Flag
 Bit 1 – Z: Zero Flag

The EEPROM Address Register – EEARH and EEARL

Bit	15	14	13	12	11	10	9	8	
	–	–	–	–	–	–	EEAR9	EEAR8	EEARH
	EEAR7	EEAR6	EEAR5	EEAR4	EEAR3	EEAR2	EEAR1	EEAR0	EEARL
Read/Write	R	R	R	R	R	R	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	X	

The EEPROM Data Register – EEDR

Bit	7	6	5	4	3	2	1	0	
	MSB							LSB	EEDR
Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

The EEPROM Control Register – EECR

Bit	7	6	5	4	3	2	1	0	
	–	–	–	–	EERIE	EEMWE	EEWE	EERE	EECR
Read/Write	R	R	R	R	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	X	0	

Bit 3 – EERIE: EEPROM Ready Interrupt Enable
 Bit 2 – EEMWE: EEPROM Master Write Enable

Bit 1 – EEWE: EEPROM Write Enable
 Bit 0 – EERE: EEPROM Read Enable

Interrupts

MCU Control Register – MCUCR

The MCU Control Register contains control bits for interrupt sense control and general MCU functions.

Bit	7	6	5	4	3	2	1	0	
	SE	SM2	SM1	SM0	ISC11	ISC10	ISC01	ISC00	MCUCR
Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

Bit 3, 2 – ISC11, ISC10: Interrupt Sense Control 1 Bit 1 and Bit 0

Bit 1, 0 – ISC01, ISC00: Interrupt Sense Control 0 Bit 1 and Bit 0

ISC11	ISC10	Description
0	0	The low level of INT1 generates an interrupt request.
0	1	Any logical change on INT1 generates an interrupt request.
1	0	The falling edge of INT1 generates an interrupt request.
1	1	The rising edge of INT1 generates an interrupt request.

ISC01	ISC00	Description
0	0	The low level of INT0 generates an interrupt request.
0	1	Any logical change on INT0 generates an interrupt request.
1	0	The falling edge of INT0 generates an interrupt request.
1	1	The rising edge of INT0 generates an interrupt request.

MCU Control and Status Register – MCUCSR

Bit	7	6	5	4	3	2	1	0	
	JTD	ISC2	–	JTRF	WDRF	BORF	EXTRF	PORF	MCUCSR
Read/Write	R/W	R/W	R	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0						See Bit Description

Bit 6 – ISC2: Interrupt Sense Control 2

General Interrupt Control Register – GICR

Bit	7	6	5	4	3	2	1	0	
	INT1	INT0	INT2	–	–	–	IVSEL	IVCE	GICR
Read/Write	R/W	R/W	R/W	R	R	R	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

Bit 7 – INT1: External Interrupt Request 1 Enable
Bit 6 – INT0: External Interrupt Request 0 Enable

Bit 5 – INT2: External Interrupt Request 2 Enable

General Interrupt Flag Register – GIFR

Bit	7	6	5	4	3	2	1	0	
	INTF1	INTF0	INTF2	–	–	–	–	–	GIFR
Read/Write	R/W	R/W	R/W	R	R	R	R	R	
Initial Value	0	0	0	0	0	0	0	0	

Bit 7 – INTF1: External Interrupt Flag 1
Bit 6 – INTF0: External Interrupt Flag 0

Bit 5 – INTF2: External Interrupt Flag 2

Port A Data Register – PORTA

Bit	7	6	5	4	3	2	1	0	
	PORTA7	PORTA6	PORTA5	PORTA4	PORTA3	PORTA2	PORTA1	PORTA0	PORTA
Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

Port A Data Direction Register – DDRA

Bit	7	6	5	4	3	2	1	0	
	DDA7	DDA6	DDA5	DDA4	DDA3	DDA2	DDA1	DDA0	DDRA
Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

Port A Input Pins Address – PINA

Bit	7	6	5	4	3	2	1	0	
	PINA7	PINA6	PINA5	PINA4	PINA3	PINA2	PINA1	PINA0	PINA
Read/Write	R	R	R	R	R	R	R	R	
Initial Value	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	

Time/Counter Control Register – TCCR0

Bit	7	6	5	4	3	2	1	0	
	FOC0	WGM00	COM01	COM00	WGM01	CS02	CS01	CS00	TCCR0
Read/Write	W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

Bit 7 – FOC0: Force Output Compare

Bit 6, 3 – WGM01:0: Waveform Generation Mode

Bit 5:4 – COM01:0: Compare Match Output Mode
Bit 2:0 – CS02:0: Clock Select

Mode	WGM01 (CTC0)	WGM00 (PWM0)	Timer/Counter Mode of Operation	TOP	Update of OCR0	TOV0 Flag Set-on	COM01	COM00	Description
0	0	0	Normal	0xFF	Immediate	MAX	0	0	Normal port operation, OC0 disconnected.
1	0	1	PWM, Phase Correct	0xFF	TOP	BOTTOM	0	1	Toggle OC0 on compare match
2	1	0	CTC	OCR0	Immediate	MAX	1	0	Clear OC0 on compare match
3	1	1	Fast PWM	0xFF	BOTTOM	MAX	1	1	Set OC0 on compare match

Timer/Counter Register – TCNT0

Bit	7	6	5	4	3	2	1	0	
	TCNT0[7:0]								TCNT0
Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

Output Compare Register – OCR0

Bit	7	6	5	4	3	2	1	0	
	OCR0[7:0]								OCR0
Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

Timer/Counter
Interrupt Mask
Register – TIMSK

Bit	7	6	5	4	3	2	1	0	
	OCIE2	TOIE2	OCIE1	OCIE1A	OCIE1B	TOIE1	OCIE0	TOIE0	TIMSK
Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

Bit 1 – OCIE0: Timer/Counter0 Output Compare Match Interrupt Enable
Bit 0 – TOIE0: Timer/Counter0 Overflow Interrupt Enable

Timer/Counter
Interrupt Flag Register
– TIFR

Bit	7	6	5	4	3	2	1	0	
	OCF2	TOV2	ICF1	OCF1A	OCF1B	TOV1	OCF0	TOV0	TIFR
Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

Bit 1 – OCF0: Output Compare Flag 0
Bit 0 – TOV0: Timer/Counter0 Overflow Flag

Timer/Counter1
Control Register A –
TCCR1A

Bit	7	6	5	4	3	2	1	0	
	COM1A1	COM1A0	COM1B1	COM1B0	FOC1A	FOC1B	WGM11	WGM10	TCCR1A
Read/Write	R/W	R/W	R/W	R/W	W	W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

Bit 7:6 – COM1A1:0: Compare Output Mode for Compare unit A
Bit 5:4 – COM1B1:0: Compare Output Mode for Compare unit B
Bit 3 – FOC1A: Force Output Compare for Compare unit A
Bit 2 – FOC1B: Force Output Compare for Compare unit B
Bit 1:0 – WGM11:0: Waveform Generation Mode

CS02	CS01	CS00	Description
0	0	0	No clock source (Timer/Counter stopped).
0	0	1	clk_{RCY} (No prescaling)
0	1	0	$clk_{RCY}/8$ (From prescaler)
0	1	1	$clk_{RCY}/64$ (From prescaler)
1	0	0	$clk_{RCY}/256$ (From prescaler)
1	0	1	$clk_{RCY}/1024$ (From prescaler)
1	1	0	External clock source on T0 pin. Clock on falling edge.
1	1	1	External clock source on T0 pin. Clock on rising edge.

COM1A1/COM1B1	COM1A0/COM1B0	Description
0	0	Normal port operation, OC1A/OC1B disconnected.
0	1	Toggle OC1A/OC1B on compare match
1	0	Clear OC1A/OC1B on compare match (Set output to low level)
1	1	Set OC1A/OC1B on compare match (Set output to high level)

Mode	WGM13	WGM12 (CTC1)	WGM11 (PWM11)	WGM10 (PWM10)	Timer/Counter Mode of Operation	TOP	Update of OCR1x	TOV1 Flag Set on
0	0	0	0	0	Normal	0xFFFF	Immediate	MAX
1	0	0	0	1	PWM, Phase Correct, 8-bit	0x00FF	TOP	BOTTOM
2	0	0	1	0	PWM, Phase Correct, 9-bit	0x01FF	TOP	BOTTOM
3	0	0	1	1	PWM, Phase Correct, 10-bit	0x03FF	TOP	BOTTOM
4	0	1	0	0	CTC	OCR1A	Immediate	MAX
5	0	1	0	1	Fast PWM, 8-bit	0x00FF	BOTTOM	TOP
6	0	1	1	0	Fast PWM, 9-bit	0x01FF	BOTTOM	TOP
7	0	1	1	1	Fast PWM, 10-bit	0x03FF	BOTTOM	TOP
8	1	0	0	0	PWM, Phase and Frequency Correct	ICR1	BOTTOM	BOTTOM
9	1	0	0	1	PWM, Phase and Frequency Correct	OCR1A	BOTTOM	BOTTOM
10	1	0	1	0	PWM, Phase Correct	ICR1	TOP	BOTTOM
11	1	0	1	1	PWM, Phase Correct	OCR1A	TOP	BOTTOM
12	1	1	0	0	CTC	ICR1	Immediate	MAX
13	1	1	0	1	Reserved	–	–	–
14	1	1	1	0	Fast PWM	ICR1	BOTTOM	TOP
15	1	1	1	1	Fast PWM	OCR1A	BOTTOM	TOP

Timer/Counter1
Control Register B –
TCCR1B

Bit	7	6	5	4	3	2	1	0	
	ICNC1	ICES1	–	WGM13	WGM12	CS12	CS11	CS10	TCCR1B
Read/Write	R/W	R/W	R	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

Bit 7 – ICNC1: Input Capture Noise Canceler
Bit 6 – ICES1: Input Capture Edge Select
Bit 5 – Reserved Bit
Bit 4:3 – WGM13:2: Waveform Generation Mode
Bit 2:0 – CS12:0: Clock Select



Operation Research326 R

11-5-2018

Third Level: Computer Science Section

Time: 3 hours

Total Degree (50 marks)

Science Faculty

Mathematical Department

Answer the following Questions:

1-Use the Simplex method to solve the following linear programming

Maximize $Z = 10x_1 + 11x_2$

Subject to $x_1 + 2x_2 \leq 150$, $3x_1 + 4x_2 \leq 200$, $6x_1 + x_2 \leq 175$

and $x_1, x_2 \geq 0$

(10 marks)

2) Use the graphical and the algebraic method to solve the problem

Max $f(\underline{x}) = 5x_1 + 7x_2$ Subject to $5x_1 + 8x_2 \leq 24$, $x_1 + x_2 \leq 4$,

$10x_1 + 7x_2 \leq 35$ and $x_1, x_2 \geq 0$

(12.5marks)

3) Use the Lagrange multiplier method to find the extreme points of the problem

Minimize $f(\underline{x}) = x_1^2 + x_2^2 - 3x_1x_2$

Subject to $g(\underline{x}) = x_1^2 + x_2^2 - 8 = 0$.

(12.5marks)

4) Use the Hessian Matrix to find the local points of the problem

$f(\underline{x}) = f(x_1, x_2) = x_1^3 + x_2^3 + 2x_1^2 + 4x_2^2 + 6$

(10marks)

5) Find the local Points

$f(x) = 3x^4 - 20x^3 + 36x^2 + 16$ (5marks)

Best Wishes

Dr. Alaa Fahim

اجب عن خمسة فقط من الاسئلة الاتية :- (10 درجات لكل سؤال : بواقع 5 درجات لكل فقرة)

(1) (i) اوجد الحل العام للمعادلة : $p_1 + 3p_2 + 2p_3(1 + \sqrt{x_1 + x_2 + x_3 - u}) = 6$
(ii) اوجد الحل الخاص للمعادلة : $(y - z)[2xyp + (x^2 - y^2)q] + z(x^2 - y^2) = 0$
الذي يمر خلال المنحنى $y = 0, x^3 = z^2$

(2) اوجد الحل العام لكل من المعادلتين التفاضليتين الجزئيتين الاتيتين :-
(i) $(D_1^3 - D_1^2 D_2 - D_1 D_2^2 + D_2^3)z = \log(x + y)$
(ii) $(D_1^2 - a^2 D_2^2)z = x^2 + y^2$, ثابت مطلق a

(3) اوجد الحل العام لكل من المعادلتين التفاضليتين الجزئيتين الاتيتين :-
(i) $(D_1^2 D_2 + D_2^2 - 2)z = e^{2y} \sin 3x - e^x \cos 2y$
(ii) $(D_1^2 - D_2^2 - D_1 - 3D_2 - 2)z = e^{2x-3y} + x + y + 1$

(4) (i) احسب التكاملات الاتية :-
(a) $\int_0^{\infty} x^{-\frac{1}{3}}(1 + 2x)^{-3} dx$ (b) $\int_0^1 \sqrt{\log \frac{1}{x}} dx$

(ii) اثبت ان :-
(a) $\tan^{-1} x = x {}_2F_1(1, \frac{1}{2}; \frac{3}{2}; -x^2)$
(b) $(a - b) {}_2F_1(a, b; c; x) = a {}_2F_1(a + 1, b; c; x) - b {}_2F_1(a, b + 1; c; x)$

(5) اثبت ان دوال بسل من النوع الاول $J_n(x)$ تحقق الاتي :-
(i) $J_{-\frac{1}{2}}(x) = \sqrt{\frac{2}{\pi x}} \cos x$, (ii) $\int x^n J_{n-1}(x) dx = x^n J_n(x) + c$

(6) (i) اثبت ان كثيرات حدود لجندر $P_n(x)$ تحقق :-
(ii) احسب التكاملات الاتية :-
(a) $\int_{-1}^1 x P_n(x) P_{n+1}(x) dx$, (b) $\int_{-1}^1 x^2 P_n(x) P_{n+1}(x) dx$, (c) $\int_{-1}^1 x^2 P_n(x) dx$



Question 1: Put True or False for each of the following items (30 marks)

1. To enter a formula into a cell, begin by typing an equal sign.
2. Functions are pre-defined worksheet formulas.
3. Formulas in Excel must be written in a very specific format, referred to as syntax.
4. The second order of precedence is for exponentiation.
5. When the formula in cell **B7 =B4+B5+B6** is copied into cell **C7** the formula will be changed to **= C4+C5+C6**.
6. The error "#####" means Data being referenced is not available.
7. The range **B2:B7** is a range down a column.
8. To keep things clear and simple only add an absolute (\$) cell reference if absolutely necessary.
9. The formula **=ROUND(78.686788,-1)** results in the value 80 .
10. Placing an absolute sign in front of a ranged name (**\$budget**) is incorrect syntax.
11. The columns of the worksheet are named with Numbers.
12. Cells may contain only Labels and Values.
13. The cell address first lists the row name and then the column name.
14. This selected cell is referred to as the **active cell**.
15. The contents of the active cell will also be displayed on the **formula bar**.
16. A cell that is on sheet 3, in the second column third row would be referred to as **Sheet3@B3**.
17. Formatted Display is the number of decimal places that appear in a cell.
18. Formulas can be copied to perform different operations on a corresponding set of data.
19. The function **COUNT(value1,[value2],...)** counts non-blank cells.
20. The Average function ignore the blank cells.
21. TRUE and FALSE are called Boolean Values.
22. SPSS stands for Statistical Package for the Social Sciences.
23. SPSS is capable of handling large amounts of data.
24. SPSS has only two windows Data view and Output view.
25. **Transform** menu includes several options to change current variables.
26. In SPSS, Each column typically represents the data from 1 case.
27. In SPSS, The first column of variable view is Name.
28. In SPSS, you can sort data from **Transform** menu then **Sort Cases**.
29. Descriptive statistics are calculated using the **Analyze** menu.
30. Correlation is used to test the degree of association between variables.

Answer Sheet		
	True	False
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Question 2: (10 marks)

	A	B	C	D	E	F	G
1		MT1	MT2	Final	Total	Honors	Passed
2	Possible points	100	100	200	400		320
3							
4	Blue	79	89	169	337	FALSE	TRUE
5	Jones	85	65	195	345	FALSE	TRUE
6	Grey	60	97	187	344	TRUE	TRUE
7	Mary	10	30	50	90	TRUE	FALSE
8							

Write the following Boolean functions

1. Blue's total and Jones' total are greater than Grey's:
2. Grey's total is not the maximum grade:
3. None of the students passed the course
4. Blue is not an Honors student
5. Blue didn't get a passing grade (320)

Question 3: (10 marks)

1. What are the difference between Data View, Variable View and Output View in SPSS?
2. Some significance tests are very restrictive about the form of data they can accept. What are the different types of measurement?
3. Describe how to test the degree of association between variables by SPSS.
4. Explain how to use SPSS to calculate the frequency and percent of females and males who did and did not have social problems.

Q2.

- a. Maintain two different Algorithm of crossover process with mention the probability of crossover (5 marks)
- b. Maintain two different Algorithm of mutation process with mention the probability of mutation. (5 marks)

Q3. a. Maintain tree type representation of solutions in genetic algorithm. (3 marks)

b. Using genetic algorithm to find the maximum value of the function $(15x - x^2)$ where parameter x varies between 0 and 15. For simplicity, we may assume that x takes only integer values. Using the genetic algorithm procedure in one step and begin with four solutions in initial solutions. (10 marks)

Q4. Discuss the internal structure of Taxi driver Robot. (7 marks)

Q5. Discuss the Tabu search method and maintain the type of memory using in this method and maintain the Tabu search algorithm. (10 marks)

==best wishes==

Dr. Alaa F. Mohamed

Answer the following questions: (50 Marks)

Question 1: Answer the following points (10 Marks)

- 1- Explain the internet "nuts and bolts"?
- 2- Explain the sources of packet delay?
- 3- What are protocols?
- 4- Explain Access network: digital subscriber line (DSL)?

Question 2: Answer the following points (10 Marks)

- 1- What is the network core?
- 2- Explain Packet Switching: queueing delay, loss?
- 3- Define throughput?
- 4- Define and explain traffic intensity?

Question 3: Answer the following points (10 Marks)

- 1- Explain the Internet protocol stack?
- 2- Mention some network applications?
- 3- Explain the application client-server architecture?
- 4- Explain P2P architecture?

Question 4: Answer the following points (10 Marks)

- 1- HTTP is "stateless". What does that mean?
- 2- Compare between persistent HTTP and non-persistent HTTP?
- 3- Give examples of HTTP response status codes?
- 4- Explain the term (web caches) and how it is useful?

Question 5: Answer the following points (10 Marks)

- 1- Give a DNS name resolution example?
- 2- Compare between multiplexing and demultiplexing? Support your answer with a diagram?
- 3- Define and explain the use of ACKs and NAKs?
- 4- Define and explain HOL? Support your answer with a diagram?

جامعة أسيوط	مايو 2018	كود المقرر: 356 رك
كلية العلوم		المقرر : مقدمة فى الحسابات العلمية
قسم الرياضيات		الزمن : ساعتان

Answer the following questions by using MATLAB language: (50 marks)

1- Using Newton's forward difference formula, find $y(0.1)$ using the table below:

x	0.0	0.2	0.4	0.6	0.8
y	1.000	1.22140	1.49182	1.82212	2.22554

2- Solve the differential equation by Adams method (without using nested for loops) at $x=0.2$:

$$\frac{dy}{dt} = t^2 - y, \quad y(0) = 1, \quad h = 0.05.$$

and compare it with the analytic solution $y = -e^{-t} + t^2 - 2t + 2$.

3- Solve the following initial value problem:

$$\frac{d^2u}{dt^2} + 4\frac{du}{dt} + 3u = 0, \quad u(0) = 1, \quad \frac{du}{dt}(0) = 0.$$

4- Let $f(x) = \cos 2x$ and $x_0 = 0$. Determine

- The third Taylor polynomial for f about x_0 .
- Find error bound at $x = 0.2$ and compare it to the actual error.

5- For the well-known Chua's circuit equation in chaotic studies that

$$\dot{x} = \alpha[y - x - f(x)], \quad \dot{y} = x - y + z, \quad \dot{z} = -\beta y - \gamma z, \quad t \in (0, 10),$$

where the nonlinear function $f(x)$ is described by

$$f(x) = bx + 0.5(a-b)(|x+1| - |x-1|) \text{ and } a < b < 0.$$

Write an M-function to describe the equation, and draw the phase trajectory for the parameters $\alpha = 9$, $\beta = 100/7$, $\gamma = 0$, $a = -8/7$, $b = -5/7$, and initial conditions

$$x(0) = -2.121304, \quad y(0) = -0.066170, \quad z(0) = 2.881090.$$

Good Luck

Dr. Tarek Aboelenen



امتحان الفرقة الثالثة شعبة الرياضيات

الزمن : ثلاث ساعات

رقم المقرر ورمزه : ١٣٤٦

المقرر : عمليات عشوائية وتطبيقاتها

أجب عن خمسة أسئلة فقط مما يأتي :- درجة جزء كل سؤال (خمس درجات)

١- (أ) لمجموعة المتغيرات العشوائية المستقلة $X_1, X_2, X_3, \dots$ بفرض أن التوقع الرياضي $E(X_i) = m$ والتباين $V(X_i)$ لكل منها محدود عرف كل من التقارب عن طريق الإحتمال وقانون الأعداد الكبرى (الضعيف).
(ب) بفرض أن $f f s s f s f f s s s f f s f f s$ هي إحدى النتائج الممكنة في محاولات برنولي العشوائية المستقلة بحيث أن $P(s) = p, P(f) = q, p + q = 1$ عرف عملية عشوائية في الفراغ R^2 موضحا ذلك بيانيا .

٢- (أ) في عملية برنولي العشوائية $\{X_n; n > 0\}$ بالإحتمال $p = 0.6$ إذا كان $X = X_1 + X_2$ ، $Y = X_1 + X_3$ احسب الإحتمالات الآتية : $P(X < 2, Y \leq 1)$ ، $P(2X < 3Y)$ ، $P(Y = X)$.
(ب) في السؤال (٢-أ) أوجد العزم الارتباطي بين X ، Y موضحا العلاقة بينهما .

٣- (أ) وضح العلاقة بين عملية برنولي العشوائية $\{X_n; n > 0\}$ و العملية العشوائية $\{Y_n; n \geq 0\}$ حيث أن المتغير Y_n يخضع لتوزيع ذي الحدين واذكر صفات كل منهما ثم عبر مع الإستنتاج عن إحتمال الحادث $(Y_{n+1} = k)$ من خلال إحتمالات الحوادث : $(Y_n = k)$ ، $(Y_n = k - 1)$ لأي عدد صحيح $k > 0$.
(ب) في العملية العشوائية $\{Y_n; n \geq 0\}$ أوجد كل من $E(Y_5)$ ، $E(Y_4^2)$ ، $P(Y_5 = 3, Y_7 = 4, Y_{14} = 9)$.

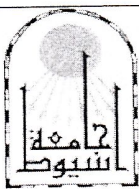
٤- (أ) عرف أزمنة النجاح T_k كعملية عشوائية موضحا العلاقة بينها وبين العملية العشوائية $\{Y_n; n \geq 0\}$ ثم اذكر فقط توزيع المتغير العشوائي T_k .
(ب) - في عملية بواسون العشوائية $\{N_t; t \geq 0\}$ بالمعدل $\lambda = 4$ احسب كل من الإحتمالات الآتية :
 $P(N_{1.5} = 2, N_4 = 5, N_{6.8} = 9)$ ، $P(N_3 = 5, N_7 = 9)$

٥- (أ) في عملية بواسون أو عملية الوصول المعودة $\{N_t; t \geq 0\}$ بالمعدل λ إثبت أن الإحتمال المشروط لعدد الوصول N_t بالنسبة إلى عدد الوصول N_{t+s} لكل $t > 0, s > 0$ يمثل توزيع ذي الحدين.
(ب) عرف العمليات العشوائية المستقلة ثم اثبت أن أي عمليتين مستقلتين لبواسون هو أيضا عملية بواسون .

٦- (أ) في عملية التجديد العشوائية $R = \{R_n; n \in N\}$ حيث N هي فئة الأعداد الصحيحة غير السالبة عرف دالة التجديد ثم عبر عنها من خلال توزيع المتغير R_n مع الإستنتاج .

(ب) في سلسلة ماركوف العشوائية المتقطعة $\{X_n; n \geq 0\}$ عرف مصفوفة الإحتمالات الإنتقالية بصفاتها المعروفة ثم احسب الإحتمال : $P(X_0 = 1, X_1 = 1, X_2 = 0, X_3 = 1, X_4 = 0, X_6 = 0)$ بفرض أن حالات الفراغ $(0, 1)$ والمصفوفة العشوائية

$$P = \begin{pmatrix} 1/2 & 1/2 \\ 1/3 & 2/3 \end{pmatrix} , \text{ ومنتجه الإحتمالات الابتدائية } \pi_0 = (2/5 \quad 3/5)$$

	المقرر: تحليل عددي (٣٢٣) الفرقة: المستوى الثالث الدرجة: ٥٠ درجة التاريخ: ٢٠١٨/٥/٢٩ الزمن: ثلاث ساعات	جامعة أسيوط كلية العلوم - قسم الرياضيات امتحان نهائي الفصل الدراسي الثاني للعام الجامعي ٢٠١٧/٢٠١٨
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Answer five questions only :- (10 marks for every question)

1-a) If the function $g \in C[a, b]$ and $g(x) \in [a, b] \forall x \in [a, b]$ and $g'(x)$ exist with $|g'(x)| \leq k < 1 \forall x \in [a, b]$ prove that the sequence defined by $P_n = g(P_{n-1}), n \geq 1$ will converge to the unique fixed point P and also $|P_{n+1} - P_n| \leq k^n |P_1 - P_0|$.

1-b) Verify that when Newton's method is used to compute $\sqrt{A}, A > 0$ (By solving the equation : $f(x) = x^2 - A$). The sequence of iterates is defined by : $x_{n+1} = (x_n + \frac{A}{x_n})/2$, and show that if the sequence $\{x_n\}$ is defined as the previous problem, then this method is quadratically convergence.

2-a) Derive Lagrange interpolation formula of degree n and write the error of the method.

2-b) For the given function $f(x) = \cos \pi x$ let $x_0 = -1, x_1 = 0, x_2 = 1$ construct the suitable interpolation polynomial and find the actual error.

3) Derive the formula of the Newton's interpolatory divided difference method and use this formula to obtain a polynomial of least degree that fits the values shown:

x	0	1	2	4	6
$f(x)$	1	9	23	93	259

من فضلك انظر خلف الورقة

السؤال الرابع :-

أ) يعرف الطي للدالتين $f(x)$, $g(x)$ كالآتي

$$f * g = \int_{-\infty}^{\infty} f(u) g(x-u) du$$

برهن علي أن تحويل فوريير للطرف الأيمن هو حاصل ضرب تحويلي فوريير للدالتين $f(x)$, $g(x)$

ب) أوجد تحويل فوريير للدالة $f(x) = \begin{cases} 1 & |x| < a \\ 0 & |x| > a \end{cases}$ وأرسم $f(x)$ كذلك تحويلها عند $a = 3$ وأوجد

$$\int_{-\infty}^{\infty} \frac{\sin u}{u} du \quad \text{كذلك} \quad \int_{-\infty}^{\infty} \frac{\sin \alpha a \cos \alpha x}{\alpha} d\alpha$$

ج) ترك خيط لانهائي من السكون وكانت أزاحته الابتدائية عن محور x هي $f(x)$ أوجد الإزاحه عند أي زمن .

انتهت الأسئلة مع تمنياتنا بالتوفيق ،،،،

لجنة الممتحنين :- أ.د/ نجاه عبد الرحمن حسين ، أ.د/ فاروق علي السيد



الامتحان النهائي للفصل الدراسي الثاني للعام الجامعي ٢٠١٧/٢٠١٨ م
 للفرقة : الثالثة
 الشعبة : الرياضيات
 التاريخ : ٢٠١٨/٥/٢٤ م

الزمن : ساعتان

الدرجة الكلية : ٥٠ درجة

درجة كل سؤال : ١٧ درجة

أسم المقرر : الطرق الرياضية
 رقم المقرر ورمزه : ٣٣٤ ر

أجب عن ثلاثة أسئلة فقط مما يأتي :-

السؤال الأول :-

أوجد تحويل لابلاس للمشتقة التفاضلية للدالة $F(t)$ عند نقط الاتصال والانفصال للدالة .

أبرهن علي أن

$$\lim_{t \rightarrow 0} F(t) = \lim_{s \rightarrow \infty} s f(s)$$

$$\lim_{t \rightarrow \infty} F(t) = \lim_{s \rightarrow 0} s f(s)$$

$$\Gamma\left(\frac{1}{2}\right) = \sqrt{\pi}, \quad \int_0^{\infty} \delta(t) dt = 1, \quad L \sin \sqrt{t} = \frac{\sqrt{\pi}}{3} e^{-\frac{1}{4s}} s^{\frac{3}{2}}$$

السؤال الثاني :-

حل المعادلات الآتية :

$$t Y''(t) + Y'(t) + 4t Y(t) = 0, \quad y(0) = 3, y'(0) = 0$$

$$\frac{\partial U}{\partial x} = 2 \frac{\partial U}{\partial t} + U, \quad x > 0, t > 0 \quad U(x, 0) = 6 e^{-3x}$$

$$\int_0^t Y(u) Y(t-u) du = 16 \sin 4t$$

السؤال الثالث :-

(أ) فك الدالة $f(x) = x^2$, $0 < x < 2\pi$ بدلالة متسلسلة فوريير ثم أحسب المجموع

$$1 + \frac{1}{2^2} + \frac{1}{3^2} + \frac{1}{4^2} + \dots$$

(ب) صفيحة علي شكل دائري نصف قطرها الوحدة ووجهيها معزولين ونصف محيطها محفوظ عند درجة حرارة u_1

والآخر عند u_2 أوجد حالة الأتزان الحراري .

من فضلك أنظر بقية الأسئلة خلف الورقة ،،،،،



Answer the following questions (50 marks)

Q1.	Complete the following: (1)..... is a representation of a two-dimensional image as a finite set of digital values, called picture elements or pixels - Common image formats include.....(2).... ,(3)..... ,(4)..... (5)..... creates a Distance tool a draggable, resizable line that measures the distance between its endpoints. (6)..... These are the result of objects that are self-luminous, such as stars and light bulbs. (7).....the resulting output pixel is computed as a sum of products of the pixel values and mask coefficients in the pixel's neighborhood in the original image. - The Sobel operators used to compute edges are(8)..... ,(9)..... - Edge detector should have:(10)..... ,(11)..... - Types of noise are(12)..... ,(13)....	(13 marks)
Q2.	a) Compute Z from the following matlab script (6 marks) <pre> x = [150 10 90;80 50 60;121 160 20] y = [-1 0 1;-2 0 2;-1 0 1] z = imfilter(x,y,'corr') </pre> b) What is the Delta compression and compute the compressed data of the data (6 marks) 220 321 335 211 250 200 233 214 232 212	(12 marks)
Q3.	a) Write the MATLAB code used to: (4 marks) - Read any image then use affine transformation matrix for each of the operations below: - Flip the image right to left - Translation by [25, 15] pixels b) What are the main differences between: (8 marks) - Global thresholding and optimal thresholding. - Raster and vector image . - Interpixel redundancy and Psychovisual redundancy	(12 marks)

(Q5) (i) Assume that U, V are open intervals and let $f : U \rightarrow \mathbb{R}$ and $g : V \rightarrow \mathbb{R}$ be two differentiable functions such that $f(U) \subset V$. Prove that $g \circ f$ is differentiable on U and that $(g \circ f)' = (g' \circ f) \cdot f'$ [5 marks]

(ii) Prove that the function $f(x) := \frac{1}{x}$ is differentiable on $]0, \infty[$ but not uniformly continuous therein. [5 marks]

(Q6) (i) State and prove Rolle's theorem then use it to prove the mean value theorem. [6 marks]

(ii) Let I be an open interval. Apply the mean value theorem to prove that a function differentiable on I is

1. increasing if and only if $f' \geq 0$ on I ,

2. decreasing if and only if $f' \leq 0$ on I .

[4 marks]

With the best of luck,

Prof. Rashwan A. Rashwan,

Dr. Ahmed A. Abdelhakim



Time: 3 hours

Total mark: 50

Answer *only five* of the following questions:

(Q1) (i) Suppose that O_i , $i \geq 1$, are open subsets of $\mathbb{R}$. Prove that $\cup_{i \geq 1} O_i$ is also open in $\mathbb{R}$. [5 marks]

(ii) Let $S \subset \mathbb{R}$. Show that S is closed if and only if S contains the limit point of every convergent sequence of elements of S . [5 marks]

(Q2) (i) Prove that a sequence of real numbers converges if and only if it is a Cauchy sequence. [6 marks]

(ii) Show that if $(x_n)_{n \geq 1} \subset \mathbb{R}$ is a monotonically increasing sequence that is bounded above, then $x_n \rightarrow \sup_{n \geq 1} x_n$, as $n \rightarrow \infty$. [4 marks]

(Q3) (i) Show that $f : D \subset \mathbb{R} \rightarrow \mathbb{R}$ is continuous at $x_0 \in D$ if and only if the sequence $(f(x_n))_{n \geq 1}$ converges to $f(x_0)$ whenever $(x_n)_{n \geq 1}$ is a sequence in D that converges to x_0 . [6 marks]

(ii) Use the characterization given in (i) to prove the discontinuity at the origin of the function $f(x) = \begin{cases} \cos \frac{1}{x}, & x \neq 0; \\ 0, & x = 0. \end{cases}$ [4 marks]

(Q4) (i) Assume that D is a closed bounded subset of $\mathbb{R}$. Prove that if $f : D \rightarrow \mathbb{R}$ is continuous then f is bounded on D , and there exist $\alpha, \beta \in D$ such that $f(\alpha) = \max_{x \in D} f(x)$ and $f(\beta) = \min_{x \in D} f(x)$. [5 marks]

(ii) Argue by contradiction to demonstrate that if $f : [a, b] \rightarrow \mathbb{R}$ is continuous then it is uniformly continuous on $[a, b]$. [5 marks]

Please Turn over the page



أجب عن أسئلة الآتية :- (كل سؤال ١٠ درجات)

(١) (أ) أثبت قاعدة التضعيف لدالة جاما $\sqrt{\pi} \Gamma(2x) = 2^{2x-1} \Gamma(x) \Gamma\left(x + \frac{1}{2}\right)$, $x > 0$

ثم استخدمها في إثبات أن: $\Gamma\left(\frac{5}{6}\right) \left[\Gamma\left(\frac{1}{3}\right)\right]^2 = 2 \sqrt[3]{2} \sqrt{\frac{\pi^3}{3}}$

(ب) باستخدام دوال جاما وبيتا أوجد التكاملات الآتية: (i) $\int_0^{\frac{\pi}{2}} \sqrt{\tan \theta} d\theta$ (ii) $\int_0^{\infty} \frac{\sqrt{x}}{e^{x^3}} dx$

(٢) (أ) أثبت أن: $\Gamma(x) \Gamma(1-x) = \frac{\pi}{\sin \pi x}$, $0 < x < 1$ ومن ثم أثبت أن

$\Gamma\left(x + \frac{1}{2}\right) \Gamma\left(\frac{1}{2} - x\right) = \frac{\pi}{\cos \pi x}$

(ب) أثبت أن:

(i) $\sqrt{1-x^2} T_n(x) = U_{n+1}(x) - x U_n(x)$,

(ii) $(1-x^2) U'_n(x) = -n x U_n(x) + n U_{n-1}(x)$

(٣) أثبت أن:

(i) ${}_2F_1(\alpha, \beta; \gamma, x) = (1-x)^{-\beta} {}_2F_1\left(\gamma - \alpha, \beta; \gamma, \frac{x}{x-1}\right)$

(ii) ${}_1F_1\left(\frac{1}{2}; \frac{3}{2}, -x^2\right) = \frac{\sqrt{\pi}}{2x} \operatorname{erf}(x)$ حيث أن: $\operatorname{erf}(x) = \frac{2}{\sqrt{\pi}} \int_0^x e^{-t^2} dt$ هي دالة الخطأ

(iii) ${}_1F_1(\alpha + 1; \gamma, x) - {}_1F_1(\alpha; \gamma, x) - \frac{x}{\gamma} {}_1F_1(\alpha + 1; \gamma + 1, x) = 0$

(٤) (أ) أوجد مفكوك ليجندر للدالة: $f(x) = x^3$

(ب) أثبت أن: $H_n(x) = (-1)^n e^{x^2} \frac{d^n}{dx^n} (e^{-x^2})$ حيث $H_n(x)$ كثيرة حدود هيرميت.

(ج) أثبت أن: $J_{\frac{1}{2}}(x) = \sqrt{\frac{2}{\pi}} \frac{\sin x}{\sqrt{x}}$

(٥) (أ) باستخدام الصيغة التكاملية لدوال بسل أثبت أن: $\int_0^{\infty} e^{-3x} J_0(4x) dx = \frac{1}{5}$

(ب) أوجد الحل العام لمعادلة بسل التفاضلية:

$x^2 \frac{d^2 y}{dx^2} + x \frac{dy}{dx} + (x^2 - n^2)y = 0$

CS12	CS11	CS10	Description
0	0	0	No clock source (Timer/Counter stopped).
0	0	1	clk _{IO} /1 (No prescaling)
0	1	0	clk _{IO} /8 (From prescaler)
0	1	1	clk _{IO} /64 (From prescaler)
1	0	0	clk _{IO} /256 (From prescaler)
1	0	1	clk _{IO} /1024 (From prescaler)
1	1	0	External clock source on T1 pin. Clock on falling edge.
1	1	1	External clock source on T1 pin. Clock on rising edge.

Timer/Counter1 – TCNT1H and TCNT1L

Bit	7	6	5	4	3	2	1	0	
	TCNT1[15:8]								TCNT1H
	TCNT1[7:0]								TCNT1L
Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

Output Compare Register 1 B – OCR1BH and OCR1BL

Bit	7	6	5	4	3	2	1	0	
	OCR1B[15:8]								OCR1BH
	OCR1B[7:0]								OCR1BL
Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

Input Capture Register 1 – ICR1H and ICR1L

Bit	7	6	5	4	3	2	1	0	
	ICR1[15:8]								ICR1H
	ICR1[7:0]								ICR1L
Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

Timer/Counter Interrupt Mask Register – TIMSK⁽¹⁾

Bit	7	6	5	4	3	2	1	0	
	OCIE2	OCIE1	OCIE1A	OCIE1B	TOIE1	OCIE0	TOIE0		TIMSK
Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

- Bit 5 – OCIE1: Timer/Counter1, Input Capture Interrupt Enable
 Bit 4 – OCIE1A: Timer/Counter1, Output Compare A Match Interrupt Enable
 Bit 3 – OCIE1B: Timer/Counter1, Output Compare B Match Interrupt Enable
 Bit 2 – TOIE1: Timer/Counter1, Overflow Interrupt Enable

Timer/Counter Interrupt Flag Register – TIFR

Bit	7	6	5	4	3	2	1	0	
	OCF2	TOV2	ICF1	OCF1A	OCF1B	TOV1	OCF0	TOV0	TIFR
Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

- Bit 5 – ICF1: Timer/Counter1, Input Capture Flag
 Bit 4 – OCF1A: Timer/Counter1, Output Compare A Match Flag
 Bit 3 – OCF1B: Timer/Counter1, Output Compare B Match Flag
 Bit 2 – TOV1: Timer/Counter1, Overflow Flag

USART

Operating Mode	Equation for Calculating Baud Rate ⁽¹⁾	Equation for Calculating UBRR Value
Asynchronous Normal Mode (U2X = 0)	$BAUD = \frac{f_{osc}}{16(UBRR + 1)}$	$UBRR = \frac{f_{osc}}{16BAUD} - 1$
Asynchronous Double Speed Mode (U2X = 1)	$BAUD = \frac{f_{osc}}{8(UBRR + 1)}$	$UBRR = \frac{f_{osc}}{8BAUD} - 1$
Synchronous Master Mode	$BAUD = \frac{f_{osc}}{2(UBRR + 1)}$	$UBRR = \frac{f_{osc}}{2BAUD} - 1$

USART I/O Data Register – UDR

Bit	7	6	5	4	3	2	1	0	
	RXB[7:0]								UDR (Read)
	TXB[7:0]								UDR (Write)
Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

Timer/Counter
Interrupt Mask
Register – TIMSK

Bit	7	6	5	4	3	2	1	0	
	OCIE2	TOIE2	OCIE1	OCIE1A	OCIE1B	TOIE1	OCIE0	TOIE0	TIMSK
Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

Bit 1 – OCIE0: Timer/Counter0 Output Compare Match Interrupt Enable
Bit 0 – TOIE0: Timer/Counter0 Overflow Interrupt Enable

Timer/Counter
Interrupt Flag Register
– TIFR

Bit	7	6	5	4	3	2	1	0	
	OCF2	TOV2	OCF1	OCF1A	OCF1B	TOV1	OCF0	TOV0	TIFR
Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

Bit 1 – OCF0: Output Compare Flag 0
Bit 0 – TOV0: Timer/Counter0 Overflow Flag

Timer/Counter1
Control Register A –
TCCR1A

Bit	7	6	5	4	3	2	1	0	
	COM1A1	COM1A0	COM1B1	COM1B0	FOC1A	FOC1B	WGM11	WGM10	TCCR1A
Read/Write	R/W	R/W	R/W	R/W	W	W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

Bit 7:6 – COM1A1:0: Compare Output Mode for Compare unit A
Bit 5:4 – COM1B1:0: Compare Output Mode for Compare unit B
Bit 3 – FOC1A: Force Output Compare for Compare unit A
Bit 2 – FOC1B: Force Output Compare for Compare unit B
Bit 1:0 – WGM11:0: Waveform Generation Mode

CS02	CS01	CS00	Description
0	0	0	No clock source (Timer/Counter stopped).
0	0	1	$clk_{IO}/1$ (No prescaling)
0	1	0	$clk_{IO}/8$ (From prescaler)
0	1	1	$clk_{IO}/64$ (From prescaler)
1	0	0	$clk_{IO}/256$ (From prescaler)
1	0	1	$clk_{IO}/1024$ (From prescaler)
1	1	0	External clock source on T0 pin, Clock on falling edge.
1	1	1	External clock source on T0 pin, Clock on rising edge.

COM1A1/COM1B1	COM1A0/COM1B0	Description
0	0	Normal port operation, OC1A/OC1B disconnected.
0	1	Toggle OC1A/OC1B on compare match
1	0	Clear OC1A/OC1B on compare match (Set output to low level)
1	1	Set OC1A/OC1B on compare match (Set output to high level)

Mode	WGM13	WGM12 (CTC1)	WGM11 (PWM11)	WGM10 (PWM10)	Timer/Counter Mode of Operation	TOP	Update of OCR1x	TOV1 Flag Set on
0	0	0	0	0	Normal	0xFFFF	Immediate	MAX
1	0	0	0	1	PWM, Phase Correct, 8-bit	0x00FF	TOP	BOTTOM
2	0	0	1	0	PWM, Phase Correct, 9-bit	0x01FF	TOP	BOTTOM
3	0	0	1	1	PWM, Phase Correct, 10-bit	0x03FF	TOP	BOTTOM
4	0	1	0	0	CTC	OCR1A	Immediate	MAX
5	0	1	0	1	Fast PWM, 8-bit	0x00FF	BOTTOM	TOP
6	0	1	1	0	Fast PWM, 9-bit	0x01FF	BOTTOM	TOP
7	0	1	1	1	Fast PWM, 10-bit	0x03FF	BOTTOM	TOP
8	1	0	0	0	PWM, Phase and Frequency Correct	ICR1	BOTTOM	BOTTOM
9	1	0	0	1	PWM, Phase and Frequency Correct	OCR1A	BOTTOM	BOTTOM
10	1	0	1	0	PWM, Phase Correct	ICR1	TOP	BOTTOM
11	1	0	1	1	PWM, Phase Correct	OCR1A	TOP	BOTTOM
12	1	1	0	0	CTC	ICR1	Immediate	MAX
13	1	1	0	1	Reserved	–	–	–
14	1	1	1	0	Fast PWM	ICR1	BOTTOM	TOP
15	1	1	1	1	Fast PWM	OCR1A	BOTTOM	TOP

Timer/Counter1
Control Register B –
TCCR1B

Bit	7	6	5	4	3	2	1	0	
	ICNC1	ICES1	–	WGM13	WGM12	CS12	CS11	CS10	TCCR1B
Read/Write	R/W	R/W	R	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

Bit 7 – ICNC1: Input Capture Noise Canceler
Bit 6 – ICES1: Input Capture Edge Select
Bit 5 – Reserved Bit
Bit 4:3 – WGM13:2: Waveform Generation Mode
Bit 2:0 – CS12:0: Clock Select

CS12	CS11	CS10	Description
0	0	0	No clock source (Timer/Counter stopped).
0	0	1	$clk_{IO}/1$ (No prescaling)
0	1	0	$clk_{IO}/8$ (From prescaler)
0	1	1	$clk_{IO}/64$ (From prescaler)
1	0	0	$clk_{IO}/256$ (From prescaler)
1	0	1	$clk_{IO}/1024$ (From prescaler)
1	1	0	External clock source on T1 pin. Clock on falling edge.
1	1	1	External clock source on T1 pin. Clock on rising edge.

Timer/Counter1 – TCNT1H and TCNT1L

Bit	7	6	5	4	3	2	1	0	
	TCNT1[15:8]								TCNT1H
	TCNT1[7:0]								TCNT1L
Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

Output Compare Register 1 B – OCR1BH and OCR1BL

Bit	7	6	5	4	3	2	1	0	
	OCR1B[15:8]								OCR1BH
	OCR1B[7:0]								OCR1BL
Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

Input Capture Register 1 – ICR1H and ICR1L

Bit	7	6	5	4	3	2	1	0	
	ICR1[15:8]								ICR1H
	ICR1[7:0]								ICR1L
Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

Timer/Counter Interrupt Mask Register – TIMSK⁽¹⁾

Bit	7	6	5	4	3	2	1	0	
	OCIE2	TOIE2	TICIE1	OCIE1A	OCIE1B	TOIE1	OCIE0	TOIE0	TIMSK
Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

- Bit 5 – TICIE1: Timer/Counter1, Input Capture Interrupt Enable
 Bit 4 – OCIE1A: Timer/Counter1, Output Compare A Match Interrupt Enable
 Bit 3 – OCIE1B: Timer/Counter1, Output Compare B Match Interrupt Enable
 Bit 2 – TOIE1: Timer/Counter1, Overflow Interrupt Enable

Timer/Counter Interrupt Flag Register – TIFR

Bit	7	6	5	4	3	2	1	0	
	OCF2	TOV2	ICF1	OCF1A	OCF1B	TOV1	OCF0	TOV0	TIFR
Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

- Bit 5 – ICF1: Timer/Counter1, Input Capture Flag
 Bit 4 – OCF1A: Timer/Counter1, Output Compare A Match Flag
 Bit 3 – OCF1B: Timer/Counter1, Output Compare B Match Flag
 Bit 2 – TOV1: Timer/Counter1, Overflow Flag

USART

Operating Mode	Equation for Calculating Baud Rate ⁽¹⁾	Equation for Calculating UBRR Value
Asynchronous Normal Mode (U2X = 0)	$BAUD = \frac{f_{osc}}{16(UBRR + 1)}$	$UBRR = \frac{f_{osc}}{16BAUD} - 1$
Asynchronous Double Speed Mode (U2X = 1)	$BAUD = \frac{f_{osc}}{8(UBRR + 1)}$	$UBRR = \frac{f_{osc}}{8BAUD} - 1$
Synchronous Master Mode	$BAUD = \frac{f_{osc}}{2(UBRR + 1)}$	$UBRR = \frac{f_{osc}}{2BAUD} - 1$

USART I/O Data Register – UDR

Bit	7	6	5	4	3	2	1	0	
	RXB[7:0]								UDR (Read)
	TXB[7:0]								UDR (Write)
Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

USART Control and Status Register A – UCSRA

Bit	7	6	5	4	3	2	1	0	
	RXC	TXC	UDRE	FE	DOR	PE	U2X	MPCM	UCSRA
Read/Write	R	R/W	R	R	R	R	R/W	R/W	
Initial Value	0	0	1	0	0	0	0	0	

- Bit 7 – RXC: USART Receive Complete
- Bit 6 – TXC: USART Transmit Complete
- Bit 5 – UDRE: USART Data Register Empty
- Bit 4 – FE: Frame Error
- Bit 3 – DOR: Data OverRun
- Bit 2 – PE: Parity Error
- Bit 1 – U2X: Double the USART Transmission Speed
- Bit 0 – MPCM: Multi-processor Communication Mode

USART Control and Status Register B – UCSRB

Bit	7	6	5	4	3	2	1	0	
	RXCIE	TXCIE	UDRIE	RXEN	TXEN	UCSZ2	RXB8	TXB8	UCSRB
Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R	R/W	
Initial Value	0	0	0	0	0	0	0	0	

- Bit 7 – RXCIE: RX Complete Interrupt Enable
- Bit 6 – TXCIE: TX Complete Interrupt Enable
- Bit 5 – UDRIE: USART Data Register Empty Interrupt Enable
- Bit 4 – RXEN: Receiver Enable
- Bit 3 – TXEN: Transmitter Enable
- Bit 2 – UCSZ2: Character Size
- Bit 1 – RXB8: Receive Data Bit 8
- Bit 0 – TXB8: Transmit Data Bit 8

USART Control and Status Register C – UCSRC

Bit	7	6	5	4	3	2	1	0	
	URSEL	UMSEL	UPM1	UPM0	USBS	UCSZ1	UCSZ0	UCPOL	UCSRC
Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	
Initial Value	1	0	0	0	0	1	1	0	

- Bit 7 – URSEL: Register Select
- Bit 6 – UMSEL: USART Mode Select
- Bit 5:4 – UPM1:0: Parity Mode
- Bit 3 – USBS: Stop Bit Select
- Bit 2:1 – UCSZ1:0: Character Size
- Bit 0 – UCPOL: Clock Polarity

UMSEL	Mode
0	Asynchronous Operation
1	Synchronous Operation

USBS	Stop Bit(s)
0	1-bit
1	2-bit

UPM1	UPM0	Parity Mode
0	0	Disabled
0	1	Reserved
1	0	Enabled, Even Parity
1	1	Enabled, Odd Parity

UCPOL	Transmitted Data Changed (Output of TxD Pin)	Received Data Sampled (Input on RxD Pin)
0	Rising XCK Edge	Falling XCK Edge
1	Falling XCK Edge	Rising XCK Edge

Table 66. UCSZ Bits Settings

UCSZ2	UCSZ1	UCSZ0	Character Size
0	0	0	5-bit
0	0	1	6-bit
0	1	0	7-bit
0	1	1	8-bit
1	0	0	Reserved
1	0	1	Reserved
1	1	0	Reserved
1	1	1	9-bit

USART Baud Rate Registers – UBRRL and UBRRH

Bit	15	14	13	12	11	10	9	8	
	URSEL	-	-	-	-	UBRR[11:9]	-	-	UBRRH
	-	-	-	-	-	UBRR[7:0]	-	-	UBRRL
Read/Write	R/W	R	R	R	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	



Operation Research326 R

11-5-2018

Third Level: Computer Science Section

Time: 3 hours

Total Degree (50 marks)

Science Faculty

Mathematical Department

Answer the following Questions:

1-Use the Simplex method to solve the following linear programming

Maximize $Z = 10x_1 + 11x_2$

Subject to $x_1 + 2x_2 \leq 150$, $3x_1 + 4x_2 \leq 200$, $6x_1 + x_2 \leq 175$

and $x_1, x_2 \geq 0$

(10 marks)

2) Use the graphical and the algebraic method to solve the problem

Max $f(\underline{x}) = 5x_1 + 7x_2$ Subject to $5x_1 + 8x_2 \leq 24$, $x_1 + x_2 \leq 4$,

$10x_1 + 7x_2 \leq 35$ and $x_1, x_2 \geq 0$

(12.5marks)

3) Use the Lagrange multiplier method to find the extreme points of the problem

Minimize $f(\underline{x}) = x_1^2 + x_2^2 - 3x_1x_2$

Subject to $g(\underline{x}) = x_1^2 + x_2^2 - 8 = 0$.

(12.5marks)

4) Use the Hessian Matrix to find the local points of the problem

$f(\underline{x}) = f(x_1, x_2) = x_1^3 + x_2^3 + 2x_1^2 + 4x_2^2 + 6$

(10marks)

5) Find the local Points

$f(x) = 3x^4 - 20x^3 + 36x^2 + 16$ (5marks)

Best Wishes

Dr. Alaa Fahim

MCU Control and Status Register – MCUCSR

Bit	7	6	5	4	3	2	1	0	
	JTD	ISC2	–	JTRF	WDRF	BORF	EXTRF	PORF	MCUCSR
Read/Write	R/W	R/W	R	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0						See Bit Description

Bit 6 – ISC2: Interrupt Sense Control 2

General Interrupt Control Register – GICR

Bit	7	6	5	4	3	2	1	0	
	INT1	INT0	INT2	–	–	–	IVSEL	IVCE	GICR
Read/Write	R/W	R/W	R/W	R	R	R	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

Bit 7 – INT1: External Interrupt Request 1 Enable

Bit 5 – INT2: External Interrupt Request 2 Enable

Bit 6 – INT0: External Interrupt Request 0 Enable

General Interrupt Flag Register – GIFR

Bit	7	6	5	4	3	2	1	0	
	INTF1	INTF0	INTF2	–	–	–	–	–	GIFR
Read/Write	R/W	R/W	R/W	R	R	R	R	R	
Initial Value	0	0	0	0	0	0	0	0	

Bit 7 – INTF1: External Interrupt Flag 1

Bit 5 – INTF2: External Interrupt Flag 2

Bit 6 – INTF0: External Interrupt Flag 0

Port A Data Register – PORTA

Bit	7	6	5	4	3	2	1	0	
	PORTA7	PORTA6	PORTA5	PORTA4	PORTA3	PORTA2	PORTA1	PORTA0	PORTA
Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

Port A Data Direction Register – DDRA

Bit	7	6	5	4	3	2	1	0	
	DDA7	DDA6	DDA5	DDA4	DDA3	DDA2	DDA1	DDA0	DDRA
Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

Port A Input Pins Address – PINA

Bit	7	6	5	4	3	2	1	0	
	PINA7	PINA6	PINA5	PINA4	PINA3	PINA2	PINA1	PINA0	PINA
Read/Write	R	R	R	R	R	R	R	R	
Initial Value	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	

Time/Counter Control Register – TCCR0

Bit	7	6	5	4	3	2	1	0	
	FOC0	WGM00	COM01	COM00	WGM01	CS02	CS01	CS00	TCCR0
Read/Write	W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

Bit 7 – FOC0: Force Output Compare

Bit 5:4 – COM01:0: Compare Match Output Mode

Bit 6, 3 – WGM01:0: Waveform Generation Mode

Bit 2:0 – CS02:0: Clock Select

Mode	WGM01 (CTC0)	WGM00 (PWM0)	Timer/Counter Mode of Operation	TOP	Update of OCR0	TOV0 Flag Set-on	COM01	COM00	Description
0	0	0	Normal	0xFF	Immediate	MAX	0	0	Normal port operation, OC0 disconnected.
1	0	1	PWM, Phase Correct	0xFF	TOP	BOTTOM	0	1	Toggle OC0 on compare match
2	1	0	CTC	OCR0	Immediate	MAX	1	0	Clear OC0 on compare match
3	1	1	Fast PWM	0xFF	BOTTOM	MAX	1	1	Set OC0 on compare match

Timer/Counter Register – TCNT0

Bit	7	6	5	4	3	2	1	0	
	TCNT0[7:0]								TCNT0
Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

Output Compare Register – OCR0

Bit	7	6	5	4	3	2	1	0	
	OCR0[7:0]								OCR0
Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

Timer/Counter
Interrupt Mask
Register – TIMSK

Bit	7	6	5	4	3	2	1	0	
	OCIE2	TOIE2	OCIE1	OCIE1A	OCIE1B	TOIE1	OCIE0	TOIE0	TIMSK
Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

Bit 1 – OCIE0: Timer/Counter0 Output Compare Match Interrupt Enable
Bit 0 – TOIE0: Timer/Counter0 Overflow Interrupt Enable

Timer/Counter
Interrupt Flag Register
– TIFR

Bit	7	6	5	4	3	2	1	0	
	OCF2	TOV2	ICF1	OCF1A	OCF1B	TOV1	OCF0	TOV0	TIFR
Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

Bit 1 – OCF0: Output Compare Flag 0
Bit 0 – TOV0: Timer/Counter0 Overflow Flag

Timer/Counter1
Control Register A –
TCCR1A

Bit	7	6	5	4	3	2	1	0	
	COM1A1	COM1A0	COM1B1	COM1B0	FOC1A	FOC1B	WGM11	WGM10	TCCR1A
Read/Write	R/W	R/W	R/W	R/W	W	W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

Bit 7:6 – COM1A1:0: Compare Output Mode for Compare unit A
Bit 5:4 – COM1B1:0: Compare Output Mode for Compare unit B
Bit 3 – FOC1A: Force Output Compare for Compare unit A
Bit 2 – FOC1B: Force Output Compare for Compare unit B
Bit 1:0 – WGM11:0: Waveform Generation Mode

CS02	CS01	CS00	Description
0	0	0	No clock source (Timer/Counter stopped).
0	0	1	clk_{RCY} (No prescaling)
0	1	0	$clk_{RCY}/8$ (From prescaler)
0	1	1	$clk_{RCY}/64$ (From prescaler)
1	0	0	$clk_{RCY}/256$ (From prescaler)
1	0	1	$clk_{RCY}/1024$ (From prescaler)
1	1	0	External clock source on T0 pin. Clock on falling edge.
1	1	1	External clock source on T0 pin. Clock on rising edge.

COM1A1/COM1B1	COM1A0/COM1B0	Description
0	0	Normal port operation, OC1A/OC1B disconnected.
0	1	Toggle OC1A/OC1B on compare match
1	0	Clear OC1A/OC1B on compare match (Set output to low level)
1	1	Set OC1A/OC1B on compare match (Set output to high level)

Mode	WGM13	WGM12 (CTC1)	WGM11 (PWM11)	WGM10 (PWM10)	Timer/Counter Mode of Operation	TOP	Update of OCR1x	TOV1 Flag Set on
0	0	0	0	0	Normal	0xFFFF	Immediate	MAX
1	0	0	0	1	PWM, Phase Correct, 8-bit	0x00FF	TOP	BOTTOM
2	0	0	1	0	PWM, Phase Correct, 9-bit	0x01FF	TOP	BOTTOM
3	0	0	1	1	PWM, Phase Correct, 10-bit	0x03FF	TOP	BOTTOM
4	0	1	0	0	CTC	OCR1A	Immediate	MAX
5	0	1	0	1	Fast PWM, 8-bit	0x00FF	BOTTOM	TOP
6	0	1	1	0	Fast PWM, 9-bit	0x01FF	BOTTOM	TOP
7	0	1	1	1	Fast PWM, 10-bit	0x03FF	BOTTOM	TOP
8	1	0	0	0	PWM, Phase and Frequency Correct	ICR1	BOTTOM	BOTTOM
9	1	0	0	1	PWM, Phase and Frequency Correct	OCR1A	BOTTOM	BOTTOM
10	1	0	1	0	PWM, Phase Correct	ICR1	TOP	BOTTOM
11	1	0	1	1	PWM, Phase Correct	OCR1A	TOP	BOTTOM
12	1	1	0	0	CTC	ICR1	Immediate	MAX
13	1	1	0	1	Reserved	–	–	–
14	1	1	1	0	Fast PWM	ICR1	BOTTOM	TOP
15	1	1	1	1	Fast PWM	OCR1A	BOTTOM	TOP

Timer/Counter1
Control Register B –
TCCR1B

Bit	7	6	5	4	3	2	1	0	
	ICNC1	ICES1	–	WGM13	WGM12	CS12	CS11	CS10	TCCR1B
Read/Write	R/W	R/W	R	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

Bit 7 – ICNC1: Input Capture Noise Canceler
Bit 6 – ICES1: Input Capture Edge Select
Bit 5 – Reserved Bit
Bit 4:3 – WGM13:2: Waveform Generation Mode
Bit 2:0 – CS12:0: Clock Select



Operation Research326 R

11-5-2018

Third Level: Computer Science Section

Time: 3 hours

Total Degree (50 marks)

Science Faculty

Mathematical Department

Answer the following Questions:

1-Use the Simplex method to solve the following linear programming

Maximize $Z = 10x_1 + 11x_2$

Subject to $x_1 + 2x_2 \leq 150$, $3x_1 + 4x_2 \leq 200$, $6x_1 + x_2 \leq 175$

and $x_1, x_2 \geq 0$

(10 marks)

2) Use the graphical and the algebraic method to solve the problem

Max $f(\underline{x}) = 5x_1 + 7x_2$ Subject to $5x_1 + 8x_2 \leq 24$, $x_1 + x_2 \leq 4$,

$10x_1 + 7x_2 \leq 35$ and $x_1, x_2 \geq 0$

(12.5marks)

3) Use the Lagrange multiplier method to find the extreme points of the problem

Minimize $f(\underline{x}) = x_1^2 + x_2^2 - 3x_1x_2$

Subject to $g(\underline{x}) = x_1^2 + x_2^2 - 8 = 0$.

(12.5marks)

4) Use the Hessian Matrix to find the local points of the problem

$f(\underline{x}) = f(x_1, x_2) = x_1^3 + x_2^3 + 2x_1^2 + 4x_2^2 + 6$

(10marks)

5) Find the local Points

$f(x) = 3x^4 - 20x^3 + 36x^2 + 16$ (5marks)

Best Wishes

Dr. Alaa Fahim

اجب عن خمسة فقط من الاسئلة الاتية :- (10 درجات لكل سؤال : بواقع 5 درجات لكل فقرة)

(1) (i) اوجد الحل العام للمعادلة : $p_1 + 3p_2 + 2p_3(1 + \sqrt{x_1 + x_2 + x_3 - u}) = 6$
(ii) اوجد الحل الخاص للمعادلة : $(y - z)[2xyp + (x^2 - y^2)q] + z(x^2 - y^2) = 0$
الذي يمر خلال المنحنى $y = 0, x^3 = z^2$

(2) اوجد الحل العام لكل من المعادلتين التفاضليتين الجزئيتين الاتيتين :-
(i) $(D_1^3 - D_1^2 D_2 - D_1 D_2^2 + D_2^3)z = \log(x + y)$
(ii) $(D_1^2 - a^2 D_2^2)z = x^2 + y^2$, ثابت مطلق a

(3) اوجد الحل العام لكل من المعادلتين التفاضليتين الجزئيتين الاتيتين :-
(i) $(D_1^2 D_2 + D_2^2 - 2)z = e^{2y} \sin 3x - e^x \cos 2y$
(ii) $(D_1^2 - D_2^2 - D_1 - 3D_2 - 2)z = e^{2x-3y} + x + y + 1$

(4) (i) احسب التكاملات الاتية :-
(a) $\int_0^{\infty} x^{-\frac{1}{3}}(1 + 2x)^{-3} dx$ (b) $\int_0^1 \sqrt{\log \frac{1}{x}} dx$

(ii) اثبت ان :-
(a) $\tan^{-1} x = x {}_2F_1(1, \frac{1}{2}; \frac{3}{2}; -x^2)$
(b) $(a - b) {}_2F_1(a, b; c; x) = a {}_2F_1(a + 1, b; c; x) - b {}_2F_1(a, b + 1; c; x)$

(5) اثبت ان دوال بسل من النوع الاول $J_n(x)$ تحقق الاتي :-
(i) $J_{-\frac{1}{2}}(x) = \sqrt{\frac{2}{\pi x}} \cos x$, (ii) $\int x^n J_{n-1}(x) dx = x^n J_n(x) + c$

(6) (i) اثبت ان كثيرات حدود لجندر $P_n(x)$ تحقق :-
(ii) احسب التكاملات الاتية :-
(a) $\int_{-1}^1 x P_n(x) P_{n+1}(x) dx$, (b) $\int_{-1}^1 x^2 P_n(x) P_{n+1}(x) dx$, (c) $\int_{-1}^1 x^2 P_n(x) dx$



Question 1: Put True or False for each of the following items (30 marks)

1. To enter a formula into a cell, begin by typing an equal sign.
2. Functions are pre-defined worksheet formulas.
3. Formulas in Excel must be written in a very specific format, referred to as syntax.
4. The second order of precedence is for exponentiation.
5. When the formula in cell **B7 =B4+B5+B6** is copied into cell **C7** the formula will be changed to **= C4+C5+C6**.
6. The error "#####" means Data being referenced is not available.
7. The range **B2:B7** is a range down a column.
8. To keep things clear and simple only add an absolute (\$) cell reference if absolutely necessary.
9. The formula **=ROUND(78.686788,-1)** results in the value 80 .
10. Placing an absolute sign in front of a ranged name (**\$budget**) is incorrect syntax.
11. The columns of the worksheet are named with Numbers.
12. Cells may contain only Labels and Values.
13. The cell address first lists the row name and then the column name.
14. This selected cell is referred to as the **active cell**.
15. The contents of the active cell will also be displayed on the **formula bar**.
16. A cell that is on sheet 3, in the second column third row would be referred to as **Sheet3@B3**.
17. Formatted Display is the number of decimal places that appear in a cell.
18. Formulas can be copied to perform different operations on a corresponding set of data.
19. The function **COUNT(value1,[value2],...)** counts non-blank cells.
20. The Average function ignore the blank cells.
21. TRUE and FALSE are called Boolean Values.
22. SPSS stands for Statistical Package for the Social Sciences.
23. SPSS is capable of handling large amounts of data.
24. SPSS has only two windows Data view and Output view.
25. **Transform** menu includes several options to change current variables.
26. In SPSS, Each column typically represents the data from 1 case.
27. In SPSS, The first column of variable view is Name.
28. In SPSS, you can sort data from **Transform** menu then **Sort Cases**.
29. Descriptive statistics are calculated using the **Analyze** menu.
30. Correlation is used to test the degree of association between variables.

Answer Sheet		
	True	False
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Question 2: (10 marks)

	A	B	C	D	E	F	G
1		MT1	MT2	Final	Total	Honors	Passed
2	Possible points	100	100	200	400		320
3							
4	Blue	79	89	169	337	FALSE	TRUE
5	Jones	85	65	195	345	FALSE	TRUE
6	Grey	60	97	187	344	TRUE	TRUE
7	Mary	10	30	50	90	TRUE	FALSE
8							

Write the following Boolean functions

1. Blue's total and Jones' total are greater than Grey's:
2. Grey's total is not the maximum grade:
3. None of the students passed the course
4. Blue is not an Honors student
5. Blue didn't get a passing grade (320)

Question 3: (10 marks)

1. What are the difference between Data View, Variable View and Output View in SPSS?
2. Some significance tests are very restrictive about the form of data they can accept. What are the different types of measurement?
3. Describe how to test the degree of association between variables by SPSS.
4. Explain how to use SPSS to calculate the frequency and percent of females and males who did and did not have social problems.

Q2.

- a. Maintain two different Algorithm of crossover process with mention the probability of crossover (5 marks)
- b. Maintain two different Algorithm of mutation process with mention the probability of mutation. (5 marks)

Q3. a. Maintain tree type representation of solutions in genetic algorithm. (3 marks)

b. Using genetic algorithm to find the maximum value of the function $(15x - x^2)$ where parameter x varies between 0 and 15. For simplicity, we may assume that x takes only integer values. Using the genetic algorithm procedure in one step and begin with four solutions in initial solutions. (10 marks)

Q4. Discuss the internal structure of Taxi driver Robot. (7 marks)

Q5. Discuss the Tabu search method and maintain the type of memory using in this method and maintain the Tabu search algorithm. (10 marks)

==best wishes==

Dr. Alaa F. Mohamed

Answer the following questions: (50 Marks)

Question 1: Answer the following points (10 Marks)

- 1- Explain the internet "nuts and bolts"?
- 2- Explain the sources of packet delay?
- 3- What are protocols?
- 4- Explain Access network: digital subscriber line (DSL)?

Question 2: Answer the following points (10 Marks)

- 1- What is the network core?
- 2- Explain Packet Switching: queueing delay, loss?
- 3- Define throughput?
- 4- Define and explain traffic intensity?

Question 3: Answer the following points (10 Marks)

- 1- Explain the Internet protocol stack?
- 2- Mention some network applications?
- 3- Explain the application client-server architecture?
- 4- Explain P2P architecture?

Question 4: Answer the following points (10 Marks)

- 1- HTTP is "stateless". What does that mean?
- 2- Compare between persistent HTTP and non-persistent HTTP?
- 3- Give examples of HTTP response status codes?
- 4- Explain the term (web caches) and how it is useful?

Question 5: Answer the following points (10 Marks)

- 1- Give a DNS name resolution example?
- 2- Compare between multiplexing and demultiplexing? Support your answer with a diagram?
- 3- Define and explain the use of ACKs and NAKs?
- 4- Define and explain HOL? Support your answer with a diagram?

جامعة أسيوط	مايو 2018	كود المقرر: 356 رك
كلية العلوم		المقرر : مقدمة فى الحسابات العلمية
قسم الرياضيات		الزمن : ساعتان

Answer the following questions by using MATLAB language: (50 marks)

1- Using Newton's forward difference formula, find $y(0.1)$ using the table below:

x	0.0	0.2	0.4	0.6	0.8
y	1.000	1.22140	1.49182	1.82212	2.22554

2- Solve the differential equation by Adams method (without using nested for loops) at $x=0.2$:

$$\frac{dy}{dt} = t^2 - y, \quad y(0) = 1, \quad h = 0.05.$$

and compare it with the analytic solution $y = -e^{-t} + t^2 - 2t + 2$.

3- Solve the following initial value problem:

$$\frac{d^2u}{dt^2} + 4\frac{du}{dt} + 3u = 0, \quad u(0) = 1, \quad \frac{du}{dt}(0) = 0.$$

4- Let $f(x) = \cos 2x$ and $x_0 = 0$. Determine

a) The third Taylor polynomial for f about x_0 .

b) Find error bound at $x = 0.2$ and compare it to the actual error.

5- For the well-known Chua's circuit equation in chaotic studies that

$$\dot{x} = \alpha[y - x - f(x)], \quad \dot{y} = x - y + z, \quad \dot{z} = -\beta y - \gamma z, \quad t \in (0, 10),$$

where the nonlinear function $f(x)$ is described by

$$f(x) = bx + 0.5(a-b)(|x+1| - |x-1|) \text{ and } a < b < 0.$$

Write an M-function to describe the equation, and draw the phase trajectory for the parameters $\alpha = 9$, $\beta = 100/7$, $\gamma = 0$, $a = -8/7$, $b = -5/7$, and initial conditions

$$x(0) = -2.121304, \quad y(0) = -0.066170, \quad z(0) = 2.881090.$$

Good Luck

Dr. Tarek Aboelenen



امتحان الفرقة الثالثة شعبة الرياضيات

الزمن : ثلاث ساعات

رقم المقرر ورمزه : ١٣٤٦

المقرر : عمليات عشوائية وتطبيقاتها

أجب عن خمسة أسئلة فقط مما يأتي :- درجة جزء كل سؤال (خمس درجات)

١- (أ) لمجموعة المتغيرات العشوائية المستقلة $X_1, X_2, X_3, \dots$ بفرض أن التوقع الرياضي $E(X_i) = m$ والتباين $V(X_i)$ لكل منها محدود عرف كل من التقارب عن طريق الإحتمال وقانون الأعداد الكبرى (الضعيف).
(ب) بفرض أن $f f s s f s f f s s s f f s f f s$ هي إحدى النتائج الممكنة في محاولات برنولي العشوائية المستقلة بحيث أن $P(s) = p, P(f) = q, p + q = 1$ عرف عملية عشوائية في الفراغ R^2 موضحا ذلك بيانيا .

٢- (أ) في عملية برنولي العشوائية $\{X_n; n > 0\}$ بالإحتمال $p = 0.6$ إذا كان $X = X_1 + X_2$ ، $Y = X_1 + X_3$ احسب الإحتمالات الآتية : $P(X < 2, Y \leq 1)$ ، $P(2X < 3Y)$ ، $P(Y = X)$.
(ب) في السؤال (٢-أ) أوجد العزم الارتباطي بين X ، Y موضحا العلاقة بينهما .

٣- (أ) وضح العلاقة بين عملية برنولي العشوائية $\{X_n; n > 0\}$ و العملية العشوائية $\{Y_n; n \geq 0\}$ حيث أن المتغير Y_n يخضع لتوزيع ذي الحدين واذكر صفات كل منهما ثم عبر مع الاستنتاج عن إحتمال الحادث $(Y_{n+1} = k)$ من خلال إحتمالات الحوادث : $(Y_n = k)$ ، $(Y_n = k - 1)$ لأي عدد صحيح $k > 0$.
(ب) في العملية العشوائية $\{Y_n; n \geq 0\}$ أوجد كل من $E(Y_5)$ ، $E(Y_4^2)$ ، $P(Y_5 = 3, Y_7 = 4, Y_{14} = 9)$.

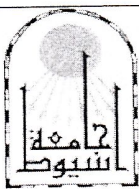
٤- (أ) عرف أزمنة النجاح T_k كعملية عشوائية موضحا العلاقة بينها وبين العملية العشوائية $\{Y_n; n \geq 0\}$ ثم اذكر فقط توزيع المتغير العشوائي T_k .
(ب) - في عملية بواسون العشوائية $\{N_t; t \geq 0\}$ بالمعدل $\lambda = 4$ احسب كل من الإحتمالات الآتية :
 $P(N_{1.5} = 2, N_4 = 5, N_{6.8} = 9)$ ، $P(N_3 = 5, N_7 = 9)$

٥- (أ) في عملية بواسون أو عملية الوصول المعودة $\{N_t; t \geq 0\}$ بالمعدل λ إثبت أن الإحتمال المشروط لعدد الوصول N_t بالنسبة إلى عدد الوصول N_{t+s} لكل $t > 0, s > 0$ يمثل توزيع ذي الحدين .
(ب) عرف العمليات العشوائية المستقلة ثم اثبت أن أي عمليتين مستقلتين لبواسون هو أيضا عملية بواسون .

٦- (أ) في عملية التجديد العشوائية $R = \{R_n; n \in N\}$ حيث N هي فئة الأعداد الصحيحة غير السالبة عرف دالة التجديد ثم عبر عنها من خلال توزيع المتغير R_n مع الاستنتاج .

(ب) في سلسلة ماركوف العشوائية المتقطعة $\{X_n; n \geq 0\}$ عرف مصفوفة الإحتمالات الإنتقالية بصفاتها المعروفة ثم احسب الإحتمال : $P(X_0 = 1, X_1 = 1, X_2 = 0, X_3 = 1, X_4 = 0, X_6 = 0)$ بفرض أن حالات الفراغ $(0, 1)$ والمصفوفة العشوائية

$$P = \begin{pmatrix} 1/2 & 1/2 \\ 1/3 & 2/3 \end{pmatrix} , \text{ ومنتجه الإحتمالات الابتدائية } \pi_0 = (2/5 \quad 3/5)$$

	المقرر: تحليل عددي (٣٢٣) الفرقة: المستوى الثالث الدرجة: ٥٠ درجة التاريخ: ٢٠١٨/٥/٢٩ الزمن: ثلاث ساعات	جامعة أسيوط كلية العلوم - قسم الرياضيات امتحان نهائي الفصل الدراسي الثاني للعام الجامعي ٢٠١٧/٢٠١٨
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Answer five questions only :- (10 marks for every question)

1-a) If the function $g \in C[a, b]$ and $g(x) \in [a, b] \forall x \in [a, b]$ and $g'(x)$ exist with $|g'(x)| \leq k < 1 \forall x \in [a, b]$ prove that the sequence defined by $P_n = g(P_{n-1}), n \geq 1$ will converge to the unique fixed point P and also $|P_{n+1} - P_n| \leq k^n |P_1 - P_0|$.

1-b) Verify that when Newton's method is used to compute $\sqrt{A}, A > 0$ (By solving the equation : $f(x) = x^2 - A$). The sequence of iterates is defined by : $x_{n+1} = (x_n + \frac{A}{x_n})/2$, and show that if the sequence $\{x_n\}$ is defined as the previous problem, then this method is quadratically convergence.

2-a) Derive Lagrange interpolation formula of degree n and write the error of the method.

2-b) For the given function $f(x) = \cos \pi x$ let $x_0 = -1, x_1 = 0, x_2 = 1$ construct the suitable interpolation polynomial and find the actual error.

3) Derive the formula of the Newton's interpolatory divided difference method and use this formula to obtain a polynomial of least degree that fits the values shown:

x	0	1	2	4	6
$f(x)$	1	9	23	93	259

من فضلك انظر خلف الورقة

السؤال الرابع :-

أ) يعرف الطي للدالتين $f(x)$, $g(x)$ كالآتي

$$f * g = \int_{-\infty}^{\infty} f(u) g(x-u) du$$

برهن علي أن تحويل فوريير للطرف الأيمن هو حاصل ضرب تحويل فوريير للدالتين $f(x)$, $g(x)$

ب) أوجد تحويل فوريير للدالة $f(x) = \begin{cases} 1 & |x| < a \\ 0 & |x| > a \end{cases}$ وأرسم $f(x)$ كذلك تحويلها عند $a = 3$ وأوجد

$$\int_{-\infty}^{\infty} \frac{\sin u}{u} du \quad \text{كذلك} \quad \int_{-\infty}^{\infty} \frac{\sin \alpha a \cos \alpha x}{\alpha} d\alpha$$

ج) ترك خيط لانهائي من السكون وكانت أزاحته الابتدائية عن محور x هي $f(x)$ أوجد الإزاحه عند أي زمن .

انتهت الأسئلة مع تمنياتنا بالتوفيق ،،،،

لجنة الممتحنين :- أ.د/ نجاه عبد الرحمن حسين ، أ.د/ فاروق علي السيد



الامتحان النهائي للفصل الدراسي الثاني للعام الجامعي ٢٠١٧/٢٠١٨ م
 للفرقة : الثالثة : الشعبة : الرياضيات التاريخ : ٢٠١٨/٥/٢٤ م

الزمن : ساعتان

الدرجة الكلية : ٥٠ درجة

درجة كل سؤال : ١٧ درجة

أسم المقرر : الطرق الرياضية
 رقم المقرر ورمزه : ٣٣٤ ر

أجب عن ثلاثة أسئلة فقط مما يأتي :-
 السؤال الأول :-

أوجد تحويل لابلاس للمشتقة التفاضلية للدالة $F(t)$ عند نقط الاتصال والانفصال للدالة .

$$\lim_{t \rightarrow 0} F(t) = \lim_{s \rightarrow \infty} s f(s)$$

أبرهن علي أن

$$\lim_{t \rightarrow \infty} F(t) = \lim_{s \rightarrow 0} s f(s)$$

$$\Gamma\left(\frac{1}{2}\right) = \sqrt{\pi}, \quad \int_0^{\infty} \delta(t) dt = 1, \quad L \sin \sqrt{t} = \frac{\sqrt{\pi}}{3} e^{-\frac{1}{4s}} s^{\frac{3}{2}}$$

السؤال الثاني :-

حل المعادلات الآتية :

$$t Y''(t) + Y'(t) + 4t Y(t) = 0, \quad y(0) = 3, y'(0) = 0$$

$$\frac{\partial U}{\partial x} = 2 \frac{\partial U}{\partial t} + U, \quad x > 0, t > 0 \quad U(x, 0) = 6 e^{-3x}$$

$$\int_0^t Y(u) Y(t-u) du = 16 \sin 4t$$

السؤال الثالث :-

(أ) فك الدالة $f(x) = x^2$, $0 < x < 2\pi$ بدلالة متسلسلة فوريير ثم أحسب المجموع

$$1 + \frac{1}{2^2} + \frac{1}{3^2} + \frac{1}{4^2} + \dots$$

(ب) صفيحة علي شكل دائري نصف قطرها الوحدة ووجهيها معزولين ونصف محيطها محفوظ عند درجة حرارة u_1

والآخر عند u_2 أوجد حالة الأتزان الحراري .

من فضلك أنظر بقية الأسئلة خلف الورقة ،،،،،



Answer the following questions (50 marks)

Q1.	Complete the following: (1)..... is a representation of a two-dimensional image as a finite set of digital values, called picture elements or pixels - Common image formats include.....(2).... ,(3)..... ,(4)..... (5)..... creates a Distance tool a draggable, resizable line that measures the distance between its endpoints. (6)..... These are the result of objects that are self-luminous, such as stars and light bulbs. (7).....the resulting output pixel is computed as a sum of products of the pixel values and mask coefficients in the pixel's neighborhood in the original image. - The Sobel operators used to compute edges are(8)..... ,(9)..... - Edge detector should have:(10)..... ,(11)..... - Types of noise are(12)..... ,(13)....	(13 marks)
Q2.	a) Compute Z from the following matlab script (6 marks) <pre> x = [150 10 90;80 50 60;121 160 20] y = [-1 0 1;-2 0 2;-1 0 1] z = imfilter(x,y,'corr') </pre> b) What is the Delta compression and compute the compressed data of the data (6 marks) 220 321 335 211 250 200 233 214 232 212	(12 marks)
Q3.	a) Write the MATLAB code used to: (4 marks) - Read any image then use affine transformation matrix for each of the operations below: - Flip the image right to left - Translation by [25, 15] pixels b) What are the main differences between: (8 marks) - Global thresholding and optimal thresholding. - Raster and vector image . - Interpixel redundancy and Psychovisual redundancy	(12 marks)

(Q5) (i) Assume that U, V are open intervals and let $f : U \rightarrow \mathbb{R}$ and $g : V \rightarrow \mathbb{R}$ be two differentiable functions such that $f(U) \subset V$. Prove that $g \circ f$ is differentiable on U and that $(g \circ f)' = (g' \circ f) \cdot f'$ [5 marks]

(ii) Prove that the function $f(x) := \frac{1}{x}$ is differentiable on $]0, \infty[$ but not uniformly continuous therein. [5 marks]

(Q6) (i) State and prove Rolle's theorem then use it to prove the mean value theorem. [6 marks]

(ii) Let I be an open interval. Apply the mean value theorem to prove that a function differentiable on I is

1. increasing if and only if $f' \geq 0$ on I ,

2. decreasing if and only if $f' \leq 0$ on I .

[4 marks]

With the best of luck,

Prof. Rashwan A. Rashwan,

Dr. Ahmed A. Abdelhakim



Time: 3 hours

Total mark: 50

Answer *only five* of the following questions:

(Q1) (i) Suppose that O_i , $i \geq 1$, are open subsets of $\mathbb{R}$. Prove that $\cup_{i \geq 1} O_i$ is also open in $\mathbb{R}$. [5 marks]

(ii) Let $S \subset \mathbb{R}$. Show that S is closed if and only if S contains the limit point of every convergent sequence of elements of S . [5 marks]

(Q2) (i) Prove that a sequence of real numbers converges if and only if it is a Cauchy sequence. [6 marks]

(ii) Show that if $(x_n)_{n \geq 1} \subset \mathbb{R}$ is a monotonically increasing sequence that is bounded above, then $x_n \rightarrow \sup_{n \geq 1} x_n$, as $n \rightarrow \infty$. [4 marks]

(Q3) (i) Show that $f : D \subset \mathbb{R} \rightarrow \mathbb{R}$ is continuous at $x_0 \in D$ if and only if the sequence $(f(x_n))_{n \geq 1}$ converges to $f(x_0)$ whenever $(x_n)_{n \geq 1}$ is a sequence in D that converges to x_0 . [6 marks]

(ii) Use the characterization given in (i) to prove the discontinuity at the origin of the function $f(x) = \begin{cases} \cos \frac{1}{x}, & x \neq 0; \\ 0, & x = 0. \end{cases}$ [4 marks]

(Q4) (i) Assume that D is a closed bounded subset of $\mathbb{R}$. Prove that if $f : D \rightarrow \mathbb{R}$ is continuous then f is bounded on D , and there exist $\alpha, \beta \in D$ such that $f(\alpha) = \max_{x \in D} f(x)$ and $f(\beta) = \min_{x \in D} f(x)$. [5 marks]

(ii) Argue by contradiction to demonstrate that if $f : [a, b] \rightarrow \mathbb{R}$ is continuous then it is uniformly continuous on $[a, b]$. [5 marks]

Please Turn over the page



أجب عن أسئلة الآتية :- (كل سؤال ١٠ درجات)

(١) (أ) أثبت قاعدة التضعيف لدالة جاما $\sqrt{\pi} \Gamma(2x) = 2^{2x-1} \Gamma(x) \Gamma\left(x + \frac{1}{2}\right), x > 0$

ثم استخدمها فى إثبات أن: $\Gamma\left(\frac{5}{6}\right) \left[\Gamma\left(\frac{1}{3}\right)\right]^2 = 2 \sqrt[3]{2} \sqrt{\frac{\pi^3}{3}}$

(ب) باستخدام دوال جاما و بيتا أوجد التكاملات الآتية: (i) $\int_0^{\frac{\pi}{2}} \sqrt{\tan \theta} d\theta$ (ii) $\int_0^{\infty} \frac{\sqrt{x}}{e^{x^3}} dx$

(٢) (أ) أثبت أن: $\Gamma(x) \Gamma(1-x) = \frac{\pi}{\sin \pi x}, 0 < x < 1$ ومن ثم أثبت أن

$$\Gamma\left(x + \frac{1}{2}\right) \Gamma\left(\frac{1}{2} - x\right) = \frac{\pi}{\cos \pi x}$$

(ب) أثبت أن:

(i) $\sqrt{1-x^2} T_n(x) = U_{n+1}(x) - x U_n(x),$

(ii) $(1-x^2) U'_n(x) = -n x U_n(x) + n U_{n-1}(x)$

(٣) أثبت أن:

(i) ${}_2F_1(\alpha, \beta; \gamma, x) = (1-x)^{-\beta} {}_2F_1\left(\gamma - \alpha, \beta; \gamma, \frac{x}{x-1}\right)$

(ii) ${}_1F_1\left(\frac{1}{2}; \frac{3}{2}, -x^2\right) = \frac{\sqrt{\pi}}{2x} \operatorname{erf}(x)$ حيث أن: $\operatorname{erf}(x) = \frac{2}{\sqrt{\pi}} \int_0^x e^{-t^2} dt$ هى دالة الخطأ

(iii) ${}_1F_1(\alpha + 1; \gamma, x) - {}_1F_1(\alpha; \gamma, x) - \frac{x}{\gamma} {}_1F_1(\alpha + 1; \gamma + 1, x) = 0$

(٤) (أ) أوجد مفكوك ليجندر للدالة: $f(x) = x^3$

(ب) أثبت أن: $H_n(x) = (-1)^n e^{x^2} \frac{d^n}{dx^n} (e^{-x^2})$ حيث $H_n(x)$ كثيرة حدود هيرميت.

(ج) أثبت أن: $J_{\frac{1}{2}}(x) = \sqrt{\frac{2}{\pi}} \frac{\sin x}{\sqrt{x}}$

(٥) (أ) باستخدام الصيغة التكاملية لدوال بسل أثبت أن: $\int_0^{\infty} e^{-3x} J_0(4x) dx = \frac{1}{5}$

(ب) أوجد الحل العام لمعادلة بسل التفاضلية:

$$x^2 \frac{d^2 y}{dx^2} + x \frac{dy}{dx} + (x^2 - n^2)y = 0$$

CS12	CS11	CS10	Description
0	0	0	No clock source (Timer/Counter stopped).
0	0	1	clk _{IO} /1 (No prescaling)
0	1	0	clk _{IO} /8 (From prescaler)
0	1	1	clk _{IO} /64 (From prescaler)
1	0	0	clk _{IO} /256 (From prescaler)
1	0	1	clk _{IO} /1024 (From prescaler)
1	1	0	External clock source on T1 pin. Clock on falling edge.
1	1	1	External clock source on T1 pin. Clock on rising edge.

Timer/Counter1 – TCNT1H and TCNT1L

Bit	7	6	5	4	3	2	1	0	
	TCNT1[15:8]								TCNT1H
	TCNT1[7:0]								TCNT1L
Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

Output Compare Register 1 B – OCR1BH and OCR1BL

Bit	7	6	5	4	3	2	1	0	
	OCR1B[15:8]								OCR1BH
	OCR1B[7:0]								OCR1BL
Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

Input Capture Register 1 – ICR1H and ICR1L

Bit	7	6	5	4	3	2	1	0	
	ICR1[15:8]								ICR1H
	ICR1[7:0]								ICR1L
Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

Timer/Counter Interrupt Mask Register – TIMSK⁽¹⁾

Bit	7	6	5	4	3	2	1	0	
	OCIE2	OCIE1	OCIE1A	OCIE1B	TOIE1	OCIE0	TOIE0		TIMSK
Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

- Bit 5 – OCIE1: Timer/Counter1, Input Capture Interrupt Enable
 Bit 4 – OCIE1A: Timer/Counter1, Output Compare A Match Interrupt Enable
 Bit 3 – OCIE1B: Timer/Counter1, Output Compare B Match Interrupt Enable
 Bit 2 – TOIE1: Timer/Counter1, Overflow Interrupt Enable

Timer/Counter Interrupt Flag Register – TIFR

Bit	7	6	5	4	3	2	1	0	
	OCF2	TOV2	ICF1	OCF1A	OCF1B	TOV1	OCF0	TOV0	TIFR
Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

- Bit 5 – ICF1: Timer/Counter1, Input Capture Flag
 Bit 4 – OCF1A: Timer/Counter1, Output Compare A Match Flag
 Bit 3 – OCF1B: Timer/Counter1, Output Compare B Match Flag
 Bit 2 – TOV1: Timer/Counter1, Overflow Flag

USART

Operating Mode	Equation for Calculating Baud Rate ⁽¹⁾	Equation for Calculating UBRR Value
Asynchronous Normal Mode (U2X = 0)	$BAUD = \frac{f_{osc}}{16(UBRR + 1)}$	$UBRR = \frac{f_{osc}}{16BAUD} - 1$
Asynchronous Double Speed Mode (U2X = 1)	$BAUD = \frac{f_{osc}}{8(UBRR + 1)}$	$UBRR = \frac{f_{osc}}{8BAUD} - 1$
Synchronous Master Mode	$BAUD = \frac{f_{osc}}{2(UBRR + 1)}$	$UBRR = \frac{f_{osc}}{2BAUD} - 1$

USART I/O Data Register – UDR

Bit	7	6	5	4	3	2	1	0	
	RXB[7:0]								UDR (Read)
	TXB[7:0]								UDR (Write)
Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

Timer/Counter
Interrupt Mask
Register – TIMSK

Bit	7	6	5	4	3	2	1	0	
	OCIE2	TOIE2	OCIE1	OCIE1A	OCIE1B	TOIE1	OCIE0	TOIE0	TIMSK
Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

Bit 1 – OCIE0: Timer/Counter0 Output Compare Match Interrupt Enable
Bit 0 – TOIE0: Timer/Counter0 Overflow Interrupt Enable

Timer/Counter
Interrupt Flag Register
– TIFR

Bit	7	6	5	4	3	2	1	0	
	OCF2	TOV2	ICF1	OCF1A	OCF1B	TOV1	OCF0	TOV0	TIFR
Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

Bit 1 – OCF0: Output Compare Flag 0
Bit 0 – TOV0: Timer/Counter0 Overflow Flag

Timer/Counter1
Control Register A –
TCCR1A

Bit	7	6	5	4	3	2	1	0	
	COM1A1	COM1A0	COM1B1	COM1B0	FOC1A	FOC1B	WGM11	WGM10	TCCR1A
Read/Write	R/W	R/W	R/W	R/W	W	W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

Bit 7:6 – COM1A1:0: Compare Output Mode for Compare unit A
Bit 5:4 – COM1B1:0: Compare Output Mode for Compare unit B
Bit 3 – FOC1A: Force Output Compare for Compare unit A
Bit 2 – FOC1B: Force Output Compare for Compare unit B
Bit 1:0 – WGM11:0: Waveform Generation Mode

CS02	CS01	CS00	Description
0	0	0	No clock source (Timer/Counter stopped).
0	0	1	$clk_{IO}/1$ (No prescaling)
0	1	0	$clk_{IO}/8$ (From prescaler)
0	1	1	$clk_{IO}/64$ (From prescaler)
1	0	0	$clk_{IO}/256$ (From prescaler)
1	0	1	$clk_{IO}/1024$ (From prescaler)
1	1	0	External clock source on T0 pin, Clock on falling edge.
1	1	1	External clock source on T0 pin, Clock on rising edge.

COM1A1/COM1B1	COM1A0/COM1B0	Description
0	0	Normal port operation, OC1A/OC1B disconnected.
0	1	Toggle OC1A/OC1B on compare match
1	0	Clear OC1A/OC1B on compare match (Set output to low level)
1	1	Set OC1A/OC1B on compare match (Set output to high level)

Mode	WGM13	WGM12 (CTC1)	WGM11 (PWM11)	WGM10 (PWM10)	Timer/Counter Mode of Operation	TOP	Update of OCR1x	TOV1 Flag Set on
0	0	0	0	0	Normal	0xFFFF	Immediate	MAX
1	0	0	0	1	PWM, Phase Correct, 8-bit	0x00FF	TOP	BOTTOM
2	0	0	1	0	PWM, Phase Correct, 9-bit	0x01FF	TOP	BOTTOM
3	0	0	1	1	PWM, Phase Correct, 10-bit	0x03FF	TOP	BOTTOM
4	0	1	0	0	CTC	OCR1A	Immediate	MAX
5	0	1	0	1	Fast PWM, 8-bit	0x00FF	BOTTOM	TOP
6	0	1	1	0	Fast PWM, 9-bit	0x01FF	BOTTOM	TOP
7	0	1	1	1	Fast PWM, 10-bit	0x03FF	BOTTOM	TOP
8	1	0	0	0	PWM, Phase and Frequency Correct	ICR1	BOTTOM	BOTTOM
9	1	0	0	1	PWM, Phase and Frequency Correct	OCR1A	BOTTOM	BOTTOM
10	1	0	1	0	PWM, Phase Correct	ICR1	TOP	BOTTOM
11	1	0	1	1	PWM, Phase Correct	OCR1A	TOP	BOTTOM
12	1	1	0	0	CTC	ICR1	Immediate	MAX
13	1	1	0	1	Reserved	–	–	–
14	1	1	1	0	Fast PWM	ICR1	BOTTOM	TOP
15	1	1	1	1	Fast PWM	OCR1A	BOTTOM	TOP

Timer/Counter1
Control Register B –
TCCR1B

Bit	7	6	5	4	3	2	1	0	
	ICNC1	ICES1	–	WGM13	WGM12	CS12	CS11	CS10	TCCR1B
Read/Write	R/W	R/W	R	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

Bit 7 – ICNC1: Input Capture Noise Canceler
Bit 6 – ICES1: Input Capture Edge Select
Bit 5 – Reserved Bit
Bit 4:3 – WGM13:2: Waveform Generation Mode
Bit 2:0 – CS12:0: Clock Select

CS12	CS11	CS10	Description
0	0	0	No clock source (Timer/Counter stopped).
0	0	1	$clk_{IO}/1$ (No prescaling)
0	1	0	$clk_{IO}/8$ (From prescaler)
0	1	1	$clk_{IO}/64$ (From prescaler)
1	0	0	$clk_{IO}/256$ (From prescaler)
1	0	1	$clk_{IO}/1024$ (From prescaler)
1	1	0	External clock source on T1 pin. Clock on falling edge.
1	1	1	External clock source on T1 pin. Clock on rising edge.

Timer/Counter1 – TCNT1H and TCNT1L

Bit	7	6	5	4	3	2	1	0	
	TCNT1[15:8]								TCNT1H
	TCNT1[7:0]								TCNT1L
Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

Output Compare Register 1 B – OCR1BH and OCR1BL

Bit	7	6	5	4	3	2	1	0	
	OCR1B[15:8]								OCR1BH
	OCR1B[7:0]								OCR1BL
Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

Input Capture Register 1 – ICR1H and ICR1L

Bit	7	6	5	4	3	2	1	0	
	ICR1[15:8]								ICR1H
	ICR1[7:0]								ICR1L
Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

Timer/Counter Interrupt Mask Register – TIMSK⁽¹⁾

Bit	7	6	5	4	3	2	1	0	
	OCIE2	TOIE2	TICIE1	OCIE1A	OCIE1B	TOIE1	OCIE0	TOIE0	TIMSK
Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

Bit 5 – TICIE1: Timer/Counter1, Input Capture Interrupt Enable

Bit 4 – OCIE1A: Timer/Counter1, Output Compare A Match Interrupt Enable

Bit 3 – OCIE1B: Timer/Counter1, Output Compare B Match Interrupt Enable

Bit 2 – TOIE1: Timer/Counter1, Overflow Interrupt Enable

Timer/Counter Interrupt Flag Register – TIFR

Bit	7	6	5	4	3	2	1	0	
	OCF2	TOV2	ICF1	OCF1A	OCF1B	TOV1	OCF0	TOV0	TIFR
Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

Bit 5 – ICF1: Timer/Counter1, Input Capture Flag

Bit 4 – OCF1A: Timer/Counter1, Output Compare A Match Flag

Bit 3 – OCF1B: Timer/Counter1, Output Compare B Match Flag

Bit 2 – TOV1: Timer/Counter1, Overflow Flag

USART

Operating Mode	Equation for Calculating Baud Rate ⁽¹⁾	Equation for Calculating UBRR Value
Asynchronous Normal Mode (U2X = 0)	$BAUD = \frac{f_{osc}}{16(UBRR + 1)}$	$UBRR = \frac{f_{osc}}{16BAUD} - 1$
Asynchronous Double Speed Mode (U2X = 1)	$BAUD = \frac{f_{osc}}{8(UBRR + 1)}$	$UBRR = \frac{f_{osc}}{8BAUD} - 1$
Synchronous Master Mode	$BAUD = \frac{f_{osc}}{2(UBRR + 1)}$	$UBRR = \frac{f_{osc}}{2BAUD} - 1$

USART I/O Data Register – UDR

Bit	7	6	5	4	3	2	1	0	
	RXB[7:0]								UDR (Read)
	TXB[7:0]								UDR (Write)
Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

USART Control and Status Register A – UCSRA

Bit	7	6	5	4	3	2	1	0	
	RXC	TXC	UDRE	FE	DOR	PE	U2X	MPCM	UCSRA
Read/Write	R	R/W	R	R	R	R	R/W	R/W	
Initial Value	0	0	1	0	0	0	0	0	

- Bit 7 – RXC: USART Receive Complete
- Bit 6 – TXC: USART Transmit Complete
- Bit 5 – UDRE: USART Data Register Empty
- Bit 4 – FE: Frame Error
- Bit 3 – DOR: Data OverRun
- Bit 2 – PE: Parity Error
- Bit 1 – U2X: Double the USART Transmission Speed
- Bit 0 – MPCM: Multi-processor Communication Mode

USART Control and Status Register B – UCSRB

Bit	7	6	5	4	3	2	1	0	
	RXCIE	TXCIE	UDRIE	RXEN	TXEN	UCSZ2	RXB8	TXB8	UCSRB
Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R	R/W	
Initial Value	0	0	0	0	0	0	0	0	

- Bit 7 – RXCIE: RX Complete Interrupt Enable
- Bit 6 – TXCIE: TX Complete Interrupt Enable
- Bit 5 – UDRIE: USART Data Register Empty Interrupt Enable
- Bit 4 – RXEN: Receiver Enable
- Bit 3 – TXEN: Transmitter Enable
- Bit 2 – UCSZ2: Character Size
- Bit 1 – RXB8: Receive Data Bit 8
- Bit 0 – TXB8: Transmit Data Bit 8

USART Control and Status Register C – UCSRC

Bit	7	6	5	4	3	2	1	0	
	URSEL	UMSEL	UPM1	UPM0	USBS	UCSZ1	UCSZ0	UCPOL	UCSRC
Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	
Initial Value	1	0	0	0	0	1	1	0	

- Bit 7 – URSEL: Register Select
- Bit 6 – UMSEL: USART Mode Select
- Bit 5:4 – UPM1:0: Parity Mode
- Bit 3 – USBS: Stop Bit Select
- Bit 2:1 – UCSZ1:0: Character Size
- Bit 0 – UCPOL: Clock Polarity

UMSEL	Mode
0	Asynchronous Operation
1	Synchronous Operation

USBS	Stop Bit(s)
0	1-bit
1	2-bit

UPM1	UPM0	Parity Mode
0	0	Disabled
0	1	Reserved
1	0	Enabled, Even Parity
1	1	Enabled, Odd Parity

UCPOL	Transmitted Data Changed (Output of TxD Pin)	Received Data Sampled (Input on RxD Pin)
0	Rising XCK Edge	Falling XCK Edge
1	Falling XCK Edge	Rising XCK Edge

Table 66. UCSZ Bits Settings

UCSZ2	UCSZ1	UCSZ0	Character Size
0	0	0	5-bit
0	0	1	6-bit
0	1	0	7-bit
0	1	1	8-bit
1	0	0	Reserved
1	0	1	Reserved
1	1	0	Reserved
1	1	1	9-bit

USART Baud Rate Registers – UBRRL and UBRRH

Bit	15	14	13	12	11	10	9	8	
	URSEL	-	-	-	-	UBRR[11:9]	-	-	UBRRH
	-	-	-	-	-	UBRR[7:0]	-	-	UBRRH
	-	-	-	-	-	-	-	-	UBRRH
Read/Write	R/W	R	R	R	R/W	R/W	R/W	R/W	
	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	



Operation Research326 R

11-5-2018

Third Level: Computer Science Section

Time: 3 hours

Total Degree (50 marks)

Science Faculty

Mathematical Department

Answer the following Questions:

1-Use the Simplex method to solve the following linear programming

Maximize $Z = 10x_1 + 11x_2$

Subject to $x_1 + 2x_2 \leq 150$, $3x_1 + 4x_2 \leq 200$, $6x_1 + x_2 \leq 175$

and $x_1, x_2 \geq 0$

(10 marks)

2) Use the graphical and the algebraic method to solve the problem

Max $f(\underline{x}) = 5x_1 + 7x_2$ Subject to $5x_1 + 8x_2 \leq 24$, $x_1 + x_2 \leq 4$,

$10x_1 + 7x_2 \leq 35$ and $x_1, x_2 \geq 0$

(12.5marks)

3) Use the Lagrange multiplier method to find the extreme points of the problem

Minimize $f(\underline{x}) = x_1^2 + x_2^2 - 3x_1x_2$

Subject to $g(\underline{x}) = x_1^2 + x_2^2 - 8 = 0$.

(12.5marks)

4) Use the Hessian Matrix to find the local points of the problem

$f(\underline{x}) = f(x_1, x_2) = x_1^3 + x_2^3 + 2x_1^2 + 4x_2^2 + 6$

(10marks)

5) Find the local Points

$f(x) = 3x^4 - 20x^3 + 36x^2 + 16$ (5marks)

Best Wishes

Dr. Alaa Fahim

(XCK/T0) PB0	1	40	PA0 (ADC0)
(T1) PB1	2	39	PA1 (ADC1)
(INT2/AIN0) PB2	3	38	PA2 (ADC2)
(OC0/AIN1) PB3	4	37	PA3 (ADC3)
(SS) PB4	5	36	PA4 (ADC4)
(MOSI) PB5	6	35	PA5 (ADC5)
(MISO) PB6	7	34	PA6 (ADC6)
(SCK) PB7	8	33	PA7 (ADC7)
RESET	9	32	AREF
VCC	10	31	GND
GND	11	30	AVCC
XTAL2	12	29	PC7 (TOSC2)
XTAL1	13	28	PC6 (TOSC1)
(RXD) PD0	14	27	PC5 (TDI)
(TXD) PD1	15	26	PC4 (TDO)
(INT0) PD2	16	25	PC3 (TMS)
(INT1) PD3	17	24	PC2 (TCK)
(OC1B) PD4	18	23	PC1 (SDA)
(OC1A) PD5	19	22	PC0 (SCL)
(ICP1) PD6	20	21	PD7 (OC2)

Status Register

Bit	7	6	5	4	3	2	1	0	
	I	T	H	S	V	N	Z	C	SREG
Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

Bit 7 – I: Global Interrupt Enable
 Bit 6 – T: Bit Copy Storage
 Bit 5 – H: Half Carry Flag
 Bit 4 – S: Sign Bit, $S = N \oplus V$

Bit 3 – V: Two's Complement Overflow Flag
 Bit 2 – N: Negative Flag
 Bit 1 – Z: Zero Flag

The EEPROM Address Register – EEARH and EEARL

Bit	15	14	13	12	11	10	9	8	
	–	–	–	–	–	–	EEAR9	EEAR8	EEARH
	EEAR7	EEAR6	EEAR5	EEAR4	EEAR3	EEAR2	EEAR1	EEAR0	EEARL
Read/Write	R	R	R	R	R	R	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	X	

The EEPROM Data Register – EEDR

Bit	7	6	5	4	3	2	1	0	
	MSB							LSB	EEDR
Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

The EEPROM Control Register – EECR

Bit	7	6	5	4	3	2	1	0	
	–	–	–	–	EERIE	EEMWE	EEWE	EERE	EECR
Read/Write	R	R	R	R	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	X	0	

Bit 3 – EERIE: EEPROM Ready Interrupt Enable
 Bit 2 – EEMWE: EEPROM Master Write Enable

Bit 1 – EEWE: EEPROM Write Enable
 Bit 0 – EERE: EEPROM Read Enable

Interrupts

MCU Control Register – MCUCR

The MCU Control Register contains control bits for interrupt sense control and general MCU functions.

Bit	7	6	5	4	3	2	1	0	
	SE	SM2	SM1	SM0	ISC11	ISC10	ISC01	ISC00	MCUCR
Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

Bit 3, 2 – ISC11, ISC10: Interrupt Sense Control 1 Bit 1 and Bit 0

Bit 1, 0 – ISC01, ISC00: Interrupt Sense Control 0 Bit 1 and Bit 0

ISC11	ISC10	Description
0	0	The low level of INT1 generates an interrupt request.
0	1	Any logical change on INT1 generates an interrupt request.
1	0	The falling edge of INT1 generates an interrupt request.
1	1	The rising edge of INT1 generates an interrupt request.

ISC01	ISC00	Description
0	0	The low level of INT0 generates an interrupt request.
0	1	Any logical change on INT0 generates an interrupt request.
1	0	The falling edge of INT0 generates an interrupt request.
1	1	The rising edge of INT0 generates an interrupt request.

MCU Control and Status Register – MCUCSR

Bit	7	6	5	4	3	2	1	0	
	JTD	ISC2	–	JTRF	WDRF	BORF	EXTRF	PORF	MCUCSR
Read/Write	R/W	R/W	R	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0						See Bit Description

Bit 6 – ISC2: Interrupt Sense Control 2

General Interrupt Control Register – GICR

Bit	7	6	5	4	3	2	1	0	
	INT1	INT0	INT2	–	–	–	IVSEL	IVCE	GICR
Read/Write	R/W	R/W	R/W	R	R	R	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

Bit 7 – INT1: External Interrupt Request 1 Enable

Bit 5 – INT2: External Interrupt Request 2 Enable

Bit 6 – INT0: External Interrupt Request 0 Enable

General Interrupt Flag Register – GIFR

Bit	7	6	5	4	3	2	1	0	
	INTF1	INTF0	INTF2	–	–	–	–	–	GIFR
Read/Write	R/W	R/W	R/W	R	R	R	R	R	
Initial Value	0	0	0	0	0	0	0	0	

Bit 7 – INTF1: External Interrupt Flag 1

Bit 5 – INTF2: External Interrupt Flag 2

Bit 6 – INTF0: External Interrupt Flag 0

Port A Data Register – PORTA

Bit	7	6	5	4	3	2	1	0	
	PORTA7	PORTA6	PORTA5	PORTA4	PORTA3	PORTA2	PORTA1	PORTA0	PORTA
Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

Port A Data Direction Register – DDRA

Bit	7	6	5	4	3	2	1	0	
	DDA7	DDA6	DDA5	DDA4	DDA3	DDA2	DDA1	DDA0	DDRA
Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

Port A Input Pins Address – PINA

Bit	7	6	5	4	3	2	1	0	
	PINA7	PINA6	PINA5	PINA4	PINA3	PINA2	PINA1	PINA0	PINA
Read/Write	R	R	R	R	R	R	R	R	
Initial Value	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	

Time/Counter Control Register – TCCR0

Bit	7	6	5	4	3	2	1	0	
	FOC0	WGM00	COM01	COM00	WGM01	CS02	CS01	CS00	TCCR0
Read/Write	W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

Bit 7 – FOC0: Force Output Compare

Bit 5:4 – COM01:0: Compare Match Output Mode

Bit 6, 3 – WGM01:0: Waveform Generation Mode

Bit 2:0 – CS02:0: Clock Select

Mode	WGM01 (CTC0)	WGM00 (PWM0)	Timer/Counter Mode of Operation	TOP	Update of OCR0	TOV0 Flag Set-on	COM01	COM00	Description
0	0	0	Normal	0xFF	Immediate	MAX	0	0	Normal port operation, OC0 disconnected.
1	0	1	PWM, Phase Correct	0xFF	TOP	BOTTOM	0	1	Toggle OC0 on compare match
2	1	0	CTC	OCR0	Immediate	MAX	1	0	Clear OC0 on compare match
3	1	1	Fast PWM	0xFF	BOTTOM	MAX	1	1	Set OC0 on compare match

Timer/Counter Register – TCNT0

Bit	7	6	5	4	3	2	1	0	
	TCNT0[7:0]								TCNT0
Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

Output Compare Register – OCR0

Bit	7	6	5	4	3	2	1	0	
	OCR0[7:0]								OCR0
Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

Timer/Counter
Interrupt Mask
Register – TIMSK

Bit	7	6	5	4	3	2	1	0	
	OCIE2	TOIE2	OCIE1	OCIE1A	OCIE1B	TOIE1	OCIE0	TOIE0	TIMSK
Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

Bit 1 – OCIE0: Timer/Counter0 Output Compare Match Interrupt Enable
Bit 0 – TOIE0: Timer/Counter0 Overflow Interrupt Enable

Timer/Counter
Interrupt Flag Register
– TIFR

Bit	7	6	5	4	3	2	1	0	
	OCF2	TOV2	ICF1	OCF1A	OCF1B	TOV1	OCF0	TOV0	TIFR
Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

Bit 1 – OCF0: Output Compare Flag 0
Bit 0 – TOV0: Timer/Counter0 Overflow Flag

Timer/Counter1
Control Register A –
TCCR1A

Bit	7	6	5	4	3	2	1	0	
	COM1A1	COM1A0	COM1B1	COM1B0	FOC1A	FOC1B	WGM11	WGM10	TCCR1A
Read/Write	R/W	R/W	R/W	R/W	W	W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

Bit 7:6 – COM1A1:0: Compare Output Mode for Compare unit A
Bit 5:4 – COM1B1:0: Compare Output Mode for Compare unit B
Bit 3 – FOC1A: Force Output Compare for Compare unit A
Bit 2 – FOC1B: Force Output Compare for Compare unit B
Bit 1:0 – WGM11:0: Waveform Generation Mode

CS02	CS01	CS00	Description
0	0	0	No clock source (Timer/Counter stopped).
0	0	1	clk_{rcy} (No prescaling)
0	1	0	$clk_{rcy}/8$ (From prescaler)
0	1	1	$clk_{rcy}/64$ (From prescaler)
1	0	0	$clk_{rcy}/256$ (From prescaler)
1	0	1	$clk_{rcy}/1024$ (From prescaler)
1	1	0	External clock source on T0 pin. Clock on falling edge.
1	1	1	External clock source on T0 pin. Clock on rising edge.

COM1A1/COM1B1	COM1A0/COM1B0	Description
0	0	Normal port operation, OC1A/OC1B disconnected.
0	1	Toggle OC1A/OC1B on compare match
1	0	Clear OC1A/OC1B on compare match (Set output to low level)
1	1	Set OC1A/OC1B on compare match (Set output to high level)

Mode	WGM13	WGM12 (CTC1)	WGM11 (PWM11)	WGM10 (PWM10)	Timer/Counter Mode of Operation	TOP	Update of OCR1x	TOV1 Flag Set on
0	0	0	0	0	Normal	0xFFFF	Immediate	MAX
1	0	0	0	1	PWM, Phase Correct, 8-bit	0x00FF	TOP	BOTTOM
2	0	0	1	0	PWM, Phase Correct, 9-bit	0x01FF	TOP	BOTTOM
3	0	0	1	1	PWM, Phase Correct, 10-bit	0x03FF	TOP	BOTTOM
4	0	1	0	0	CTC	OCR1A	Immediate	MAX
5	0	1	0	1	Fast PWM, 8-bit	0x00FF	BOTTOM	TOP
6	0	1	1	0	Fast PWM, 9-bit	0x01FF	BOTTOM	TOP
7	0	1	1	1	Fast PWM, 10-bit	0x03FF	BOTTOM	TOP
8	1	0	0	0	PWM, Phase and Frequency Correct	ICR1	BOTTOM	BOTTOM
9	1	0	0	1	PWM, Phase and Frequency Correct	OCR1A	BOTTOM	BOTTOM
10	1	0	1	0	PWM, Phase Correct	ICR1	TOP	BOTTOM
11	1	0	1	1	PWM, Phase Correct	OCR1A	TOP	BOTTOM
12	1	1	0	0	CTC	ICR1	Immediate	MAX
13	1	1	0	1	Reserved	–	–	–
14	1	1	1	0	Fast PWM	ICR1	BOTTOM	TOP
15	1	1	1	1	Fast PWM	OCR1A	BOTTOM	TOP

Timer/Counter1
Control Register B –
TCCR1B

Bit	7	6	5	4	3	2	1	0	
	ICNC1	ICES1	–	WGM13	WGM12	CS12	CS11	CS10	TCCR1B
Read/Write	R/W	R/W	R	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

Bit 7 – ICNC1: Input Capture Noise Canceler
Bit 6 – ICES1: Input Capture Edge Select
Bit 5 – Reserved Bit
Bit 4:3 – WGM13:2: Waveform Generation Mode
Bit 2:0 – CS12:0: Clock Select



Operation Research326 R

11-5-2018

Third Level: Computer Science Section

Time: 3 hours

Total Degree (50 marks)

Science Faculty

Mathematical Department

Answer the following Questions:

1-Use the Simplex method to solve the following linear programming

Maximize $Z = 10x_1 + 11x_2$

Subject to $x_1 + 2x_2 \leq 150$, $3x_1 + 4x_2 \leq 200$, $6x_1 + x_2 \leq 175$

and $x_1, x_2 \geq 0$

(10 marks)

2) Use the graphical and the algebraic method to solve the problem

Max $f(\underline{x}) = 5x_1 + 7x_2$ Subject to $5x_1 + 8x_2 \leq 24$, $x_1 + x_2 \leq 4$,

$10x_1 + 7x_2 \leq 35$ and $x_1, x_2 \geq 0$

(12.5marks)

3) Use the Lagrange multiplier method to find the extreme points of the problem

Minimize $f(\underline{x}) = x_1^2 + x_2^2 - 3x_1x_2$

Subject to $g(\underline{x}) = x_1^2 + x_2^2 - 8 = 0$.

(12.5marks)

4) Use the Hessian Matrix to find the local points of the problem

$f(\underline{x}) = f(x_1, x_2) = x_1^3 + x_2^3 + 2x_1^2 + 4x_2^2 + 6$

(10marks)

5) Find the local Points

$f(x) = 3x^4 - 20x^3 + 36x^2 + 16$ (5marks)

Best Wishes

Dr. Alaa Fahim

اجب عن خمسة فقط من الاسئلة الاتية :- (10 درجات لكل سؤال : بواقع 5 درجات لكل فقرة)

(1) (i) اوجد الحل العام للمعادلة : $p_1 + 3p_2 + 2p_3(1 + \sqrt{x_1 + x_2 + x_3 - u}) = 6$
(ii) اوجد الحل الخاص للمعادلة : $(y - z)[2xyp + (x^2 - y^2)q] + z(x^2 - y^2) = 0$
الذي يمر خلال المنحنى $y = 0, x^3 = z^2$

(2) اوجد الحل العام لكل من المعادلتين التفاضليتين الجزئيتين الاتيتين :-
(i) $(D_1^3 - D_1^2 D_2 - D_1 D_2^2 + D_2^3)z = \log(x + y)$
(ii) $(D_1^2 - a^2 D_2^2)z = x^2 + y^2$, ثابت مطلق a

(3) اوجد الحل العام لكل من المعادلتين التفاضليتين الجزئيتين الاتيتين :-
(i) $(D_1^2 D_2 + D_2^2 - 2)z = e^{2y} \sin 3x - e^x \cos 2y$
(ii) $(D_1^2 - D_2^2 - D_1 - 3D_2 - 2)z = e^{2x-3y} + x + y + 1$

(4) (i) احسب التكاملات الاتية :-
(a) $\int_0^{\infty} x^{-\frac{1}{3}}(1 + 2x)^{-3} dx$ (b) $\int_0^1 \sqrt{\log \frac{1}{x}} dx$

(ii) اثبت ان :-
(a) $\tan^{-1} x = x {}_2F_1(1, \frac{1}{2}; \frac{3}{2}; -x^2)$
(b) $(a - b) {}_2F_1(a, b; c; x) = a {}_2F_1(a + 1, b; c; x) - b {}_2F_1(a, b + 1; c; x)$

(5) اثبت ان دوال بسل من النوع الاول $J_n(x)$ تحقق الاتي :-
(i) $J_{-\frac{1}{2}}(x) = \sqrt{\frac{2}{\pi x}} \cos x$, (ii) $\int x^n J_{n-1}(x) dx = x^n J_n(x) + c$

(6) (i) اثبت ان كثيرات حدود لجندر $P_n(x)$ تحقق :-
(ii) احسب التكاملات الاتية :-
(a) $\int_{-1}^1 x P_n(x) P_{n+1}(x) dx$, (b) $\int_{-1}^1 x^2 P_n(x) P_{n+1}(x) dx$, (c) $\int_{-1}^1 x^2 P_n(x) dx$

	Assiut University Faculty of Science Mathematics Dept.	Final Exam 2017-2018 Course: Mathematical and Statistical Packages Course code: MC300	Date: 14/5/2018 Level: Three Time: 2 Hours	
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Question 1: Put True or False for each of the following items (30 marks)

1. To enter a formula into a cell, begin by typing an equal sign.
2. Functions are pre-defined worksheet formulas.
3. Formulas in Excel must be written in a very specific format, referred to as syntax.
4. The second order of precedence is for exponentiation.
5. When the formula in cell **B7 =B4+B5+B6** is copied into cell **C7** the formula will be changed to **= C4+C5+C6**.
6. The error "#####" means Data being referenced is not available.
7. The range **B2:B7** is a range down a column.
8. To keep things clear and simple only add an absolute (\$) cell reference if absolutely necessary.
9. The formula **=ROUND(78.686788,-1)** results in the value 80 .
10. Placing an absolute sign in front of a ranged name (**\$budget**) is incorrect syntax.
11. The columns of the worksheet are named with Numbers.
12. Cells may contain only Labels and Values.
13. The cell address first lists the row name and then the column name.
14. This selected cell is referred to as the **active cell**.
15. The contents of the active cell will also be displayed on the **formula bar**.
16. A cell that is on sheet 3, in the second column third row would be referred to as **Sheet3@B3**.
17. Formatted Display is the number of decimal places that appear in a cell.
18. Formulas can be copied to perform different operations on a corresponding set of data.
19. The function **COUNT(value1,[value2],...)** counts non-blank cells.
20. The Average function ignore the blank cells.
21. TRUE and FALSE are called Boolean Values.
22. SPSS stands for Statistical Package for the Social Sciences.
23. SPSS is capable of handling large amounts of data.
24. SPSS has only two windows Data view and Output view.
25. **Transform** menu includes several options to change current variables.
26. In SPSS, Each column typically represents the data from 1 case.
27. In SPSS, The first column of variable view is Name.
28. In SPSS, you can sort data from **Transform** menu then **Sort Cases**.
29. Descriptive statistics are calculated using the **Analyze** menu.
30. Correlation is used to test the degree of association between variables.

Answer Sheet		
	True	False
1		
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30		

Question 2: (10 marks)

	A	B	C	D	E	F	G
1		MT1	MT2	Final	Total	Honors	Passed
2	Possible points	100	100	200	400		320
3							
4	Blue	79	89	169	337	FALSE	TRUE
5	Jones	85	65	195	345	FALSE	TRUE
6	Grey	60	97	187	344	TRUE	TRUE
7	Mary	10	30	50	90	TRUE	FALSE
8							

Write the following Boolean functions

1. Blue's total and Jones' total are greater than Grey's:
2. Grey's total is not the maximum grade:
3. None of the students passed the course
4. Blue is not an Honors student
5. Blue didn't get a passing grade (320)

Question 3: (10 marks)

1. What are the difference between Data View, Variable View and Output View in SPSS?
2. Some significance tests are very restrictive about the form of data they can accept. What are the different types of measurement?
3. Describe how to test the degree of association between variables by SPSS.
4. Explain how to use SPSS to calculate the frequency and percent of females and males who did and did not have social problems.

Q2.

- a. Maintain two different Algorithm of crossover process with mention the probability of crossover (5 marks)
- b. Maintain two different Algorithm of mutation process with mention the probability of mutation. (5 marks)

Q3. a. Maintain tree type representation of solutions in genetic algorithm. (3 marks)

b. Using genetic algorithm to find the maximum value of the function $(15x - x^2)$ where parameter x varies between 0 and 15. For simplicity, we may assume that x takes only integer values. Using the genetic algorithm procedure in one step and begin with four solutions in initial solutions. (10 marks)

Q4. Discuss the internal structure of Taxi driver Robot. (7 marks)

Q5. Discuss the Tabu search method and maintain the type of memory using in this method and maintain the Tabu search algorithm. (10 marks)

==best wishes==

Dr. Alaa F. Mohamed

Answer the following questions: (50 Marks)

Question 1: Answer the following points (10 Marks)

- 1- Explain the internet "nuts and bolts"?
- 2- Explain the sources of packet delay?
- 3- What are protocols?
- 4- Explain Access network: digital subscriber line (DSL)?

Question 2: Answer the following points (10 Marks)

- 1- What is the network core?
- 2- Explain Packet Switching: queueing delay, loss?
- 3- Define throughput?
- 4- Define and explain traffic intensity?

Question 3: Answer the following points (10 Marks)

- 1- Explain the Internet protocol stack?
- 2- Mention some network applications?
- 3- Explain the application client-server architecture?
- 4- Explain P2P architecture?

Question 4: Answer the following points (10 Marks)

- 1- HTTP is "stateless". What does that mean?
- 2- Compare between persistent HTTP and non-persistent HTTP?
- 3- Give examples of HTTP response status codes?
- 4- Explain the term (web caches) and how it is useful?

Question 5: Answer the following points (10 Marks)

- 1- Give a DNS name resolution example?
- 2- Compare between multiplexing and demultiplexing? Support your answer with a diagram?
- 3- Define and explain the use of ACKs and NAKs?
- 4- Define and explain HOL? Support your answer with a diagram?

جامعة أسيوط	مايو 2018	كود المقرر: 356 رك
كلية العلوم		المقرر : مقدمة فى الحسابات العلمية
قسم الرياضيات		الزمن : ساعتان

Answer the following questions by using MATLAB language: (50 marks)

1- Using Newton's forward difference formula, find $y(0.1)$ using the table below:

x	0.0	0.2	0.4	0.6	0.8
y	1.000	1.22140	1.49182	1.82212	2.22554

2- Solve the differential equation by Adams method (without using nested for loops) at $x=0.2$:

$$\frac{dy}{dt} = t^2 - y, \quad y(0) = 1, \quad h = 0.05.$$

and compare it with the analytic solution $y = -e^{-t} + t^2 - 2t + 2$.

3- Solve the following initial value problem:

$$\frac{d^2u}{dt^2} + 4\frac{du}{dt} + 3u = 0, \quad u(0) = 1, \quad \frac{du}{dt}(0) = 0.$$

4- Let $f(x) = \cos 2x$ and $x_0 = 0$. Determine

a) The third Taylor polynomial for f about x_0 .

b) Find error bound at $x = 0.2$ and compare it to the actual error.

5- For the well-known Chua's circuit equation in chaotic studies that

$$\dot{x} = \alpha[y - x - f(x)], \quad \dot{y} = x - y + z, \quad \dot{z} = -\beta y - \gamma z, \quad t \in (0, 10),$$

where the nonlinear function $f(x)$ is described by

$$f(x) = bx + 0.5(a-b)(|x+1| - |x-1|) \text{ and } a < b < 0.$$

Write an M-function to describe the equation, and draw the phase trajectory for the parameters $\alpha = 9$, $\beta = 100/7$, $\gamma = 0$, $a = -8/7$, $b = -5/7$, and initial conditions

$$x(0) = -2.121304, \quad y(0) = -0.066170, \quad z(0) = 2.881090.$$

Good Luck

Dr. Tarek Aboelenen



امتحان الفرقة الثالثة شعبة الرياضيات

الزمن : ثلاث ساعات

رقم المقرر ورمزه : ١٣٤٦

المقرر : عمليات عشوائية وتطبيقاتها

أجب عن خمسة أسئلة فقط مما يأتي :- درجة جزء كل سؤال (خمس درجات)

١- (أ) لمجموعة المتغيرات العشوائية المستقلة $X_1, X_2, X_3, \dots$ بفرض أن التوقع الرياضي $E(X_i) = m$ والتباين $V(X_i)$ لكل منها محدود عرف كل من التقارب عن طريق الإحتمال وقانون الأعداد الكبرى (الضعيف).
(ب) بفرض أن $f f s s f s f f s s s f f s f f s$ هي إحدى النتائج الممكنة في محاولات برنولي العشوائية المستقلة بحيث أن $P(s) = p, P(f) = q, p + q = 1$ عرف عملية عشوائية في الفراغ R^2 موضحا ذلك بيانيا .

٢- (أ) في عملية برنولي العشوائية $\{X_n; n > 0\}$ بالإحتمال $p = 0.6$ إذا كان $X = X_1 + X_2$ ، $Y = X_1 + X_3$ احسب الإحتمالات الآتية : $P(X < 2, Y \leq 1)$ ، $P(2X < 3Y)$ ، $P(Y = X)$.
(ب) في السؤال (٢-أ) أوجد العزم الارتباطي بين X ، Y موضحا العلاقة بينهما .

٣- (أ) وضح العلاقة بين عملية برنولي العشوائية $\{X_n; n > 0\}$ و العملية العشوائية $\{Y_n; n \geq 0\}$ حيث أن المتغير Y_n يخضع لتوزيع ذي الحدين واذكر صفات كل منهما ثم عبر مع الاستنتاج عن إحتمال الحادث $(Y_{n+1} = k)$ من خلال إحتمالات الحوادث : $(Y_n = k)$ ، $(Y_n = k - 1)$ لأي عدد صحيح $k > 0$.
(ب) في العملية العشوائية $\{Y_n; n \geq 0\}$ أوجد كل من $E(Y_5)$ ، $E(Y_4^2)$ ، $P(Y_5 = 3, Y_7 = 4, Y_{14} = 9)$.

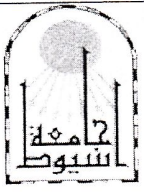
٤- (أ) عرف أزمنة النجاح T_k كعملية عشوائية موضحا العلاقة بينها وبين العملية العشوائية $\{Y_n; n \geq 0\}$ ثم اذكر فقط توزيع المتغير العشوائي T_k .
(ب) - في عملية بواسون العشوائية $\{N_t; t \geq 0\}$ بالمعدل $\lambda = 4$ احسب كل من الإحتمالات الآتية :
 $P(N_{1.5} = 2, N_4 = 5, N_{6.8} = 9)$ ، $P(N_3 = 5, N_7 = 9)$

٥- (أ) في عملية بواسون أو عملية الوصول المعودة $\{N_t; t \geq 0\}$ بالمعدل λ إثبت أن الإحتمال المشروط لعدد الوصول N_t بالنسبة إلى عدد الوصول N_{t+s} لكل $t > 0, s > 0$ يمثل توزيع ذي الحدين.
(ب) عرف العمليات العشوائية المستقلة ثم اثبت أن أي عمليتين مستقلتين لبواسون هو أيضا عملية بواسون .

٦- (أ) في عملية التجديد العشوائية $R = \{R_n; n \in N\}$ حيث N هي فئة الأعداد الصحيحة غير السالبة عرف دالة التجديد ثم عبر عنها من خلال توزيع المتغير R_n مع الاستنتاج .

(ب) في سلسلة ماركوف العشوائية المتقطعة $\{X_n; n \geq 0\}$ عرف مصفوفة الإحتمالات الإنتقالية بصفاتها المعروفة ثم احسب الإحتمال : $P(X_0 = 1, X_1 = 1, X_2 = 0, X_3 = 1, X_4 = 0, X_6 = 0)$ بفرض أن حالات الفراغ $(0, 1)$ والمصفوفة العشوائية

$$P = \begin{pmatrix} 1/2 & 1/2 \\ 1/3 & 2/3 \end{pmatrix} , \text{ ومنتجه الإحتمالات الابتدائية } \pi_0 = (2/5 \quad 3/5)$$

	المقرر: تحليل عددي (٣٢٣) الفرقة: المستوى الثالث الدرجة: ٥٠ درجة التاريخ: ٢٠١٨/٥/٢٩ الزمن: ثلاث ساعات	جامعة أسيوط كلية العلوم - قسم الرياضيات امتحان نهائي الفصل الدراسي الثاني للعام الجامعي ٢٠١٧/٢٠١٨
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Answer five questions only :- (10 marks for every question)

1-a) If the function $g \in C[a, b]$ and $g(x) \in [a, b] \forall x \in [a, b]$ and $g'(x)$ exist with $|g'(x)| \leq k < 1 \forall x \in [a, b]$ prove that the sequence defined by $P_n = g(P_{n-1}), n \geq 1$ will converge to the unique fixed point P and also $|P_{n+1} - P_n| \leq k^n |P_1 - P_0|$.

1-b) Verify that when Newton's method is used to compute $\sqrt{A}, A > 0$ (By solving the equation : $f(x) = x^2 - A$). The sequence of iterates is defined by : $x_{n+1} = (x_n + \frac{A}{x_n})/2$, and show that if the sequence $\{x_n\}$ is defined as the previous problem, then this method is quadratically convergence.

2-a) Derive Lagrange interpolation formula of degree n and write the error of the method.

2-b) For the given function $f(x) = \cos \pi x$ let $x_0 = -1, x_1 = 0, x_2 = 1$ construct the suitable interpolation polynomial and find the actual error.

3) Derive the formula of the Newton's interpolatory divided difference method and use this formula to obtain a polynomial of least degree that fits the values shown:

x	0	1	2	4	6
$f(x)$	1	9	23	93	259

من فضلك انظر خلف الورقة

السؤال الرابع :-

أ) يعرف الطي للدالتين $f(x)$, $g(x)$ كالآتي

$$f * g = \int_{-\infty}^{\infty} f(u) g(x-u) du$$

برهن علي أن تحويل فوريير للطرف الأيمن هو حاصل ضرب تحويلي فوريير للدالتين $f(x)$, $g(x)$

ب) أوجد تحويل فوريير للدالة $f(x) = \begin{cases} 1 & |x| < a \\ 0 & |x| > a \end{cases}$ وأرسم $f(x)$ كذلك تحويلها عند $a = 3$ وأوجد

$$\int_{-\infty}^{\infty} \frac{\sin u}{u} du \quad \text{كذلك} \quad \int_{-\infty}^{\infty} \frac{\sin \alpha a \cos \alpha x}{\alpha} d\alpha$$

ج) ترك خيط لانهائي من السكون وكانت أزاحته الابتدائية عن محور x هي $f(x)$ أوجد الإزاحه عند أي زمن .

انتهت الأسئلة مع تمنياتنا بالتوفيق ،،،،

لجنة الممتحنين :- أ. د/ نجاه عبد الرحمن حسين ، أ. د/ فاروق علي السيد



الامتحان النهائي للفصل الدراسي الثاني للعام الجامعي ٢٠١٧/٢٠١٨ م
 للفرقة : الثالثة : الشعبة : الرياضيات التاريخ : ٢٠١٨/٥/٢٤ م

الزمن : ساعتان

الدرجة الكلية : ٥٠ درجة

أسم المقرر : الطرق الرياضية
 رقم المقرر ورمزه : ٣٣٤ ر

درجة كل سؤال : ١٧ درجة

أجب عن ثلاثة أسئلة فقط مما يأتي :-

السؤال الأول :-

أوجد تحويل لابلاس للمشتقة التفاضلية للدالة $F(t)$ عند نقط الاتصال والانفصال للدالة .

أبرهن علي أن

$$\lim_{t \rightarrow 0} F(t) = \lim_{s \rightarrow \infty} s f(s)$$

$$\lim_{t \rightarrow \infty} F(t) = \lim_{s \rightarrow 0} s f(s)$$

$$\Gamma\left(\frac{1}{2}\right) = \sqrt{\pi}, \quad \int_0^{\infty} \delta(t) dt = 1, \quad L \sin \sqrt{t} = \frac{\sqrt{\pi}}{3} e^{-\frac{1}{4s}} s^{\frac{3}{2}}$$

السؤال الثاني :-

حل المعادلات الآتية :

$$t Y''(t) + Y'(t) + 4t Y(t) = 0, \quad y(0) = 3, y'(0) = 0$$

$$\frac{\partial U}{\partial x} = 2 \frac{\partial U}{\partial t} + U, \quad x > 0, t > 0 \quad U(x, 0) = 6 e^{-3x}$$

$$\int_0^t Y(u) Y(t-u) du = 16 \sin 4t$$

السؤال الثالث :-

(أ) فك الدالة $f(x) = x^2$, $0 < x < 2\pi$ بدلالة متسلسلة فوريير ثم أحسب المجموع

$$1 + \frac{1}{2^2} + \frac{1}{3^2} + \frac{1}{4^2} + \dots$$

(ب) صفيحة علي شكل دائري نصف قطرها الوحدة ووجهيها معزولين ونصف محيطها محفوظ عند درجة حرارة u_1

والآخر عند u_2 أوجد حالة الأتزان الحراري .

من فضلك أنظر بقية الأسئلة خلف الورقة ،،،،،



Answer the following questions (50 marks)

Q1.	Complete the following: (1)..... is a representation of a two-dimensional image as a finite set of digital values, called picture elements or pixels - Common image formats include.....(2).... ,(3)..... ,(4)..... (5)..... creates a Distance tool a draggable, resizable line that measures the distance between its endpoints. (6)..... These are the result of objects that are self-luminous, such as stars and light bulbs. (7).....the resulting output pixel is computed as a sum of products of the pixel values and mask coefficients in the pixel's neighborhood in the original image. - The Sobel operators used to compute edges are(8)..... ,(9)..... - Edge detector should have:(10)..... ,(11)..... - Types of noise are(12)..... ,(13)....	(13 marks)
Q2.	a) Compute Z from the following matlab script (6 marks) <pre> x = [150 10 90;80 50 60;121 160 20] y = [-1 0 1;-2 0 2;-1 0 1] z = imfilter(x,y,'corr') </pre> b) What is the Delta compression and compute the compressed data of the data (6 marks) 220 321 335 211 250 200 233 214 232 212	(12 marks)
Q3.	a) Write the MATLAB code used to: (4 marks) - Read any image then use affine transformation matrix for each of the operations below: - Flip the image right to left - Translation by [25, 15] pixels b) What are the main differences between: (8 marks) - Global thresholding and optimal thresholding. - Raster and vector image . - Interpixel redundancy and Psychovisual redundancy	(12 marks)

(Q5) (i) Assume that U, V are open intervals and let $f : U \rightarrow \mathbb{R}$ and $g : V \rightarrow \mathbb{R}$ be two differentiable functions such that $f(U) \subset V$. Prove that $g \circ f$ is differentiable on U and that $(g \circ f)' = (g' \circ f) \cdot f'$ [5 marks]

(ii) Prove that the function $f(x) := \frac{1}{x}$ is differentiable on $]0, \infty[$ but not uniformly continuous therein. [5 marks]

(Q6) (i) State and prove Rolle's theorem then use it to prove the mean value theorem. [6 marks]

(ii) Let I be an open interval. Apply the mean value theorem to prove that a function differentiable on I is

1. increasing if and only if $f' \geq 0$ on I ,

2. decreasing if and only if $f' \leq 0$ on I .

[4 marks]

With the best of luck,

Prof. Rashwan A. Rashwan,

Dr. Ahmed A. Abdelhakim



Time: 3 hours

Total mark: 50

Answer *only five* of the following questions:

(Q1) (i) Suppose that O_i , $i \geq 1$, are open subsets of $\mathbb{R}$. Prove that $\cup_{i \geq 1} O_i$ is also open in $\mathbb{R}$. [5 marks]

(ii) Let $S \subset \mathbb{R}$. Show that S is closed if and only if S contains the limit point of every convergent sequence of elements of S . [5 marks]

(Q2) (i) Prove that a sequence of real numbers converges if and only if it is a Cauchy sequence. [6 marks]

(ii) Show that if $(x_n)_{n \geq 1} \subset \mathbb{R}$ is a monotonically increasing sequence that is bounded above, then $x_n \rightarrow \sup_{n \geq 1} x_n$, as $n \rightarrow \infty$. [4 marks]

(Q3) (i) Show that $f : D \subset \mathbb{R} \rightarrow \mathbb{R}$ is continuous at $x_0 \in D$ if and only if the sequence $(f(x_n))_{n \geq 1}$ converges to $f(x_0)$ whenever $(x_n)_{n \geq 1}$ is a sequence in D that converges to x_0 . [6 marks]

(ii) Use the characterization given in (i) to prove the discontinuity at the origin of the function $f(x) = \begin{cases} \cos \frac{1}{x}, & x \neq 0; \\ 0, & x = 0. \end{cases}$ [4 marks]

(Q4) (i) Assume that D is a closed bounded subset of $\mathbb{R}$. Prove that if $f : D \rightarrow \mathbb{R}$ is continuous then f is bounded on D , and there exist $\alpha, \beta \in D$ such that $f(\alpha) = \max_{x \in D} f(x)$ and $f(\beta) = \min_{x \in D} f(x)$. [5 marks]

(ii) Argue by contradiction to demonstrate that if $f : [a, b] \rightarrow \mathbb{R}$ is continuous then it is uniformly continuous on $[a, b]$. [5 marks]

Please Turn over the page



أجب عن أسئلة الآتية :- (كل سؤال ١٠ درجات)

(١) (أ) أثبت قاعدة التضعيف لدالة جاما $\sqrt{\pi} \Gamma(2x) = 2^{2x-1} \Gamma(x) \Gamma\left(x + \frac{1}{2}\right), x > 0$

ثم استخدمها فى إثبات أن: $\Gamma\left(\frac{5}{6}\right) \left[\Gamma\left(\frac{1}{3}\right)\right]^2 = 2 \sqrt[3]{2} \sqrt{\frac{\pi^3}{3}}$

(ب) باستخدام دوال جاما و بيتا أوجد التكاملات الآتية: (i) $\int_0^{\frac{\pi}{2}} \sqrt{\tan \theta} d\theta$ (ii) $\int_0^{\infty} \frac{\sqrt{x}}{e^{x^3}} dx$

(٢) (أ) أثبت أن: $\Gamma(x) \Gamma(1-x) = \frac{\pi}{\sin \pi x}, 0 < x < 1$ ومن ثم أثبت أن

$\Gamma\left(x + \frac{1}{2}\right) \Gamma\left(\frac{1}{2} - x\right) = \frac{\pi}{\cos \pi x}$

(ب) أثبت أن:

(i) $\sqrt{1-x^2} T_n(x) = U_{n+1}(x) - x U_n(x),$

(ii) $(1-x^2) U'_n(x) = -n x U_n(x) + n U_{n-1}(x)$

(٣) أثبت أن:

(i) ${}_2F_1(\alpha, \beta; \gamma, x) = (1-x)^{-\beta} {}_2F_1\left(\gamma - \alpha, \beta; \gamma, \frac{x}{x-1}\right)$

(ii) ${}_1F_1\left(\frac{1}{2}; \frac{3}{2}, -x^2\right) = \frac{\sqrt{\pi}}{2x} \operatorname{erf}(x)$ حيث أن: $\operatorname{erf}(x) = \frac{2}{\sqrt{\pi}} \int_0^x e^{-t^2} dt$ هى دالة الخطأ

(iii) ${}_1F_1(\alpha + 1; \gamma, x) - {}_1F_1(\alpha; \gamma, x) - \frac{x}{\gamma} {}_1F_1(\alpha + 1; \gamma + 1, x) = 0$

(٤) (أ) أوجد مفكوك ليجندر للدالة: $f(x) = x^3$

(ب) أثبت أن: $H_n(x) = (-1)^n e^{x^2} \frac{d^n}{dx^n} (e^{-x^2})$ حيث $H_n(x)$ كثيرة حدود هيرميت.

(ج) أثبت أن: $J_{\frac{1}{2}}(x) = \sqrt{\frac{2}{\pi}} \frac{\sin x}{\sqrt{x}}$

(٥) (أ) باستخدام الصيغة التكاملية لدوال بسل أثبت أن: $\int_0^{\infty} e^{-3x} J_0(4x) dx = \frac{1}{5}$

(ب) أوجد الحل العام لمعادلة بسل التفاضلية:

$x^2 \frac{d^2 y}{dx^2} + x \frac{dy}{dx} + (x^2 - n^2)y = 0$

CS12	CS11	CS10	Description
0	0	0	No clock source (Timer/Counter stopped).
0	0	1	clk _{IO} /1 (No prescaling)
0	1	0	clk _{IO} /8 (From prescaler)
0	1	1	clk _{IO} /64 (From prescaler)
1	0	0	clk _{IO} /256 (From prescaler)
1	0	1	clk _{IO} /1024 (From prescaler)
1	1	0	External clock source on T1 pin. Clock on falling edge.
1	1	1	External clock source on T1 pin. Clock on rising edge.

Timer/Counter1 – TCNT1H and TCNT1L

Bit	7	6	5	4	3	2	1	0	
	TCNT1[15:8]								TCNT1H
	TCNT1[7:0]								TCNT1L
Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

Output Compare Register 1 B – OCR1BH and OCR1BL

Bit	7	6	5	4	3	2	1	0	
	OCR1B[15:8]								OCR1BH
	OCR1B[7:0]								OCR1BL
Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

Input Capture Register 1 – ICR1H and ICR1L

Bit	7	6	5	4	3	2	1	0	
	ICR1[15:8]								ICR1H
	ICR1[7:0]								ICR1L
Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

Timer/Counter Interrupt Mask Register – TIMSK⁽¹⁾

Bit	7	6	5	4	3	2	1	0	
	OCIE2	OCIE1	OCIE1A	OCIE1B	TOIE1	OCIE0	TOIE0		TIMSK
Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

- Bit 5 – OCIE1: Timer/Counter1, Input Capture Interrupt Enable
 Bit 4 – OCIE1A: Timer/Counter1, Output Compare A Match Interrupt Enable
 Bit 3 – OCIE1B: Timer/Counter1, Output Compare B Match Interrupt Enable
 Bit 2 – TOIE1: Timer/Counter1, Overflow Interrupt Enable

Timer/Counter Interrupt Flag Register – TIFR

Bit	7	6	5	4	3	2	1	0	
	OCF2	TOV2	ICF1	OCF1A	OCF1B	TOV1	OCF0	TOV0	TIFR
Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

- Bit 5 – ICF1: Timer/Counter1, Input Capture Flag
 Bit 4 – OCF1A: Timer/Counter1, Output Compare A Match Flag
 Bit 3 – OCF1B: Timer/Counter1, Output Compare B Match Flag
 Bit 2 – TOV1: Timer/Counter1, Overflow Flag

USART

Operating Mode	Equation for Calculating Baud Rate ⁽¹⁾	Equation for Calculating UBRR Value
Asynchronous Normal Mode (U2X = 0)	$BAUD = \frac{f_{osc}}{16(UBRR + 1)}$	$UBRR = \frac{f_{osc}}{16BAUD} - 1$
Asynchronous Double Speed Mode (U2X = 1)	$BAUD = \frac{f_{osc}}{8(UBRR + 1)}$	$UBRR = \frac{f_{osc}}{8BAUD} - 1$
Synchronous Master Mode	$BAUD = \frac{f_{osc}}{2(UBRR + 1)}$	$UBRR = \frac{f_{osc}}{2BAUD} - 1$

USART I/O Data Register – UDR

Bit	7	6	5	4	3	2	1	0	
	RXB[7:0]								UDR (Read)
	TXB[7:0]								UDR (Write)
Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

Timer/Counter
Interrupt Mask
Register – TIMSK

Bit	7	6	5	4	3	2	1	0	
	OCIE2	TOIE2	OCIE1	OCIE1A	OCIE1B	TOIE1	OCIE0	TOIE0	TIMSK
Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

Bit 1 – OCIE0: Timer/Counter0 Output Compare Match Interrupt Enable
Bit 0 – TOIE0: Timer/Counter0 Overflow Interrupt Enable

Timer/Counter
Interrupt Flag Register
– TIFR

Bit	7	6	5	4	3	2	1	0	
	OCF2	TOV2	ICF1	OCF1A	OCF1B	TOV1	OCF0	TOV0	TIFR
Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

Bit 1 – OCF0: Output Compare Flag 0
Bit 0 – TOV0: Timer/Counter0 Overflow Flag

Timer/Counter1
Control Register A –
TCCR1A

Bit	7	6	5	4	3	2	1	0	
	COM1A1	COM1A0	COM1B1	COM1B0	FOC1A	FOC1B	WGM11	WGM10	TCCR1A
Read/Write	R/W	R/W	R/W	R/W	W	W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

Bit 7:6 – COM1A1:0: Compare Output Mode for Compare unit A
Bit 5:4 – COM1B1:0: Compare Output Mode for Compare unit B
Bit 3 – FOC1A: Force Output Compare for Compare unit A
Bit 2 – FOC1B: Force Output Compare for Compare unit B
Bit 1:0 – WGM11:0: Waveform Generation Mode

CS02	CS01	CS00	Description
0	0	0	No clock source (Timer/Counter stopped).
0	0	1	$clk_{IO}/1$ (No prescaling)
0	1	0	$clk_{IO}/8$ (From prescaler)
0	1	1	$clk_{IO}/64$ (From prescaler)
1	0	0	$clk_{IO}/256$ (From prescaler)
1	0	1	$clk_{IO}/1024$ (From prescaler)
1	1	0	External clock source on T0 pin, Clock on falling edge.
1	1	1	External clock source on T0 pin, Clock on rising edge.

COM1A1/COM1B1	COM1A0/COM1B0	Description
0	0	Normal port operation, OC1A/OC1B disconnected.
0	1	Toggle OC1A/OC1B on compare match
1	0	Clear OC1A/OC1B on compare match (Set output to low level)
1	1	Set OC1A/OC1B on compare match (Set output to high level)

Mode	WGM13	WGM12 (CTC1)	WGM11 (PWM11)	WGM10 (PWM10)	Timer/Counter Mode of Operation	TOP	Update of OCR1x	TOV1 Flag Set on
0	0	0	0	0	Normal	0xFFFF	Immediate	MAX
1	0	0	0	1	PWM, Phase Correct, 8-bit	0x00FF	TOP	BOTTOM
2	0	0	1	0	PWM, Phase Correct, 9-bit	0x01FF	TOP	BOTTOM
3	0	0	1	1	PWM, Phase Correct, 10-bit	0x03FF	TOP	BOTTOM
4	0	1	0	0	CTC	OCR1A	Immediate	MAX
5	0	1	0	1	Fast PWM, 8-bit	0x00FF	BOTTOM	TOP
6	0	1	1	0	Fast PWM, 9-bit	0x01FF	BOTTOM	TOP
7	0	1	1	1	Fast PWM, 10-bit	0x03FF	BOTTOM	TOP
8	1	0	0	0	PWM, Phase and Frequency Correct	ICR1	BOTTOM	BOTTOM
9	1	0	0	1	PWM, Phase and Frequency Correct	OCR1A	BOTTOM	BOTTOM
10	1	0	1	0	PWM, Phase Correct	ICR1	TOP	BOTTOM
11	1	0	1	1	PWM, Phase Correct	OCR1A	TOP	BOTTOM
12	1	1	0	0	CTC	ICR1	Immediate	MAX
13	1	1	0	1	Reserved	–	–	–
14	1	1	1	0	Fast PWM	ICR1	BOTTOM	TOP
15	1	1	1	1	Fast PWM	OCR1A	BOTTOM	TOP

Timer/Counter1
Control Register B –
TCCR1B

Bit	7	6	5	4	3	2	1	0	
	ICNC1	ICES1	–	WGM13	WGM12	CS12	CS11	CS10	TCCR1B
Read/Write	R/W	R/W	R	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

Bit 7 – ICNC1: Input Capture Noise Canceler
Bit 6 – ICES1: Input Capture Edge Select
Bit 5 – Reserved Bit
Bit 4:3 – WGM13:2: Waveform Generation Mode
Bit 2:0 – CS12:0: Clock Select

CS12	CS11	CS10	Description
0	0	0	No clock source (Timer/Counter stopped).
0	0	1	$clk_{IO}/1$ (No prescaling)
0	1	0	$clk_{IO}/8$ (From prescaler)
0	1	1	$clk_{IO}/64$ (From prescaler)
1	0	0	$clk_{IO}/256$ (From prescaler)
1	0	1	$clk_{IO}/1024$ (From prescaler)
1	1	0	External clock source on T1 pin. Clock on falling edge.
1	1	1	External clock source on T1 pin. Clock on rising edge.

Timer/Counter1 – TCNT1H and TCNT1L

Bit	7	6	5	4	3	2	1	0	
	TCNT1[15:8]								TCNT1H
	TCNT1[7:0]								TCNT1L
Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

Output Compare Register 1 B – OCR1BH and OCR1BL

Bit	7	6	5	4	3	2	1	0	
	OCR1B[15:8]								OCR1BH
	OCR1B[7:0]								OCR1BL
Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

Input Capture Register 1 – ICR1H and ICR1L

Bit	7	6	5	4	3	2	1	0	
	ICR1[15:8]								ICR1H
	ICR1[7:0]								ICR1L
Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

Timer/Counter Interrupt Mask Register – TIMSK⁽¹⁾

Bit	7	6	5	4	3	2	1	0	
	OCIE2	TOIE2	TICIE1	OCIE1A	OCIE1B	TOIE1	OCIE0	TOIE0	TIMSK
Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

Bit 5 – TICIE1: Timer/Counter1, Input Capture Interrupt Enable

Bit 4 – OCIE1A: Timer/Counter1, Output Compare A Match Interrupt Enable

Bit 3 – OCIE1B: Timer/Counter1, Output Compare B Match Interrupt Enable

Bit 2 – TOIE1: Timer/Counter1, Overflow Interrupt Enable

Timer/Counter Interrupt Flag Register – TIFR

Bit	7	6	5	4	3	2	1	0	
	OCF2	TOV2	ICF1	OCF1A	OCF1B	TOV1	OCF0	TOV0	TIFR
Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

Bit 5 – ICF1: Timer/Counter1, Input Capture Flag

Bit 4 – OCF1A: Timer/Counter1, Output Compare A Match Flag

Bit 3 – OCF1B: Timer/Counter1, Output Compare B Match Flag

Bit 2 – TOV1: Timer/Counter1, Overflow Flag

USART

Operating Mode	Equation for Calculating Baud Rate ⁽¹⁾	Equation for Calculating UBRR Value
Asynchronous Normal Mode (U2X = 0)	$BAUD = \frac{f_{osc}}{16(UBRR + 1)}$	$UBRR = \frac{f_{osc}}{16BAUD} - 1$
Asynchronous Double Speed Mode (U2X = 1)	$BAUD = \frac{f_{osc}}{8(UBRR + 1)}$	$UBRR = \frac{f_{osc}}{8BAUD} - 1$
Synchronous Master Mode	$BAUD = \frac{f_{osc}}{2(UBRR + 1)}$	$UBRR = \frac{f_{osc}}{2BAUD} - 1$

USART I/O Data Register – UDR

Bit	7	6	5	4	3	2	1	0	
	RXB[7:0]								UDR (Read)
	TXB[7:0]								UDR (Write)
Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

USART Control and Status Register A – UCSRA

Bit	7	6	5	4	3	2	1	0	
	RXC	TXC	UDRE	FE	DOR	PE	U2X	MPCM	UCSRA
Read/Write	R	R/W	R	R	R	R	R/W	R/W	
Initial Value	0	0	1	0	0	0	0	0	

- Bit 7 – RXC: USART Receive Complete
- Bit 6 – TXC: USART Transmit Complete
- Bit 5 – UDRE: USART Data Register Empty
- Bit 4 – FE: Frame Error
- Bit 3 – DOR: Data OverRun
- Bit 2 – PE: Parity Error
- Bit 1 – U2X: Double the USART Transmission Speed
- Bit 0 – MPCM: Multi-processor Communication Mode

USART Control and Status Register B – UCSRB

Bit	7	6	5	4	3	2	1	0	
	RXCIE	TXCIE	UDRIE	RXEN	TXEN	UCSZ2	RXB8	TXB8	UCSRB
Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R	R/W	
Initial Value	0	0	0	0	0	0	0	0	

- Bit 7 – RXCIE: RX Complete Interrupt Enable
- Bit 6 – TXCIE: TX Complete Interrupt Enable
- Bit 5 – UDRIE: USART Data Register Empty Interrupt Enable
- Bit 4 – RXEN: Receiver Enable
- Bit 3 – TXEN: Transmitter Enable
- Bit 2 – UCSZ2: Character Size
- Bit 1 – RXB8: Receive Data Bit 8
- Bit 0 – TXB8: Transmit Data Bit 8

USART Control and Status Register C – UCSRC

Bit	7	6	5	4	3	2	1	0	
	URSEL	UMSEL	UPM1	UPM0	USBS	UCSZ1	UCSZ0	UCPOL	UCSRC
Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	
Initial Value	1	0	0	0	0	1	1	0	

- Bit 7 – URSEL: Register Select
- Bit 6 – UMSEL: USART Mode Select
- Bit 5:4 – UPM1:0: Parity Mode
- Bit 3 – USBS: Stop Bit Select
- Bit 2:1 – UCSZ1:0: Character Size
- Bit 0 – UCPOL: Clock Polarity

UMSEL	Mode
0	Asynchronous Operation
1	Synchronous Operation

USBS	Stop Bit(s)
0	1-bit
1	2-bit

UPM1	UPM0	Parity Mode
0	0	Disabled
0	1	Reserved
1	0	Enabled, Even Parity
1	1	Enabled, Odd Parity

UCPOL	Transmitted Data Changed (Output of Tx D Pin)	Received Data Sampled (Input on Rx D Pin)
0	Rising XCK Edge	Falling XCK Edge
1	Falling XCK Edge	Rising XCK Edge

Table 66. UCSZ Bits Settings

UCSZ2	UCSZ1	UCSZ0	Character Size
0	0	0	5-bit
0	0	1	6-bit
0	1	0	7-bit
0	1	1	8-bit
1	0	0	Reserved
1	0	1	Reserved
1	1	0	Reserved
1	1	1	9-bit

USART Baud Rate Registers – UBRRL and UBRRH

Bit	15	14	13	12	11	10	9	8	
	URSEL	-	-	-	-	UBRR[11:9]	-	-	UBRRH
	-	-	-	-	-	UBRR[7:0]	-	-	UBRRL
Read/Write	R/W	R	R	R	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	



Operation Research326 R

11-5-2018

Third Level: Computer Science Section

Time: 3 hours

Total Degree (50 marks)

Science Faculty

Mathematical Department

Answer the following Questions:

1-Use the Simplex method to solve the following linear programming

Maximize $Z = 10x_1 + 11x_2$

Subject to $x_1 + 2x_2 \leq 150$, $3x_1 + 4x_2 \leq 200$, $6x_1 + x_2 \leq 175$

and $x_1, x_2 \geq 0$

(10 marks)

2) Use the graphical and the algebraic method to solve the problem

Max $f(\underline{x}) = 5x_1 + 7x_2$ Subject to $5x_1 + 8x_2 \leq 24$, $x_1 + x_2 \leq 4$,

$10x_1 + 7x_2 \leq 35$ and $x_1, x_2 \geq 0$

(12.5marks)

3) Use the Lagrange multiplier method to find the extreme points of the problem

Minimize $f(\underline{x}) = x_1^2 + x_2^2 - 3x_1x_2$

Subject to $g(\underline{x}) = x_1^2 + x_2^2 - 8 = 0$.

(12.5marks)

4) Use the Hessian Matrix to find the local points of the problem

$f(\underline{x}) = f(x_1, x_2) = x_1^3 + x_2^3 + 2x_1^2 + 4x_2^2 + 6$

(10marks)

5) Find the local Points

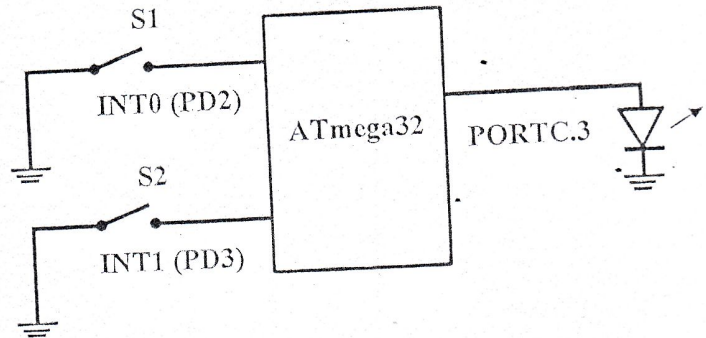
$f(x) = 3x^4 - 20x^3 + 36x^2 + 16$ (5marks)

Best Wishes

Dr. Alaa Fahim

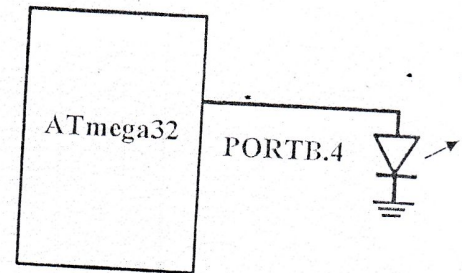
Question No. 2 (5 marks).

Assume that the INT0 and INT1 are connected to two SWITCHES named S1 and S2. Write a program in which, whenever S1 goes low, the content of EEPROM memory location 0x005F increases by one; and when S2 goes low, the content of EEPROM decreases by one. When the value stored in the EEPROM memory is bigger than 100, turn on the LED connected to PC3; otherwise, it is turned off. Use the external interrupt in level-triggered mode.



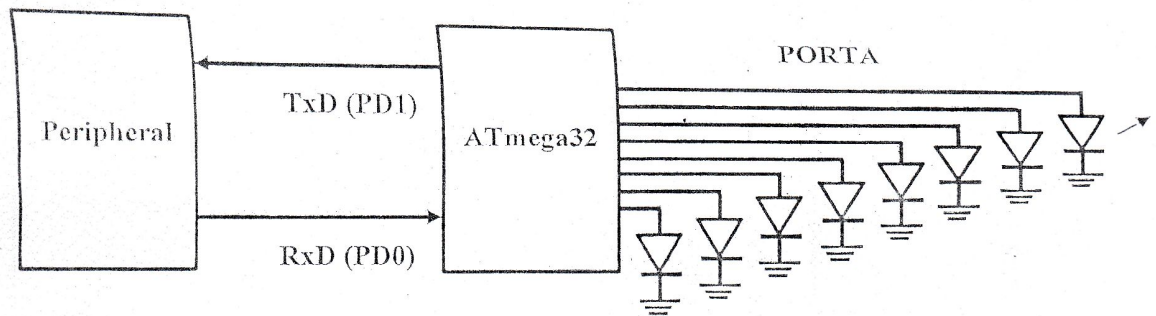
Question No. 3 (5 Marks).

Write a C program to toggle the LED connected to only the PORTB.4 bit continuously every second. Use TIMER1, Normal mode, and 1:256 prescaler to create the delay. Assume $XTAL = 8\text{ MHz}$.



Question No. 4 (5 marks).

Use the UART communication tool to transfer the letter 'Z' serially at 9600 baud, continuously and receive bytes of data serially and put them on Port A. Set the frame format to be 8-bit data, 1 stop bit, no parity bits. Assume XTAL = 8 MHz.



Question No. 5 (10 marks, 2 ½ each part).

Read the following program codes carefully, and write the function of each program code in the blank space provided:

C Program # 1	Function
<pre>#include <avr/io.h> int main (void) { while (EECR & (1 << EEWE)); EEAR = 0x5F; EEDR = 'G'; EECR = (1 << EEMWE); EECR = (1 << EEWE); return 0; }</pre>	

C Program # 2	Function
<pre>#include <avr/io.h> #define LED 7 #define SENSOR 1 int main (void) { DDRB = DDRB & ~(1 << SENSOR); DDRC = DDRC (1 << LED); while (1) { if (PINB & (1 << SENSOR)) PORTC = PORTC (1 << LED); else PORTC = PORTC & ~(1 << LED); } return 0; }</pre>	

C Program # 3	Function
<pre> #include <avr/io.h> int main (void) { DDRB = 0xFF; while (1) { T0Delay (); PORTB = PORTB ^ 0x10; } } void T0Delay () { TCNT0 = 186; TCCR0 = 0x02; while ((TIFR & (1 << TOV0)) == 0); TCCR0 = 0; TIFR = 0x1; } </pre>	

C Program # 4	Function
<pre> #include <avr/io.h> #include <avr/interrupt.h> int main () { DDRC = 0x08; PORTD = 1 << 2; GICR = (1 << INT0); sei (); while (1) { ISR (INT0_vect) { PORTC = ~(1 << 3); } } } </pre>	

Question No. 6 (10 Marks).

It is required to design a sliding door controlled by Atmega32. The store also counts the number of people entered in its EEPROM (\$000) and display it on LCD (PORT A). When user press a push button (ETX INT2), it activate a DC motor to open the door in one direction and increment the number stored in EEPROM. When the door is fully opened, another switch is activated (EXT INT1) to stop the motor for 5 seconds (use TIMER0), then the motor rotate in the reverse direction to close. When the door is fully closed, it activate another switch (EXT INT0) to stop the motor. The motor works according to the below table:

	PORTC.0	PORTC.1
Stop	0	0
Opening the door	1	0
Closing the door	1	1

- a) Draw the general layout of the embedded system. (4 marks)

- b) Write an AVR C program to control the sliding door and, count the number of visitors and display it on LCD. (6 marks)

Best Wishes

----- End of Questions -----

Dr. Osama Haraz

(XCK/T0) PB0	1	40	PA0 (ADC0)
(T1) PB1	2	39	PA1 (ADC1)
(INT2/AIN0) PB2	3	38	PA2 (ADC2)
(OC0/AIN1) PB3	4	37	PA3 (ADC3)
(SS) PB4	5	36	PA4 (ADC4)
(MOSI) PB5	6	35	PA5 (ADC5)
(MISO) PB6	7	34	PA6 (ADC6)
(SCK) PB7	8	33	PA7 (ADC7)
RESET	9	32	AREF
VCC	10	31	GND
GND	11	30	AVCC
XTAL2	12	29	PC7 (TOSC2)
XTAL1	13	28	PC6 (TOSC1)
(RXD) PD0	14	27	PC5 (TDI)
(TXD) PD1	15	26	PC4 (TDO)
(INT0) PD2	16	25	PC3 (TMS)
(INT1) PD3	17	24	PC2 (TCK)
(OC1B) PD4	18	23	PC1 (SDA)
(OC1A) PD5	19	22	PC0 (SCL)
(ICP1) PD6	20	21	PD7 (OC2)

Status Register

Bit	7	6	5	4	3	2	1	0	
	I	T	H	S	V	N	Z	C	SREG
Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

Bit 7 – I: Global Interrupt Enable
 Bit 6 – T: Bit Copy Storage
 Bit 5 – H: Half Carry Flag
 Bit 4 – S: Sign Bit, $S = N \oplus V$

Bit 3 – V: Two's Complement Overflow Flag
 Bit 2 – N: Negative Flag
 Bit 1 – Z: Zero Flag

The EEPROM Address Register – EEARH and EEARL

Bit	15	14	13	12	11	10	9	8	
	–	–	–	–	–	–	EEAR9	EEAR8	EEARH
	EEAR7	EEAR6	EEAR5	EEAR4	EEAR3	EEAR2	EEAR1	EEAR0	EEARL
Read/Write	R	R	R	R	R	R	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	X	

The EEPROM Data Register – EEDR

Bit	7	6	5	4	3	2	1	0	
	MSB							LSB	EEDR
Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

The EEPROM Control Register – EECR

Bit	7	6	5	4	3	2	1	0	
	–	–	–	–	EERIE	EEMWE	EEWE	EERE	EECR
Read/Write	R	R	R	R	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	X	0	

Bit 3 – EERIE: EEPROM Ready Interrupt Enable
 Bit 2 – EEMWE: EEPROM Master Write Enable

Bit 1 – EEWE: EEPROM Write Enable
 Bit 0 – EERE: EEPROM Read Enable

Interrupts

MCU Control Register – MCUCR

The MCU Control Register contains control bits for interrupt sense control and general MCU functions.

Bit	7	6	5	4	3	2	1	0	
	SE	SM2	SM1	SM0	ISC11	ISC10	ISC01	ISC00	MCUCR
Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

Bit 3, 2 – ISC11, ISC10: Interrupt Sense Control 1 Bit 1 and Bit 0

Bit 1, 0 – ISC01, ISC00: Interrupt Sense Control 0 Bit 1 and Bit 0

ISC11	ISC10	Description
0	0	The low level of INT1 generates an interrupt request.
0	1	Any logical change on INT1 generates an interrupt request.
1	0	The falling edge of INT1 generates an interrupt request.
1	1	The rising edge of INT1 generates an interrupt request.

ISC01	ISC00	Description
0	0	The low level of INT0 generates an interrupt request.
0	1	Any logical change on INT0 generates an interrupt request.
1	0	The falling edge of INT0 generates an interrupt request.
1	1	The rising edge of INT0 generates an interrupt request.

MCU Control and Status Register – MCUCSR

Bit	7	6	5	4	3	2	1	0	
	JTD	ISC2	–	JTRF	WDRF	BORF	EXTRF	PORF	MCUCSR
Read/Write	R/W	R/W	R	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0						See Bit Description

Bit 6 – ISC2: Interrupt Sense Control 2

General Interrupt Control Register – GICR

Bit	7	6	5	4	3	2	1	0	
	INT1	INT0	INT2	–	–	–	IVSEL	IVCE	GICR
Read/Write	R/W	R/W	R/W	R	R	R	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

Bit 7 – INT1: External Interrupt Request 1 Enable
Bit 6 – INT0: External Interrupt Request 0 Enable

Bit 5 – INT2: External Interrupt Request 2 Enable

General Interrupt Flag Register – GIFR

Bit	7	6	5	4	3	2	1	0	
	INTF1	INTF0	INTF2	–	–	–	–	–	GIFR
Read/Write	R/W	R/W	R/W	R	R	R	R	R	
Initial Value	0	0	0	0	0	0	0	0	

Bit 7 – INTF1: External Interrupt Flag 1
Bit 6 – INTF0: External Interrupt Flag 0

Bit 5 – INTF2: External Interrupt Flag 2

Port A Data Register – PORTA

Bit	7	6	5	4	3	2	1	0	
	PORTA7	PORTA6	PORTA5	PORTA4	PORTA3	PORTA2	PORTA1	PORTA0	PORTA
Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

Port A Data Direction Register – DDRA

Bit	7	6	5	4	3	2	1	0	
	DDA7	DDA6	DDA5	DDA4	DDA3	DDA2	DDA1	DDA0	DDRA
Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

Port A Input Pins Address – PINA

Bit	7	6	5	4	3	2	1	0	
	PINA7	PINA6	PINA5	PINA4	PINA3	PINA2	PINA1	PINA0	PINA
Read/Write	R	R	R	R	R	R	R	R	
Initial Value	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	

Time/Counter Control Register – TCCR0

Bit	7	6	5	4	3	2	1	0	
	FOC0	WGM00	COM01	COM00	WGM01	CS02	CS01	CS00	TCCR0
Read/Write	W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

Bit 7 – FOC0: Force Output Compare

Bit 6, 3 – WGM01:0: Waveform Generation Mode

Bit 5:4 – COM01:0: Compare Match Output Mode
Bit 2:0 – CS02:0: Clock Select

Mode	WGM01 (CTC0)	WGM00 (PWM0)	Timer/Counter Mode of Operation	TOP	Update of OCR0	TOV0 Flag Set-on	COM01	COM00	Description
0	0	0	Normal	0xFF	Immediate	MAX	0	0	Normal port operation, OC0 disconnected.
1	0	1	PWM, Phase Correct	0xFF	TOP	BOTTOM	0	1	Toggle OC0 on compare match
2	1	0	CTC	OCR0	Immediate	MAX	1	0	Clear OC0 on compare match
3	1	1	Fast PWM	0xFF	BOTTOM	MAX	1	1	Set OC0 on compare match

Timer/Counter Register – TCNT0

Bit	7	6	5	4	3	2	1	0	
	TCNT0[7:0]								TCNT0
Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

Output Compare Register – OCR0

Bit	7	6	5	4	3	2	1	0	
	OCR0[7:0]								OCR0
Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

Timer/Counter
Interrupt Mask
Register – TIMSK

Bit	7	6	5	4	3	2	1	0	
	OCIE2	TOIE2	OCIE1	OCIE1A	OCIE1B	TOIE1	OCIE0	TOIE0	TIMSK
Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

Bit 1 – OCIE0: Timer/Counter0 Output Compare Match Interrupt Enable
Bit 0 – TOIE0: Timer/Counter0 Overflow Interrupt Enable

Timer/Counter
Interrupt Flag Register
– TIFR

Bit	7	6	5	4	3	2	1	0	
	OCF2	TOV2	ICF1	OCF1A	OCF1B	TOV1	OCF0	TOV0	TIFR
Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

Bit 1 – OCF0: Output Compare Flag 0
Bit 0 – TOV0: Timer/Counter0 Overflow Flag

Timer/Counter1
Control Register A –
TCCR1A

Bit	7	6	5	4	3	2	1	0	
	COM1A1	COM1A0	COM1B1	COM1B0	FOC1A	FOC1B	WGM11	WGM10	TCCR1A
Read/Write	R/W	R/W	R/W	R/W	W	W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

Bit 7:6 – COM1A1:0: Compare Output Mode for Compare unit A
Bit 5:4 – COM1B1:0: Compare Output Mode for Compare unit B
Bit 3 – FOC1A: Force Output Compare for Compare unit A
Bit 2 – FOC1B: Force Output Compare for Compare unit B
Bit 1:0 – WGM11:0: Waveform Generation Mode

CS02	CS01	CS00	Description
0	0	0	No clock source (Timer/Counter stopped).
0	0	1	clk_{RCY} (No prescaling)
0	1	0	$clk_{RCY}/8$ (From prescaler)
0	1	1	$clk_{RCY}/64$ (From prescaler)
1	0	0	$clk_{RCY}/256$ (From prescaler)
1	0	1	$clk_{RCY}/1024$ (From prescaler)
1	1	0	External clock source on T0 pin. Clock on falling edge.
1	1	1	External clock source on T0 pin. Clock on rising edge.

COM1A1/COM1B1	COM1A0/COM1B0	Description
0	0	Normal port operation, OC1A/OC1B disconnected.
0	1	Toggle OC1A/OC1B on compare match
1	0	Clear OC1A/OC1B on compare match (Set output to low level)
1	1	Set OC1A/OC1B on compare match (Set output to high level)

Mode	WGM13	WGM12 (CTC1)	WGM11 (PWM11)	WGM10 (PWM10)	Timer/Counter Mode of Operation	TOP	Update of OCR1x	TOV1 Flag Set on
0	0	0	0	0	Normal	0xFFFF	Immediate	MAX
1	0	0	0	1	PWM, Phase Correct, 8-bit	0x00FF	TOP	BOTTOM
2	0	0	1	0	PWM, Phase Correct, 9-bit	0x01FF	TOP	BOTTOM
3	0	0	1	1	PWM, Phase Correct, 10-bit	0x03FF	TOP	BOTTOM
4	0	1	0	0	CTC	OCR1A	Immediate	MAX
5	0	1	0	1	Fast PWM, 8-bit	0x00FF	BOTTOM	TOP
6	0	1	1	0	Fast PWM, 9-bit	0x01FF	BOTTOM	TOP
7	0	1	1	1	Fast PWM, 10-bit	0x03FF	BOTTOM	TOP
8	1	0	0	0	PWM, Phase and Frequency Correct	ICR1	BOTTOM	BOTTOM
9	1	0	0	1	PWM, Phase and Frequency Correct	OCR1A	BOTTOM	BOTTOM
10	1	0	1	0	PWM, Phase Correct	ICR1	TOP	BOTTOM
11	1	0	1	1	PWM, Phase Correct	OCR1A	TOP	BOTTOM
12	1	1	0	0	CTC	ICR1	Immediate	MAX
13	1	1	0	1	Reserved	–	–	–
14	1	1	1	0	Fast PWM	ICR1	BOTTOM	TOP
15	1	1	1	1	Fast PWM	OCR1A	BOTTOM	TOP

Timer/Counter1
Control Register B –
TCCR1B

Bit	7	6	5	4	3	2	1	0	
	ICNC1	ICES1	–	WGM13	WGM12	CS12	CS11	CS10	TCCR1B
Read/Write	R/W	R/W	R	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

Bit 7 – ICNC1: Input Capture Noise Canceler
Bit 6 – ICES1: Input Capture Edge Select
Bit 5 – Reserved Bit
Bit 4:3 – WGM13:2: Waveform Generation Mode
Bit 2:0 – CS12:0: Clock Select



Operation Research326 R

11-5-2018

Third Level: Computer Science Section

Time: 3 hours

Total Degree (50 marks)

Science Faculty

Mathematical Department

Answer the following Questions:

1-Use the Simplex method to solve the following linear programming

Maximize $Z = 10x_1 + 11x_2$

Subject to $x_1 + 2x_2 \leq 150$, $3x_1 + 4x_2 \leq 200$, $6x_1 + x_2 \leq 175$

and $x_1, x_2 \geq 0$

(10 marks)

2) Use the graphical and the algebraic method to solve the problem

Max $f(\underline{x}) = 5x_1 + 7x_2$ Subject to $5x_1 + 8x_2 \leq 24$, $x_1 + x_2 \leq 4$,

$10x_1 + 7x_2 \leq 35$ and $x_1, x_2 \geq 0$

(12.5marks)

3) Use the Lagrange multiplier method to find the extreme points of the problem

Minimize $f(\underline{x}) = x_1^2 + x_2^2 - 3x_1x_2$

Subject to $g(\underline{x}) = x_1^2 + x_2^2 - 8 = 0$.

(12.5marks)

4) Use the Hessian Matrix to find the local points of the problem

$f(\underline{x}) = f(x_1, x_2) = x_1^3 + x_2^3 + 2x_1^2 + 4x_2^2 + 6$

(10marks)

5) Find the local Points

$f(x) = 3x^4 - 20x^3 + 36x^2 + 16$ (5marks)

Best Wishes

Dr. Alaa Fahim

اجب عن خمسة فقط من الاسئلة الاتية :- (10 درجات لكل سؤال : بواقع 5 درجات لكل فقرة)

(1) (i) اوجد الحل العام للمعادلة : $p_1 + 3p_2 + 2p_3(1 + \sqrt{x_1 + x_2 + x_3 - u}) = 6$
(ii) اوجد الحل الخاص للمعادلة : $(y - z)[2xyp + (x^2 - y^2)q] + z(x^2 - y^2) = 0$
الذي يمر خلال المنحنى $y = 0, x^3 = z^2$

(2) اوجد الحل العام لكل من المعادلتين التفاضليتين الجزئيتين الاتيتين :-
(i) $(D_1^3 - D_1^2 D_2 - D_1 D_2^2 + D_2^3)z = \log(x + y)$
(ii) $(D_1^2 - a^2 D_2^2)z = x^2 + y^2$, ثابت مطلق a

(3) اوجد الحل العام لكل من المعادلتين التفاضليتين الجزئيتين الاتيتين :-
(i) $(D_1^2 D_2 + D_2^2 - 2)z = e^{2y} \sin 3x - e^x \cos 2y$
(ii) $(D_1^2 - D_2^2 - D_1 - 3D_2 - 2)z = e^{2x-3y} + x + y + 1$

(4) (i) احسب التكاملات الاتية :-
(a) $\int_0^{\infty} x^{-\frac{1}{3}}(1 + 2x)^{-3} dx$ (b) $\int_0^1 \sqrt{\log \frac{1}{x}} dx$

(ii) اثبت ان :-
(a) $\tan^{-1} x = x {}_2F_1(1, \frac{1}{2}; \frac{3}{2}; -x^2)$
(b) $(a - b) {}_2F_1(a, b; c; x) = a {}_2F_1(a + 1, b; c; x) - b {}_2F_1(a, b + 1; c; x)$

(5) اثبت ان دوال بسل من النوع الاول $J_n(x)$ تحقق الاتي :-
(i) $J_{-\frac{1}{2}}(x) = \sqrt{\frac{2}{\pi x}} \cos x$, (ii) $\int x^n J_{n-1}(x) dx = x^n J_n(x) + c$

(6) (i) اثبت ان كثيرات حدود لجندر $P_n(x)$ تحقق :-
(ii) احسب التكاملات الاتية :-
(a) $\int_{-1}^1 x P_n(x) P_{n+1}(x) dx$, (b) $\int_{-1}^1 x^2 P_n(x) P_{n+1}(x) dx$, (c) $\int_{-1}^1 x^2 P_n(x) dx$

	Assiut University Faculty of Science Mathematics Dept.	Final Exam 2017-2018 Course: Mathematical and Statistical Packages Course code: MC300	Date: 14/5/2018 Level: Three Time: 2 Hours	
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Question 1: Put True or False for each of the following items (30 marks)

1. To enter a formula into a cell, begin by typing an equal sign.
2. Functions are pre-defined worksheet formulas.
3. Formulas in Excel must be written in a very specific format, referred to as syntax.
4. The second order of precedence is for exponentiation.
5. When the formula in cell **B7 =B4+B5+B6** is copied into cell **C7** the formula will be changed to **= C4+C5+C6**.
6. The error "#####" means Data being referenced is not available.
7. The range **B2:B7** is a range down a column.
8. To keep things clear and simple only add an absolute (\$) cell reference if absolutely necessary.
9. The formula **=ROUND(78.686788,-1)** results in the value 80 .
10. Placing an absolute sign in front of a ranged name (**\$budget**) is incorrect syntax.
11. The columns of the worksheet are named with Numbers.
12. Cells may contain only Labels and Values.
13. The cell address first lists the row name and then the column name.
14. This selected cell is referred to as the **active cell**.
15. The contents of the active cell will also be displayed on the **formula bar**.
16. A cell that is on sheet 3, in the second column third row would be referred to as **Sheet3@B3**.
17. Formatted Display is the number of decimal places that appear in a cell.
18. Formulas can be copied to perform different operations on a corresponding set of data.
19. The function **COUNT(value1,[value2],...)** counts non-blank cells.
20. The Average function ignore the blank cells.
21. TRUE and FALSE are called Boolean Values.
22. SPSS stands for Statistical Package for the Social Sciences.
23. SPSS is capable of handling large amounts of data.
24. SPSS has only two windows Data view and Output view.
25. **Transform** menu includes several options to change current variables.
26. In SPSS, Each column typically represents the data from 1 case.
27. In SPSS, The first column of variable view is Name.
28. In SPSS, you can sort data from **Transform** menu then **Sort Cases**.
29. Descriptive statistics are calculated using the **Analyze** menu.
30. Correlation is used to test the degree of association between variables.

Answer Sheet		
	True	False
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Question 2: (10 marks)

	A	B	C	D	E	F	G
1		MT1	MT2	Final	Total	Honors	Passed
2	Possible points	100	100	200	400		320
3							
4	Blue	79	89	169	337	FALSE	TRUE
5	Jones	85	65	195	345	FALSE	TRUE
6	Grey	60	97	187	344	TRUE	TRUE
7	Mary	10	30	50	90	TRUE	FALSE
8							

Write the following Boolean functions

1. Blue's total and Jones' total are greater than Grey's:
2. Grey's total is not the maximum grade:
3. None of the students passed the course
4. Blue is not an Honors student
5. Blue didn't get a passing grade (320)

Question 3: (10 marks)

1. What are the difference between Data View, Variable View and Output View in SPSS?
2. Some significance tests are very restrictive about the form of data they can accept. What are the different types of measurement?
3. Describe how to test the degree of association between variables by SPSS.
4. Explain how to use SPSS to calculate the frequency and percent of females and males who did and did not have social problems.

Q2.

- a. Maintain two different Algorithm of crossover process with mention the probability of crossover (5 marks)
- b. Maintain two different Algorithm of mutation process with mention the probability of mutation. (5 marks)

Q3. a. Maintain tree type representation of solutions in genetic algorithm. (3 marks)

b. Using genetic algorithm to find the maximum value of the function $(15x - x^2)$ where parameter x varies between 0 and 15. For simplicity, we may assume that x takes only integer values. Using the genetic algorithm procedure in one step and begin with four solutions in initial solutions. (10 marks)

Q4. Discuss the internal structure of Taxi driver Robot. (7 marks)

Q5. Discuss the Tabu search method and maintain the type of memory using in this method and maintain the Tabu search algorithm. (10 marks)

==best wishes==

Dr. Alaa F. Mohamed

Answer the following questions: (50 Marks)

Question 1: Answer the following points (10 Marks)

- 1- Explain the internet "nuts and bolts"?
- 2- Explain the sources of packet delay?
- 3- What are protocols?
- 4- Explain Access network: digital subscriber line (DSL)?

Question 2: Answer the following points (10 Marks)

- 1- What is the network core?
- 2- Explain Packet Switching: queueing delay, loss?
- 3- Define throughput?
- 4- Define and explain traffic intensity?

Question 3: Answer the following points (10 Marks)

- 1- Explain the Internet protocol stack?
- 2- Mention some network applications?
- 3- Explain the application client-server architecture?
- 4- Explain P2P architecture?

Question 4: Answer the following points (10 Marks)

- 1- HTTP is "stateless". What does that mean?
- 2- Compare between persistent HTTP and non-persistent HTTP?
- 3- Give examples of HTTP response status codes?
- 4- Explain the term (web caches) and how it is useful?

Question 5: Answer the following points (10 Marks)

- 1- Give a DNS name resolution example?
- 2- Compare between multiplexing and demultiplexing? Support your answer with a diagram?
- 3- Define and explain the use of ACKs and NAKs?
- 4- Define and explain HOL? Support your answer with a diagram?

جامعة أسيوط	مايو 2018	كود المقرر: 356 رك
كلية العلوم		المقرر : مقدمة فى الحسابات العلمية
قسم الرياضيات		الزمن : ساعتان

Answer the following questions by using MATLAB language: (50 marks)

1- Using Newton's forward difference formula, find $y(0.1)$ using the table below:

x	0.0	0.2	0.4	0.6	0.8
y	1.000	1.22140	1.49182	1.82212	2.22554

2- Solve the differential equation by Adams method (without using nested for loops) at $x=0.2$:

$$\frac{dy}{dt} = t^2 - y, \quad y(0) = 1, \quad h = 0.05.$$

and compare it with the analytic solution $y = -e^{-t} + t^2 - 2t + 2$.

3- Solve the following initial value problem:

$$\frac{d^2u}{dt^2} + 4\frac{du}{dt} + 3u = 0, \quad u(0) = 1, \quad \frac{du}{dt}(0) = 0.$$

4- Let $f(x) = \cos 2x$ and $x_0 = 0$. Determine

- The third Taylor polynomial for f about x_0 .
- Find error bound at $x = 0.2$ and compare it to the actual error.

5- For the well-known Chua's circuit equation in chaotic studies that

$$\dot{x} = \alpha[y - x - f(x)], \quad \dot{y} = x - y + z, \quad \dot{z} = -\beta y - \gamma z, \quad t \in (0, 10),$$

where the nonlinear function $f(x)$ is described by

$$f(x) = bx + 0.5(a-b)(|x+1| - |x-1|) \text{ and } a < b < 0.$$

Write an M-function to describe the equation, and draw the phase trajectory for the parameters $\alpha = 9$, $\beta = 100/7$, $\gamma = 0$, $a = -8/7$, $b = -5/7$, and initial conditions

$$x(0) = -2.121304, \quad y(0) = -0.066170, \quad z(0) = 2.881090.$$

Good Luck

Dr. Tarek Aboelenen



امتحان الفرقة الثالثة شعبة الرياضيات

الزمن : ثلاث ساعات

رقم المقرر ورمزه : ١٣٤٦

المقرر : عمليات عشوائية وتطبيقاتها

أجب عن خمسة أسئلة فقط مما يأتي :- درجة جزء كل سؤال (خمس درجات)

١- (أ) لمجموعة المتغيرات العشوائية المستقلة $X_1, X_2, X_3, \dots$ بفرض أن التوقع الرياضي $E(X_i) = m$ والتباين $V(X_i)$ لكل منها محدود عرف كل من التقارب عن طريق الإحتمال وقانون الأعداد الكبرى (الضعيف).
(ب) بفرض أن $f f s s f s f f s s s f f s f f s$ هي إحدى النتائج الممكنة في محاولات برنولي العشوائية المستقلة بحيث أن $P(s) = p, P(f) = q, p + q = 1$ عرف عملية عشوائية في الفراغ R^2 موضحا ذلك بيانيا .

٢- (أ) في عملية برنولي العشوائية $\{X_n; n > 0\}$ بالإحتمال $p = 0.6$ إذا كان $X = X_1 + X_2$ ، $Y = X_1 + X_3$ احسب الإحتمالات الآتية : $P(X < 2, Y \leq 1)$ ، $P(2X < 3Y)$ ، $P(Y = X)$.
(ب) في السؤال (٢-أ) أوجد العزم الارتباطي بين X ، Y موضحا العلاقة بينهما .

٣- (أ) وضح العلاقة بين عملية برنولي العشوائية $\{X_n; n > 0\}$ و العملية العشوائية $\{Y_n; n \geq 0\}$ حيث أن المتغير Y_n يخضع لتوزيع ذي الحدين واذكر صفات كل منهما ثم عبر مع الاستنتاج عن إحتمال الحادث $(Y_{n+1} = k)$ من خلال إحتمالات الحوادث : $(Y_n = k)$ ، $(Y_n = k - 1)$ لأي عدد صحيح $k > 0$.
(ب) في العملية العشوائية $\{Y_n; n \geq 0\}$ أوجد كل من $E(Y_5)$ ، $E(Y_4^2)$ ، $P(Y_5 = 3, Y_7 = 4, Y_{14} = 9)$.

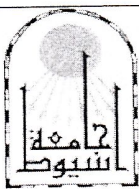
٤- (أ) عرف أزمنة النجاح T_k كعملية عشوائية موضحا العلاقة بينها وبين العملية العشوائية $\{Y_n; n \geq 0\}$ ثم اذكر فقط توزيع المتغير العشوائي T_k .
(ب) - في عملية بواسون العشوائية $\{N_t; t \geq 0\}$ بالمعدل $\lambda = 4$ احسب كل من الإحتمالات الآتية :
 $P(N_{1.5} = 2, N_4 = 5, N_{6.8} = 9)$ ، $P(N_3 = 5, N_7 = 9)$

٥- (أ) في عملية بواسون أو عملية الوصول المعودة $\{N_t; t \geq 0\}$ بالمعدل λ إثبت أن الإحتمال المشروط لعدد الوصول N_t بالنسبة إلى عدد الوصول N_{t+s} لكل $t > 0, s > 0$ يمثل توزيع ذي الحدين.
(ب) عرف العمليات العشوائية المستقلة ثم اثبت أن أي عمليتين مستقلتين لبواسون هو أيضا عملية بواسون .

٦- (أ) في عملية التجديد العشوائية $R = \{R_n; n \in N\}$ حيث N هي فئة الأعداد الصحيحة غير السالبة عرف دالة التجديد ثم عبر عنها من خلال توزيع المتغير R_n مع الاستنتاج .

(ب) في سلسلة ماركوف العشوائية المتقطعة $\{X_n; n \geq 0\}$ عرف مصفوفة الإحتمالات الإنتقالية بصفاتها المعروفة ثم احسب الإحتمال : $P(X_0 = 1, X_1 = 1, X_2 = 0, X_3 = 1, X_4 = 0, X_6 = 0)$ بفرض أن حالات الفراغ $(0, 1)$ والمصفوفة العشوائية

$$P = \begin{pmatrix} 1/2 & 1/2 \\ 1/3 & 2/3 \end{pmatrix} , \text{ ومنتجه الإحتمالات الابتدائية } \pi_0 = (2/5 \quad 3/5)$$

	المقرر: تحليل عددي (٣٢٣) الفرقة: المستوى الثالث الدرجة: ٥٠ درجة التاريخ: ٢٠١٨/٥/٢٩ الزمن: ثلاث ساعات	جامعة أسيوط كلية العلوم - قسم الرياضيات امتحان نهائي الفصل الدراسي الثاني للعام الجامعي ٢٠١٧/٢٠١٨
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Answer five questions only :- (10 marks for every question)

1-a) If the function $g \in C[a, b]$ and $g(x) \in [a, b] \forall x \in [a, b]$ and $g'(x)$ exist with $|g'(x)| \leq k < 1 \forall x \in [a, b]$ prove that the sequence defined by $P_n = g(P_{n-1}), n \geq 1$ will converge to the unique fixed point P and also $|P_{n+1} - P_n| \leq k^n |P_1 - P_0|$.

1-b) Verify that when Newton's method is used to compute $\sqrt{A}, A > 0$ (By solving the equation : $f(x) = x^2 - A$). The sequence of iterates is defined by : $x_{n+1} = (x_n + \frac{A}{x_n})/2$, and show that if the sequence $\{x_n\}$ is defined as the previous problem, then this method is quadratically convergence.

2-a) Derive Lagrange interpolation formula of degree n and write the error of the method.

2-b) For the given function $f(x) = \cos \pi x$ let $x_0 = -1, x_1 = 0, x_2 = 1$ construct the suitable interpolation polynomial and find the actual error.

3) Derive the formula of the Newton's interpolatory divided difference method and use this formula to obtain a polynomial of least degree that fits the values shown:

x	0	1	2	4	6
$f(x)$	1	9	23	93	259

من فضلك انظر خلف الورقة

السؤال الرابع :-

أ) يعرف الطي للدالتين $f(x)$, $g(x)$ كالآتي

$$f * g = \int_{-\infty}^{\infty} f(u) g(x-u) du$$

برهن علي أن تحويل فوريير للطرف الأيمن هو حاصل ضرب تحويلي فوريير للدالتين $f(x)$, $g(x)$

ب) أوجد تحويل فوريير للدالة $f(x) = \begin{cases} 1 & |x| < a \\ 0 & |x| > a \end{cases}$ وأرسم $f(x)$ كذلك تحويلها عند $a = 3$ وأوجد

$$\int_{-\infty}^{\infty} \frac{\sin u}{u} du \quad \text{كذلك} \quad \int_{-\infty}^{\infty} \frac{\sin \alpha a \cos \alpha x}{\alpha} d\alpha$$

ج) ترك خيط لانهائي من السكون وكانت أزاحته الابتدائية عن محور x هي $f(x)$ أوجد الإزاحه عند أي زمن .

انتهت الأسئلة مع تمنياتنا بالتوفيق ،،،،

لجنة الممتحنين :- أ. د/ نجاه عبد الرحمن حسين ، أ. د/ فاروق علي السيد



الامتحان النهائي للفصل الدراسي الثاني للعام الجامعي ٢٠١٧/٢٠١٨ م
 للفرقة : الثالثة
 الشعبة : الرياضيات
 التاريخ : ٢٠١٨/٥/٢٤ م

الزمن : ساعتان

الدرجة الكلية : ٥٠ درجة

درجة كل سؤال : ١٧ درجة

أسم المقرر : الطرق الرياضية
 رقم المقرر ورمزه : ٣٣٤ ر

أجب عن ثلاثة أسئلة فقط مما يأتي :-

السؤال الأول :-

أوجد تحويل لابلاس للمشتقة التفاضلية للدالة $F(t)$ عند نقط الاتصال والانفصال للدالة .

أبرهن علي أن

$$\lim_{t \rightarrow 0} F(t) = \lim_{s \rightarrow \infty} s f(s)$$

$$\lim_{t \rightarrow \infty} F(t) = \lim_{s \rightarrow 0} s f(s)$$

$$\Gamma\left(\frac{1}{2}\right) = \sqrt{\pi}, \quad \int_0^{\infty} \delta(t) dt = 1, \quad L \sin \sqrt{t} = \frac{\sqrt{\pi}}{3} e^{-\frac{1}{4s}} s^{\frac{3}{2}}$$

السؤال الثاني :-

حل المعادلات الآتية :

$$t Y''(t) + Y'(t) + 4t Y(t) = 0, \quad y(0) = 3, y'(0) = 0$$

$$\frac{\partial U}{\partial x} = 2 \frac{\partial U}{\partial t} + U, \quad x > 0, t > 0 \quad U(x, 0) = 6 e^{-3x}$$

$$\int_0^t Y(u) Y(t-u) du = 16 \sin 4t$$

السؤال الثالث :-

(أ) فك الدالة $f(x) = x^2$, $0 < x < 2\pi$ بدلالة متسلسلة فوريير ثم أحسب المجموع

$$1 + \frac{1}{2^2} + \frac{1}{3^2} + \frac{1}{4^2} + \dots$$

(ب) صفيحة علي شكل دائري نصف قطرها الوحدة ووجهيها معزولين ونصف محيطها محفوظ عند درجة حرارة u_1

والآخر عند u_2 أوجد حالة الأتزان الحراري .

من فضلك أنظر بقية الأسئلة خلف الورقة ،،،،،



Answer the following questions (50 marks)

Q1.	Complete the following: (1)..... is a representation of a two-dimensional image as a finite set of digital values, called picture elements or pixels - Common image formats include.....(2).... ,(3)..... ,(4)..... (5)..... creates a Distance tool a draggable, resizable line that measures the distance between its endpoints. (6)..... These are the result of objects that are self-luminous, such as stars and light bulbs. (7).....the resulting output pixel is computed as a sum of products of the pixel values and mask coefficients in the pixel's neighborhood in the original image. - The Sobel operators used to compute edges are(8)..... ,(9)..... - Edge detector should have:(10)..... ,(11)..... - Types of noise are(12)..... ,(13)....	(13 marks)
Q2.	a) Compute Z from the following matlab script (6 marks) <pre> x = [150 10 90;80 50 60;121 160 20] y = [-1 0 1;-2 0 2;-1 0 1] z = imfilter(x,y,'corr') </pre> b) What is the Delta compression and compute the compressed data of the data (6 marks) 220 321 335 211 250 200 233 214 232 212	(12 marks)
Q3.	a) Write the MATLAB code used to: (4 marks) - Read any image then use affine transformation matrix for each of the operations below: - Flip the image right to left - Translation by [25, 15] pixels b) What are the main differences between: (8 marks) - Global thresholding and optimal thresholding. - Raster and vector image . - Interpixel redundancy and Psychovisual redundancy	(12 marks)

(Q5) (i) Assume that U, V are open intervals and let $f : U \rightarrow \mathbb{R}$ and $g : V \rightarrow \mathbb{R}$ be two differentiable functions such that $f(U) \subset V$. Prove that $g \circ f$ is differentiable on U and that $(g \circ f)' = (g' \circ f) \cdot f'$ [5 marks]

(ii) Prove that the function $f(x) := \frac{1}{x}$ is differentiable on $]0, \infty[$ but not uniformly continuous therein. [5 marks]

(Q6) (i) State and prove Rolle's theorem then use it to prove the mean value theorem. [6 marks]

(ii) Let I be an open interval. Apply the mean value theorem to prove that a function differentiable on I is

1. increasing if and only if $f' \geq 0$ on I ,

2. decreasing if and only if $f' \leq 0$ on I .

[4 marks]

With the best of luck,

Prof. Rashwan A. Rashwan,

Dr. Ahmed A. Abdelhakim



Time: 3 hours

Total mark: 50

Answer *only five* of the following questions:

(Q1) (i) Suppose that O_i , $i \geq 1$, are open subsets of $\mathbb{R}$. Prove that $\cup_{i \geq 1} O_i$ is also open in $\mathbb{R}$. [5 marks]

(ii) Let $S \subset \mathbb{R}$. Show that S is closed if and only if S contains the limit point of every convergent sequence of elements of S . [5 marks]

(Q2) (i) Prove that a sequence of real numbers converges if and only if it is a Cauchy sequence. [6 marks]

(ii) Show that if $(x_n)_{n \geq 1} \subset \mathbb{R}$ is a monotonically increasing sequence that is bounded above, then $x_n \rightarrow \sup_{n \geq 1} x_n$, as $n \rightarrow \infty$. [4 marks]

(Q3) (i) Show that $f : D \subset \mathbb{R} \rightarrow \mathbb{R}$ is continuous at $x_0 \in D$ if and only if the sequence $(f(x_n))_{n \geq 1}$ converges to $f(x_0)$ whenever $(x_n)_{n \geq 1}$ is a sequence in D that converges to x_0 . [6 marks]

(ii) Use the characterization given in (i) to prove the discontinuity at the origin of the function $f(x) = \begin{cases} \cos \frac{1}{x}, & x \neq 0; \\ 0, & x = 0. \end{cases}$ [4 marks]

(Q4) (i) Assume that D is a closed bounded subset of $\mathbb{R}$. Prove that if $f : D \rightarrow \mathbb{R}$ is continuous then f is bounded on D , and there exist $\alpha, \beta \in D$ such that $f(\alpha) = \max_{x \in D} f(x)$ and $f(\beta) = \min_{x \in D} f(x)$. [5 marks]

(ii) Argue by contradiction to demonstrate that if $f : [a, b] \rightarrow \mathbb{R}$ is continuous then it is uniformly continuous on $[a, b]$. [5 marks]

Please Turn over the page



أجب عن أسئلة الآتية :- (كل سؤال ١٠ درجات)

(١) (أ) أثبت قاعدة التضعيف لدالة جاما $\sqrt{\pi} \Gamma(2x) = 2^{2x-1} \Gamma(x) \Gamma\left(x + \frac{1}{2}\right), x > 0$

ثم استخدمها فى إثبات أن: $\Gamma\left(\frac{5}{6}\right) \left[\Gamma\left(\frac{1}{3}\right)\right]^2 = 2 \sqrt[3]{2} \sqrt{\frac{\pi^3}{3}}$

(ب) باستخدام دوال جاما و بيتا أوجد التكاملات الآتية: (i) $\int_0^{\frac{\pi}{2}} \sqrt{\tan \theta} d\theta$ (ii) $\int_0^{\infty} \frac{\sqrt{x}}{e^{x^3}} dx$

(٢) (أ) أثبت أن: $\Gamma(x) \Gamma(1-x) = \frac{\pi}{\sin \pi x}, 0 < x < 1$ ومن ثم أثبت أن

$\Gamma\left(x + \frac{1}{2}\right) \Gamma\left(\frac{1}{2} - x\right) = \frac{\pi}{\cos \pi x}$

(ب) أثبت أن:

(i) $\sqrt{1-x^2} T_n(x) = U_{n+1}(x) - x U_n(x),$

(ii) $(1-x^2) U'_n(x) = -n x U_n(x) + n U_{n-1}(x)$

(٣) أثبت أن:

(i) ${}_2F_1(\alpha, \beta; \gamma, x) = (1-x)^{-\beta} {}_2F_1\left(\gamma - \alpha, \beta; \gamma, \frac{x}{x-1}\right)$

(ii) ${}_1F_1\left(\frac{1}{2}; \frac{3}{2}, -x^2\right) = \frac{\sqrt{\pi}}{2x} \operatorname{erf}(x)$ حيث أن: $\operatorname{erf}(x) = \frac{2}{\sqrt{\pi}} \int_0^x e^{-t^2} dt$ هى دالة الخطأ

(iii) ${}_1F_1(\alpha + 1; \gamma, x) - {}_1F_1(\alpha; \gamma, x) - \frac{x}{\gamma} {}_1F_1(\alpha + 1; \gamma + 1, x) = 0$

(٤) (أ) أوجد مفكوك ليجندر للدالة: $f(x) = x^3$

(ب) أثبت أن: $H_n(x) = (-1)^n e^{x^2} \frac{d^n}{dx^n} (e^{-x^2})$ حيث $H_n(x)$ كثيرة حدود هيرميت.

(ج) أثبت أن: $J_{\frac{1}{2}}(x) = \sqrt{\frac{2}{\pi}} \frac{\sin x}{\sqrt{x}}$

(٥) (أ) باستخدام الصيغة التكاملية لدوال بسل أثبت أن: $\int_0^{\infty} e^{-3x} J_0(4x) dx = \frac{1}{5}$

(ب) أوجد الحل العام لمعادلة بسل التفاضلية:

$x^2 \frac{d^2 y}{dx^2} + x \frac{dy}{dx} + (x^2 - n^2)y = 0$

CS12	CS11	CS10	Description
0	0	0	No clock source (Timer/Counter stopped).
0	0	1	clk _{IO} /1 (No prescaling)
0	1	0	clk _{IO} /8 (From prescaler)
0	1	1	clk _{IO} /64 (From prescaler)
1	0	0	clk _{IO} /256 (From prescaler)
1	0	1	clk _{IO} /1024 (From prescaler)
1	1	0	External clock source on T1 pin. Clock on falling edge.
1	1	1	External clock source on T1 pin. Clock on rising edge.

Timer/Counter1 – TCNT1H and TCNT1L

Bit	7	6	5	4	3	2	1	0	
	TCNT1[15:8]								TCNT1H
	TCNT1[7:0]								TCNT1L
Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

Output Compare Register 1 B – OCR1BH and OCR1BL

Bit	7	6	5	4	3	2	1	0	
	OCR1B[15:8]								OCR1BH
	OCR1B[7:0]								OCR1BL
Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

Input Capture Register 1 – ICR1H and ICR1L

Bit	7	6	5	4	3	2	1	0	
	ICR1[15:8]								ICR1H
	ICR1[7:0]								ICR1L
Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

Timer/Counter Interrupt Mask Register – TIMSK⁽¹⁾

Bit	7	6	5	4	3	2	1	0	
	OCIE2	OCIE1	OCIE1A	OCIE1B	TOIE1	OCIE0	TOIE0		TIMSK
Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

- Bit 5 – OCIE1: Timer/Counter1, Input Capture Interrupt Enable
 Bit 4 – OCIE1A: Timer/Counter1, Output Compare A Match Interrupt Enable
 Bit 3 – OCIE1B: Timer/Counter1, Output Compare B Match Interrupt Enable
 Bit 2 – TOIE1: Timer/Counter1, Overflow Interrupt Enable

Timer/Counter Interrupt Flag Register – TIFR

Bit	7	6	5	4	3	2	1	0	
	OCF2	TOV2	ICF1	OCF1A	OCF1B	TOV1	OCF0	TOV0	TIFR
Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

- Bit 5 – ICF1: Timer/Counter1, Input Capture Flag
 Bit 4 – OCF1A: Timer/Counter1, Output Compare A Match Flag
 Bit 3 – OCF1B: Timer/Counter1, Output Compare B Match Flag
 Bit 2 – TOV1: Timer/Counter1, Overflow Flag

USART

Operating Mode	Equation for Calculating Baud Rate ⁽¹⁾	Equation for Calculating UBRR Value
Asynchronous Normal Mode (U2X = 0)	$BAUD = \frac{f_{osc}}{16(UBRR + 1)}$	$UBRR = \frac{f_{osc}}{16BAUD} - 1$
Asynchronous Double Speed Mode (U2X = 1)	$BAUD = \frac{f_{osc}}{8(UBRR + 1)}$	$UBRR = \frac{f_{osc}}{8BAUD} - 1$
Synchronous Master Mode	$BAUD = \frac{f_{osc}}{2(UBRR + 1)}$	$UBRR = \frac{f_{osc}}{2BAUD} - 1$

USART I/O Data Register – UDR

Bit	7	6	5	4	3	2	1	0	
	RXB[7:0]								UDR (Read)
	TXB[7:0]								UDR (Write)
Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

Timer/Counter
Interrupt Mask
Register – TIMSK

Bit	7	6	5	4	3	2	1	0	
	OCIE2	TOIE2	OCIE1	OCIE1A	OCIE1B	TOIE1	OCIE0	TOIE0	TIMSK
Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

Bit 1 – OCIE0: Timer/Counter0 Output Compare Match Interrupt Enable
Bit 0 – TOIE0: Timer/Counter0 Overflow Interrupt Enable

Timer/Counter
Interrupt Flag Register
– TIFR

Bit	7	6	5	4	3	2	1	0	
	OCF2	TOV2	OCF1	OCF1A	OCF1B	TOV1	OCF0	TOV0	TIFR
Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

Bit 1 – OCF0: Output Compare Flag 0
Bit 0 – TOV0: Timer/Counter0 Overflow Flag

Timer/Counter1
Control Register A –
TCCR1A

Bit	7	6	5	4	3	2	1	0	
	COM1A1	COM1A0	COM1B1	COM1B0	FOC1A	FOC1B	WGM11	WGM10	TCCR1A
Read/Write	R/W	R/W	R/W	R/W	W	W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

Bit 7:6 – COM1A1:0: Compare Output Mode for Compare unit A
Bit 5:4 – COM1B1:0: Compare Output Mode for Compare unit B
Bit 3 – FOC1A: Force Output Compare for Compare unit A
Bit 2 – FOC1B: Force Output Compare for Compare unit B
Bit 1:0 – WGM11:0: Waveform Generation Mode

CS02	CS01	CS00	Description
0	0	0	No clock source (Timer/Counter stopped).
0	0	1	$clk_{IO}/1$ (No prescaling)
0	1	0	$clk_{IO}/8$ (From prescaler)
0	1	1	$clk_{IO}/64$ (From prescaler)
1	0	0	$clk_{IO}/256$ (From prescaler)
1	0	1	$clk_{IO}/1024$ (From prescaler)
1	1	0	External clock source on T0 pin, Clock on falling edge.
1	1	1	External clock source on T0 pin, Clock on rising edge.

COM1A1/COM1B1	COM1A0/COM1B0	Description
0	0	Normal port operation, OC1A/OC1B disconnected.
0	1	Toggle OC1A/OC1B on compare match
1	0	Clear OC1A/OC1B on compare match (Set output to low level)
1	1	Set OC1A/OC1B on compare match (Set output to high level)

Mode	WGM13	WGM12 (CTC1)	WGM11 (PWM11)	WGM10 (PWM10)	Timer/Counter Mode of Operation	TOP	Update of OCR1x	TOV1 Flag Set on
0	0	0	0	0	Normal	0xFFFF	Immediate	MAX
1	0	0	0	1	PWM, Phase Correct, 8-bit	0x00FF	TOP	BOTTOM
2	0	0	1	0	PWM, Phase Correct, 9-bit	0x01FF	TOP	BOTTOM
3	0	0	1	1	PWM, Phase Correct, 10-bit	0x03FF	TOP	BOTTOM
4	0	1	0	0	CTC	OCR1A	Immediate	MAX
5	0	1	0	1	Fast PWM, 8-bit	0x00FF	BOTTOM	TOP
6	0	1	1	0	Fast PWM, 9-bit	0x01FF	BOTTOM	TOP
7	0	1	1	1	Fast PWM, 10-bit	0x03FF	BOTTOM	TOP
8	1	0	0	0	PWM, Phase and Frequency Correct	ICR1	BOTTOM	BOTTOM
9	1	0	0	1	PWM, Phase and Frequency Correct	OCR1A	BOTTOM	BOTTOM
10	1	0	1	0	PWM, Phase Correct	ICR1	TOP	BOTTOM
11	1	0	1	1	PWM, Phase Correct	OCR1A	TOP	BOTTOM
12	1	1	0	0	CTC	ICR1	Immediate	MAX
13	1	1	0	1	Reserved	–	–	–
14	1	1	1	0	Fast PWM	ICR1	BOTTOM	TOP
15	1	1	1	1	Fast PWM	OCR1A	BOTTOM	TOP

Timer/Counter1
Control Register B –
TCCR1B

Bit	7	6	5	4	3	2	1	0	
	ICNC1	ICES1	–	WGM13	WGM12	CS12	CS11	CS10	TCCR1B
Read/Write	R/W	R/W	R	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

Bit 7 – ICNC1: Input Capture Noise Canceler
Bit 6 – ICES1: Input Capture Edge Select
Bit 5 – Reserved Bit
Bit 4:3 – WGM13:2: Waveform Generation Mode
Bit 2:0 – CS12:0: Clock Select

CS12	CS11	CS10	Description
0	0	0	No clock source (Timer/Counter stopped).
0	0	1	$clk_{IO}/1$ (No prescaling)
0	1	0	$clk_{IO}/8$ (From prescaler)
0	1	1	$clk_{IO}/64$ (From prescaler)
1	0	0	$clk_{IO}/256$ (From prescaler)
1	0	1	$clk_{IO}/1024$ (From prescaler)
1	1	0	External clock source on T1 pin. Clock on falling edge.
1	1	1	External clock source on T1 pin. Clock on rising edge.

Timer/Counter1 – TCNT1H and TCNT1L

Bit	7	6	5	4	3	2	1	0	
	TCNT1[15:8]								TCNT1H
	TCNT1[7:0]								TCNT1L
Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

Output Compare Register 1 B – OCR1BH and OCR1BL

Bit	7	6	5	4	3	2	1	0	
	OCR1B[15:8]								OCR1BH
	OCR1B[7:0]								OCR1BL
Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

Input Capture Register 1 – ICR1H and ICR1L

Bit	7	6	5	4	3	2	1	0	
	ICR1[15:8]								ICR1H
	ICR1[7:0]								ICR1L
Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

Timer/Counter Interrupt Mask Register – TIMSK⁽¹⁾

Bit	7	6	5	4	3	2	1	0	
	OCIE2	TOIE2	TICIE1	OCIE1A	OCIE1B	TOIE1	OCIE0	TOIE0	TIMSK
Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

- Bit 5 – TICIE1: Timer/Counter1, Input Capture Interrupt Enable
 Bit 4 – OCIE1A: Timer/Counter1, Output Compare A Match Interrupt Enable
 Bit 3 – OCIE1B: Timer/Counter1, Output Compare B Match Interrupt Enable
 Bit 2 – TOIE1: Timer/Counter1, Overflow Interrupt Enable

Timer/Counter Interrupt Flag Register – TIFR

Bit	7	6	5	4	3	2	1	0	
	OCF2	TOV2	ICF1	OCF1A	OCF1B	TOV1	OCF0	TOV0	TIFR
Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

- Bit 5 – ICF1: Timer/Counter1, Input Capture Flag
 Bit 4 – OCF1A: Timer/Counter1, Output Compare A Match Flag
 Bit 3 – OCF1B: Timer/Counter1, Output Compare B Match Flag
 Bit 2 – TOV1: Timer/Counter1, Overflow Flag

USART

Operating Mode	Equation for Calculating Baud Rate ⁽¹⁾	Equation for Calculating UBRR Value
Asynchronous Normal Mode (U2X = 0)	$BAUD = \frac{f_{osc}}{16(UBRR + 1)}$	$UBRR = \frac{f_{osc}}{16BAUD} - 1$
Asynchronous Double Speed Mode (U2X = 1)	$BAUD = \frac{f_{osc}}{8(UBRR + 1)}$	$UBRR = \frac{f_{osc}}{8BAUD} - 1$
Synchronous Master Mode	$BAUD = \frac{f_{osc}}{2(UBRR + 1)}$	$UBRR = \frac{f_{osc}}{2BAUD} - 1$

USART I/O Data Register – UDR

Bit	7	6	5	4	3	2	1	0	
	RXB[7:0]								UDR (Read)
	TXB[7:0]								UDR (Write)
Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

USART Control and Status Register A – UCSRA

Bit	7	6	5	4	3	2	1	0	
	RXC	TXC	UDRE	FE	DOR	PE	U2X	MPCM	UCSRA
Read/Write	R	R/W	R	R	R	R	R/W	R/W	
Initial Value	0	0	1	0	0	0	0	0	

- Bit 7 – RXC: USART Receive Complete
- Bit 6 – TXC: USART Transmit Complete
- Bit 5 – UDRE: USART Data Register Empty
- Bit 4 – FE: Frame Error
- Bit 3 – DOR: Data OverRun
- Bit 2 – PE: Parity Error
- Bit 1 – U2X: Double the USART Transmission Speed
- Bit 0 – MPCM: Multi-processor Communication Mode

USART Control and Status Register B – UCSRB

Bit	7	6	5	4	3	2	1	0	
	RXCIE	TXCIE	UDRIE	RXEN	TXEN	UCSZ2	RXB8	TXB8	UCSRB
Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R	R/W	
Initial Value	0	0	0	0	0	0	0	0	

- Bit 7 – RXCIE: RX Complete Interrupt Enable
- Bit 6 – TXCIE: TX Complete Interrupt Enable
- Bit 5 – UDRIE: USART Data Register Empty Interrupt Enable
- Bit 4 – RXEN: Receiver Enable
- Bit 3 – TXEN: Transmitter Enable
- Bit 2 – UCSZ2: Character Size
- Bit 1 – RXB8: Receive Data Bit 8
- Bit 0 – TXB8: Transmit Data Bit 8

USART Control and Status Register C – UCSRC

Bit	7	6	5	4	3	2	1	0	
	URSEL	UMSEL	UPM1	UPM0	USBS	UCSZ1	UCSZ0	UCPOL	UCSRC
Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	
Initial Value	1	0	0	0	0	1	1	0	

- Bit 7 – URSEL: Register Select
- Bit 6 – UMSEL: USART Mode Select
- Bit 5:4 – UPM1:0: Parity Mode
- Bit 3 – USBS: Stop Bit Select
- Bit 2:1 – UCSZ1:0: Character Size
- Bit 0 – UCPOL: Clock Polarity

UMSEL	Mode
0	Asynchronous Operation
1	Synchronous Operation

USBS	Stop Bit(s)
0	1-bit
1	2-bit

UPM1	UPM0	Parity Mode
0	0	Disabled
0	1	Reserved
1	0	Enabled, Even Parity
1	1	Enabled, Odd Parity

UCPOL	Transmitted Data Changed (Output of Tx D Pin)	Received Data Sampled (Input on Rx D Pin)
0	Rising XCK Edge	Falling XCK Edge
1	Falling XCK Edge	Rising XCK Edge

Table 66. UCSZ Bits Settings

UCSZ2	UCSZ1	UCSZ0	Character Size
0	0	0	5-bit
0	0	1	6-bit
0	1	0	7-bit
0	1	1	8-bit
1	0	0	Reserved
1	0	1	Reserved
1	1	0	Reserved
1	1	1	9-bit

USART Baud Rate Registers – UBRRL and UBRRH

Bit	15	14	13	12	11	10	9	8	
	URSEL	-	-	-	-	UBRR[11:9]	-	-	UBRRH
	-	-	-	-	-	UBRR[7:0]	-	-	UBRRL
Read/Write	R/W	R	R	R	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	



Operation Research326 R

11-5-2018

Third Level: Computer Science Section

Time: 3 hours

Total Degree (50 marks)

Science Faculty

Mathematical Department

Answer the following Questions:

1-Use the Simplex method to solve the following linear programming

Maximize $Z = 10x_1 + 11x_2$

Subject to $x_1 + 2x_2 \leq 150$, $3x_1 + 4x_2 \leq 200$, $6x_1 + x_2 \leq 175$

and $x_1, x_2 \geq 0$

(10 marks)

2) Use the graphical and the algebraic method to solve the problem

Max $f(\underline{x}) = 5x_1 + 7x_2$ Subject to $5x_1 + 8x_2 \leq 24$, $x_1 + x_2 \leq 4$,

$10x_1 + 7x_2 \leq 35$ and $x_1, x_2 \geq 0$

(12.5marks)

3) Use the Lagrange multiplier method to find the extreme points of the problem

Minimize $f(\underline{x}) = x_1^2 + x_2^2 - 3x_1x_2$

Subject to $g(\underline{x}) = x_1^2 + x_2^2 - 8 = 0$.

(12.5marks)

4) Use the Hessian Matrix to find the local points of the problem

$f(\underline{x}) = f(x_1, x_2) = x_1^3 + x_2^3 + 2x_1^2 + 4x_2^2 + 6$

(10marks)

5) Find the local Points

$f(x) = 3x^4 - 20x^3 + 36x^2 + 16$ (5marks)

Best Wishes

Dr. Alaa Fahim

- b) Write an AVR C program to control the sliding door and, count the number of visitors and display it on LCD. (6 marks)

Best Wishes

----- End of Questions -----

Dr. Osama Haraz

(XCK/T0) PB0	1	40	PA0 (ADC0)
(T1) PB1	2	39	PA1 (ADC1)
(INT2/AIN0) PB2	3	38	PA2 (ADC2)
(OC0/AIN1) PB3	4	37	PA3 (ADC3)
(SS) PB4	5	36	PA4 (ADC4)
(MOSI) PB5	6	35	PA5 (ADC5)
(MISO) PB6	7	34	PA6 (ADC6)
(SCK) PB7	8	33	PA7 (ADC7)
RESET	9	32	AREF
VCC	10	31	GND
GND	11	30	AVCC
XTAL2	12	29	PC7 (TOSC2)
XTAL1	13	28	PC6 (TOSC1)
(RXD) PD0	14	27	PC5 (TDI)
(TXD) PD1	15	26	PC4 (TDO)
(INT0) PD2	16	25	PC3 (TMS)
(INT1) PD3	17	24	PC2 (TCK)
(OC1B) PD4	18	23	PC1 (SDA)
(OC1A) PD5	19	22	PC0 (SCL)
(ICP1) PD6	20	21	PD7 (OC2)

Status Register

Bit	7	6	5	4	3	2	1	0	
	I	T	H	S	V	N	Z	C	SREG
Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

Bit 7 – I: Global Interrupt Enable
 Bit 6 – T: Bit Copy Storage
 Bit 5 – H: Half Carry Flag
 Bit 4 – S: Sign Bit, $S = N \oplus V$

Bit 3 – V: Two's Complement Overflow Flag
 Bit 2 – N: Negative Flag
 Bit 1 – Z: Zero Flag

The EEPROM Address Register – EEARH and EEARL

Bit	15	14	13	12	11	10	9	8	
	–	–	–	–	–	–	EEAR9	EEAR8	EEARH
	EEAR7	EEAR6	EEAR5	EEAR4	EEAR3	EEAR2	EEAR1	EEAR0	EEARL
Read/Write	R	R	R	R	R	R	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	X	

The EEPROM Data Register – EEDR

Bit	7	6	5	4	3	2	1	0	
	MSB							LSB	EEDR
Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

The EEPROM Control Register – EECR

Bit	7	6	5	4	3	2	1	0	
	–	–	–	–	EERIE	EEMWE	EEWE	EERE	EECR
Read/Write	R	R	R	R	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	X	0	

Bit 3 – EERIE: EEPROM Ready Interrupt Enable
 Bit 2 – EEMWE: EEPROM Master Write Enable

Bit 1 – EEWE: EEPROM Write Enable
 Bit 0 – EERE: EEPROM Read Enable

Interrupts

MCU Control Register – MCUCR

The MCU Control Register contains control bits for interrupt sense control and general MCU functions.

Bit	7	6	5	4	3	2	1	0	
	SE	SM2	SM1	SM0	ISC11	ISC10	ISC01	ISC00	MCUCR
Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

Bit 3, 2 – ISC11, ISC10: Interrupt Sense Control 1 Bit 1 and Bit 0

Bit 1, 0 – ISC01, ISC00: Interrupt Sense Control 0 Bit 1 and Bit 0

ISC11	ISC10	Description
0	0	The low level of INT1 generates an interrupt request.
0	1	Any logical change on INT1 generates an interrupt request.
1	0	The falling edge of INT1 generates an interrupt request.
1	1	The rising edge of INT1 generates an interrupt request.

ISC01	ISC00	Description
0	0	The low level of INT0 generates an interrupt request.
0	1	Any logical change on INT0 generates an interrupt request.
1	0	The falling edge of INT0 generates an interrupt request.
1	1	The rising edge of INT0 generates an interrupt request.

MCU Control and Status Register – MCUCSR

Bit	7	6	5	4	3	2	1	0	
	JTD	ISC2	–	JTRF	WDRF	BORF	EXTRF	PORF	MCUCSR
Read/Write	R/W	R/W	R	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0						See Bit Description

Bit 6 – ISC2: Interrupt Sense Control 2

General Interrupt Control Register – GICR

Bit	7	6	5	4	3	2	1	0	
	INT1	INT0	INT2	–	–	–	IVSEL	IVCE	GICR
Read/Write	R/W	R/W	R/W	R	R	R	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

Bit 7 – INT1: External Interrupt Request 1 Enable
Bit 6 – INT0: External Interrupt Request 0 Enable

Bit 5 – INT2: External Interrupt Request 2 Enable

General Interrupt Flag Register – GIFR

Bit	7	6	5	4	3	2	1	0	
	INTF1	INTF0	INTF2	–	–	–	–	–	GIFR
Read/Write	R/W	R/W	R/W	R	R	R	R	R	
Initial Value	0	0	0	0	0	0	0	0	

Bit 7 – INTF1: External Interrupt Flag 1
Bit 6 – INTF0: External Interrupt Flag 0

Bit 5 – INTF2: External Interrupt Flag 2

Port A Data Register – PORTA

Bit	7	6	5	4	3	2	1	0	
	PORTA7	PORTA6	PORTA5	PORTA4	PORTA3	PORTA2	PORTA1	PORTA0	PORTA
Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

Port A Data Direction Register – DDRA

Bit	7	6	5	4	3	2	1	0	
	DDA7	DDA6	DDA5	DDA4	DDA3	DDA2	DDA1	DDA0	DDRA
Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

Port A Input Pins Address – PINA

Bit	7	6	5	4	3	2	1	0	
	PINA7	PINA6	PINA5	PINA4	PINA3	PINA2	PINA1	PINA0	PINA
Read/Write	R	R	R	R	R	R	R	R	
Initial Value	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	

Time/Counter Control Register – TCCR0

Bit	7	6	5	4	3	2	1	0	
	FOC0	WGM00	COM01	COM00	WGM01	CS02	CS01	CS00	TCCR0
Read/Write	W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

Bit 7 – FOC0: Force Output Compare

Bit 6, 3 – WGM01:0: Waveform Generation Mode

Bit 5:4 – COM01:0: Compare Match Output Mode
Bit 2:0 – CS02:0: Clock Select

Mode	WGM01 (CTC0)	WGM00 (PWM0)	Timer/Counter Mode of Operation	TOP	Update of OCR0	TOV0 Flag Set-on	COM01	COM00	Description
0	0	0	Normal	0xFF	Immediate	MAX	0	0	Normal port operation, OC0 disconnected.
1	0	1	PWM, Phase Correct	0xFF	TOP	BOTTOM	0	1	Toggle OC0 on compare match
2	1	0	CTC	OCR0	Immediate	MAX	1	0	Clear OC0 on compare match
3	1	1	Fast PWM	0xFF	BOTTOM	MAX	1	1	Set OC0 on compare match

Timer/Counter Register – TCNT0

Bit	7	6	5	4	3	2	1	0	
	TCNT0[7:0]								TCNT0
Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

Output Compare Register – OCR0

Bit	7	6	5	4	3	2	1	0	
	OCR0[7:0]								OCR0
Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

Timer/Counter
Interrupt Mask
Register – TIMSK

Bit	7	6	5	4	3	2	1	0	
	OCIE2	TOIE2	OCIE1	OCIE1A	OCIE1B	TOIE1	OCIE0	TOIE0	TIMSK
Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

Bit 1 – OCIE0: Timer/Counter0 Output Compare Match Interrupt Enable
Bit 0 – TOIE0: Timer/Counter0 Overflow Interrupt Enable

Timer/Counter
Interrupt Flag Register
– TIFR

Bit	7	6	5	4	3	2	1	0	
	OCF2	TOV2	ICF1	OCF1A	OCF1B	TOV1	OCF0	TOV0	TIFR
Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

Bit 1 – OCF0: Output Compare Flag 0
Bit 0 – TOV0: Timer/Counter0 Overflow Flag

Timer/Counter1
Control Register A –
TCCR1A

Bit	7	6	5	4	3	2	1	0	
	COM1A1	COM1A0	COM1B1	COM1B0	FOC1A	FOC1B	WGM11	WGM10	TCCR1A
Read/Write	R/W	R/W	R/W	R/W	W	W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

Bit 7:6 – COM1A1:0: Compare Output Mode for Compare unit A
Bit 5:4 – COM1B1:0: Compare Output Mode for Compare unit B
Bit 3 – FOC1A: Force Output Compare for Compare unit A
Bit 2 – FOC1B: Force Output Compare for Compare unit B
Bit 1:0 – WGM11:0: Waveform Generation Mode

CS02	CS01	CS00	Description
0	0	0	No clock source (Timer/Counter stopped).
0	0	1	clk_{RCY} (No prescaling)
0	1	0	$clk_{RCY}/8$ (From prescaler)
0	1	1	$clk_{RCY}/64$ (From prescaler)
1	0	0	$clk_{RCY}/256$ (From prescaler)
1	0	1	$clk_{RCY}/1024$ (From prescaler)
1	1	0	External clock source on T0 pin. Clock on falling edge.
1	1	1	External clock source on T0 pin. Clock on rising edge.

COM1A1/COM1B1	COM1A0/COM1B0	Description
0	0	Normal port operation, OC1A/OC1B disconnected.
0	1	Toggle OC1A/OC1B on compare match
1	0	Clear OC1A/OC1B on compare match (Set output to low level)
1	1	Set OC1A/OC1B on compare match (Set output to high level)

Mode	WGM13	WGM12 (CTC1)	WGM11 (PWM11)	WGM10 (PWM10)	Timer/Counter Mode of Operation	TOP	Update of OCR1x	TOV1 Flag Set on
0	0	0	0	0	Normal	0xFFFF	Immediate	MAX
1	0	0	0	1	PWM, Phase Correct, 8-bit	0x00FF	TOP	BOTTOM
2	0	0	1	0	PWM, Phase Correct, 9-bit	0x01FF	TOP	BOTTOM
3	0	0	1	1	PWM, Phase Correct, 10-bit	0x03FF	TOP	BOTTOM
4	0	1	0	0	CTC	OCR1A	Immediate	MAX
5	0	1	0	1	Fast PWM, 8-bit	0x00FF	BOTTOM	TOP
6	0	1	1	0	Fast PWM, 9-bit	0x01FF	BOTTOM	TOP
7	0	1	1	1	Fast PWM, 10-bit	0x03FF	BOTTOM	TOP
8	1	0	0	0	PWM, Phase and Frequency Correct	ICR1	BOTTOM	BOTTOM
9	1	0	0	1	PWM, Phase and Frequency Correct	OCR1A	BOTTOM	BOTTOM
10	1	0	1	0	PWM, Phase Correct	ICR1	TOP	BOTTOM
11	1	0	1	1	PWM, Phase Correct	OCR1A	TOP	BOTTOM
12	1	1	0	0	CTC	ICR1	Immediate	MAX
13	1	1	0	1	Reserved	–	–	–
14	1	1	1	0	Fast PWM	ICR1	BOTTOM	TOP
15	1	1	1	1	Fast PWM	OCR1A	BOTTOM	TOP

Timer/Counter1
Control Register B –
TCCR1B

Bit	7	6	5	4	3	2	1	0	
	ICNC1	ICES1	–	WGM13	WGM12	CS12	CS11	CS10	TCCR1B
Read/Write	R/W	R/W	R	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

Bit 7 – ICNC1: Input Capture Noise Canceler
Bit 6 – ICES1: Input Capture Edge Select
Bit 5 – Reserved Bit
Bit 4:3 – WGM13:2: Waveform Generation Mode
Bit 2:0 – CS12:0: Clock Select



Operation Research326 R

11-5-2018

Third Level: Computer Science Section

Time: 3 hours

Total Degree (50 marks)

Science Faculty

Mathematical Department

Answer the following Questions:

1-Use the Simplex method to solve the following linear programming

Maximize $Z = 10x_1 + 11x_2$

Subject to $x_1 + 2x_2 \leq 150$, $3x_1 + 4x_2 \leq 200$, $6x_1 + x_2 \leq 175$

and $x_1, x_2 \geq 0$

(10 marks)

2) Use the graphical and the algebraic method to solve the problem

Max $f(\underline{x}) = 5x_1 + 7x_2$ Subject to $5x_1 + 8x_2 \leq 24$, $x_1 + x_2 \leq 4$,

$10x_1 + 7x_2 \leq 35$ and $x_1, x_2 \geq 0$

(12.5marks)

3) Use the Lagrange multiplier method to find the extreme points of the problem

Minimize $f(\underline{x}) = x_1^2 + x_2^2 - 3x_1x_2$

Subject to $g(\underline{x}) = x_1^2 + x_2^2 - 8 = 0$.

(12.5marks)

4) Use the Hessian Matrix to find the local points of the problem

$f(\underline{x}) = f(x_1, x_2) = x_1^3 + x_2^3 + 2x_1^2 + 4x_2^2 + 6$

(10marks)

5) Find the local Points

$f(x) = 3x^4 - 20x^3 + 36x^2 + 16$ (5marks)

Best Wishes

Dr. Alaa Fahim

اجب عن خمسة فقط من الاسئلة الاتية :- (10 درجات لكل سؤال : بواقع 5 درجات لكل فقرة)

(1) (i) اوجد الحل العام للمعادلة : $p_1 + 3p_2 + 2p_3(1 + \sqrt{x_1 + x_2 + x_3 - u}) = 6$
(ii) اوجد الحل الخاص للمعادلة : $(y - z)[2xyp + (x^2 - y^2)q] + z(x^2 - y^2) = 0$
الذي يمر خلال المنحنى $y = 0, x^3 = z^2$

(2) اوجد الحل العام لكل من المعادلتين التفاضليتين الجزئيتين الاتيتين :-
(i) $(D_1^3 - D_1^2 D_2 - D_1 D_2^2 + D_2^3)z = \log(x + y)$
(ii) $(D_1^2 - a^2 D_2^2)z = x^2 + y^2$, ثابت مطلق a

(3) اوجد الحل العام لكل من المعادلتين التفاضليتين الجزئيتين الاتيتين :-
(i) $(D_1^2 D_2 + D_2^2 - 2)z = e^{2y} \sin 3x - e^x \cos 2y$
(ii) $(D_1^2 - D_2^2 - D_1 - 3D_2 - 2)z = e^{2x-3y} + x + y + 1$

(4) (i) احسب التكاملات الاتية :-
(a) $\int_0^{\infty} x^{-\frac{1}{3}}(1 + 2x)^{-3} dx$ (b) $\int_0^1 \sqrt{\log \frac{1}{x}} dx$

(ii) اثبت ان :-
(a) $\tan^{-1} x = x {}_2F_1(1, \frac{1}{2}; \frac{3}{2}; -x^2)$
(b) $(a - b) {}_2F_1(a, b; c; x) = a {}_2F_1(a + 1, b; c; x) - b {}_2F_1(a, b + 1; c; x)$

(5) اثبت ان دوال بسل من النوع الاول $J_n(x)$ تحقق الاتي :-
(i) $J_{-\frac{1}{2}}(x) = \sqrt{\frac{2}{\pi x}} \cos x$, (ii) $\int x^n J_{n-1}(x) dx = x^n J_n(x) + c$

(6) (i) اثبت ان كثيرات حدود لجندر $P_n(x)$ تحقق :-
(ii) احسب التكاملات الاتية :-
(a) $\int_{-1}^1 x P_n(x) P_{n+1}(x) dx$, (b) $\int_{-1}^1 x^2 P_n(x) P_{n+1}(x) dx$, (c) $\int_{-1}^1 x^2 P_n(x) dx$

	Assiut University Faculty of Science Mathematics Dept.	Final Exam 2017-2018 Course: Mathematical and Statistical Packages Course code: MC300	Date: 14/5/2018 Level: Three Time: 2 Hours	
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Question 1: Put True or False for each of the following items (30 marks)

1. To enter a formula into a cell, begin by typing an equal sign.
2. Functions are pre-defined worksheet formulas.
3. Formulas in Excel must be written in a very specific format, referred to as syntax.
4. The second order of precedence is for exponentiation.
5. When the formula in cell **B7 =B4+B5+B6** is copied into cell **C7** the formula will be changed to **= C4+C5+C6**.
6. The error "#####" means Data being referenced is not available.
7. The range **B2:B7** is a range down a column.
8. To keep things clear and simple only add an absolute (\$) cell reference if absolutely necessary.
9. The formula **=ROUND(78.686788,-1)** results in the value 80 .
10. Placing an absolute sign in front of a ranged name (**\$budget**) is incorrect syntax.
11. The columns of the worksheet are named with Numbers.
12. Cells may contain only Labels and Values.
13. The cell address first lists the row name and then the column name.
14. This selected cell is referred to as the **active cell**.
15. The contents of the active cell will also be displayed on the **formula bar**.
16. A cell that is on sheet 3, in the second column third row would be referred to as **Sheet3@B3**.
17. Formatted Display is the number of decimal places that appear in a cell.
18. Formulas can be copied to perform different operations on a corresponding set of data.
19. The function **COUNT(value1,[value2],...)** counts non-blank cells.
20. The Average function ignore the blank cells.
21. TRUE and FALSE are called Boolean Values.
22. SPSS stands for Statistical Package for the Social Sciences.
23. SPSS is capable of handling large amounts of data.
24. SPSS has only two windows Data view and Output view.
25. **Transform** menu includes several options to change current variables.
26. In SPSS, Each column typically represents the data from 1 case.
27. In SPSS, The first column of variable view is Name.
28. In SPSS, you can sort data from **Transform** menu then **Sort Cases**.
29. Descriptive statistics are calculated using the **Analyze** menu.
30. Correlation is used to test the degree of association between variables.

Answer Sheet		
	True	False
1		
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Question 2: (10 marks)

	A	B	C	D	E	F	G
1		MT1	MT2	Final	Total	Honors	Passed
2	Possible points	100	100	200	400		320
3							
4	Blue	79	89	169	337	FALSE	TRUE
5	Jones	85	65	195	345	FALSE	TRUE
6	Grey	60	97	187	344	TRUE	TRUE
7	Mary	10	30	50	90	TRUE	FALSE
8							

Write the following Boolean functions

1. Blue's total and Jones' total are greater than Grey's:
2. Grey's total is not the maximum grade:
3. None of the students passed the course
4. Blue is not an Honors student
5. Blue didn't get a passing grade (320)

Question 3: (10 marks)

1. What are the difference between Data View, Variable View and Output View in SPSS?
2. Some significance tests are very restrictive about the form of data they can accept. What are the different types of measurement?
3. Describe how to test the degree of association between variables by SPSS.
4. Explain how to use SPSS to calculate the frequency and percent of females and males who did and did not have social problems.

Q2.

- a. Maintain two different Algorithm of crossover process with mention the probability of crossover (5 marks)
- b. Maintain two different Algorithm of mutation process with mention the probability of mutation. (5 marks)

Q3. a. Maintain tree type representation of solutions in genetic algorithm. (3 marks)

b. Using genetic algorithm to find the maximum value of the function $(15x - x^2)$ where parameter x varies between 0 and 15. For simplicity, we may assume that x takes only integer values. Using the genetic algorithm procedure in one step and begin with four solutions in initial solutions. (10 marks)

Q4. Discuss the internal structure of Taxi driver Robot. (7 marks)

Q5. Discuss the Tabu search method and maintain the type of memory using in this method and maintain the Tabu search algorithm. (10 marks)

==best wishes==

Dr. Alaa F. Mohamed

Answer the following questions: (50 Marks)

Question 1: Answer the following points (10 Marks)

- 1- Explain the internet "nuts and bolts"?
- 2- Explain the sources of packet delay?
- 3- What are protocols?
- 4- Explain Access network: digital subscriber line (DSL)?

Question 2: Answer the following points (10 Marks)

- 1- What is the network core?
- 2- Explain Packet Switching: queueing delay, loss?
- 3- Define throughput?
- 4- Define and explain traffic intensity?

Question 3: Answer the following points (10 Marks)

- 1- Explain the Internet protocol stack?
- 2- Mention some network applications?
- 3- Explain the application client-server architecture?
- 4- Explain P2P architecture?

Question 4: Answer the following points (10 Marks)

- 1- HTTP is "stateless". What does that mean?
- 2- Compare between persistent HTTP and non-persistent HTTP?
- 3- Give examples of HTTP response status codes?
- 4- Explain the term (web caches) and how it is useful?

Question 5: Answer the following points (10 Marks)

- 1- Give a DNS name resolution example?
- 2- Compare between multiplexing and demultiplexing? Support your answer with a diagram?
- 3- Define and explain the use of ACKs and NAKs?
- 4- Define and explain HOL? Support your answer with a diagram?

جامعة أسيوط	مايو 2018	كود المقرر: 356 رك
كلية العلوم		المقرر : مقدمة فى الحسابات العلمية
قسم الرياضيات		الزمن : ساعتان

Answer the following questions by using MATLAB language: (50 marks)

1- Using Newton's forward difference formula, find $y(0.1)$ using the table below:

x	0.0	0.2	0.4	0.6	0.8
y	1.000	1.22140	1.49182	1.82212	2.22554

2- Solve the differential equation by Adams method (without using nested for loops) at $x=0.2$:

$$\frac{dy}{dt} = t^2 - y, \quad y(0) = 1, \quad h = 0.05.$$

and compare it with the analytic solution $y = -e^{-t} + t^2 - 2t + 2$.

3- Solve the following initial value problem:

$$\frac{d^2u}{dt^2} + 4\frac{du}{dt} + 3u = 0, \quad u(0) = 1, \quad \frac{du}{dt}(0) = 0.$$

4- Let $f(x) = \cos 2x$ and $x_0 = 0$. Determine

a) The third Taylor polynomial for f about x_0 .

b) Find error bound at $x = 0.2$ and compare it to the actual error.

5- For the well-known Chua's circuit equation in chaotic studies that

$$\dot{x} = \alpha[y - x - f(x)], \quad \dot{y} = x - y + z, \quad \dot{z} = -\beta y - \gamma z, \quad t \in (0, 10),$$

where the nonlinear function $f(x)$ is described by

$$f(x) = bx + 0.5(a-b)(|x+1| - |x-1|) \text{ and } a < b < 0.$$

Write an M-function to describe the equation, and draw the phase trajectory for the parameters $\alpha = 9$, $\beta = 100/7$, $\gamma = 0$, $a = -8/7$, $b = -5/7$, and initial conditions

$$x(0) = -2.121304, \quad y(0) = -0.066170, \quad z(0) = 2.881090.$$

Good Luck

Dr. Tarek Aboelenen



امتحان الفرقة الثالثة شعبة الرياضيات

الزمن : ثلاث ساعات

رقم المقرر ورمزه : ١٣٤٦

المقرر : عمليات عشوائية وتطبيقاتها

أجب عن خمسة أسئلة فقط مما يأتي :- درجة جزء كل سؤال (خمس درجات)

١- (أ) لمجموعة المتغيرات العشوائية المستقلة $X_1, X_2, X_3, \dots$ بفرض أن التوقع الرياضي $E(X_i) = m$ والتباين $V(X_i)$ لكل منها محدود عرف كل من التقارب عن طريق الإحتمال وقانون الأعداد الكبرى (الضعيف).
(ب) بفرض أن $f f s s f s f f s s s f f s f f s$ هي إحدى النتائج الممكنة في محاولات برنولي العشوائية المستقلة بحيث أن $P(s) = p, P(f) = q, p + q = 1$ عرف عملية عشوائية في الفراغ R^2 موضحا ذلك بيانيا .

٢- (أ) في عملية برنولي العشوائية $\{X_n; n > 0\}$ بالإحتمال $p = 0.6$ إذا كان $X = X_1 + X_2$ ، $Y = X_1 + X_3$ احسب الإحتمالات الآتية : $P(X < 2, Y \leq 1)$ ، $P(2X < 3Y)$ ، $P(Y = X)$.
(ب) في السؤال (٢-أ) أوجد العزم الارتباطي بين X ، Y موضحا العلاقة بينهما .

٣- (أ) وضح العلاقة بين عملية برنولي العشوائية $\{X_n; n > 0\}$ و العملية العشوائية $\{Y_n; n \geq 0\}$ حيث أن المتغير Y_n يخضع لتوزيع ذي الحدين واذكر صفات كل منهما ثم عبر مع الاستنتاج عن إحتمال الحادث $(Y_{n+1} = k)$ من خلال إحتمالات الحوادث : $(Y_n = k)$ ، $(Y_n = k - 1)$ لأي عدد صحيح $k > 0$.
(ب) في العملية العشوائية $\{Y_n; n \geq 0\}$ أوجد كل من $E(Y_5)$ ، $E(Y_4^2)$ ، $P(Y_5 = 3, Y_7 = 4, Y_{14} = 9)$.

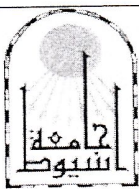
٤- (أ) عرف أزمنة النجاح T_k كعملية عشوائية موضحا العلاقة بينها وبين العملية العشوائية $\{Y_n; n \geq 0\}$ ثم اذكر فقط توزيع المتغير العشوائي T_k .
(ب) - في عملية بواسون العشوائية $\{N_t; t \geq 0\}$ بالمعدل $\lambda = 4$ احسب كل من الإحتمالات الآتية :
 $P(N_{1.5} = 2, N_4 = 5, N_{6.8} = 9)$ ، $P(N_3 = 5, N_7 = 9)$

٥- (أ) في عملية بواسون أو عملية الوصول المعودة $\{N_t; t \geq 0\}$ بالمعدل λ إثبت أن الإحتمال المشروط لعدد الوصول N_t بالنسبة إلى عدد الوصول N_{t+s} لكل $t > 0, s > 0$ يمثل توزيع ذي الحدين .
(ب) عرف العمليات العشوائية المستقلة ثم اثبت أن أي عمليتين مستقلتين لبواسون هو أيضا عملية بواسون .

٦- (أ) في عملية التجديد العشوائية $R = \{R_n; n \in N\}$ حيث N هي فئة الأعداد الصحيحة غير السالبة عرف دالة التجديد ثم عبر عنها من خلال توزيع المتغير R_n مع الاستنتاج .

(ب) في سلسلة ماركوف العشوائية المتقطعة $\{X_n; n \geq 0\}$ عرف مصفوفة الإحتمالات الإنتقالية بصفاتها المعروفة ثم احسب الإحتمال : $P(X_0 = 1, X_1 = 1, X_2 = 0, X_3 = 1, X_4 = 0, X_6 = 0)$ بفرض أن حالات الفراغ $(0, 1)$ والمصفوفة العشوائية

$$P = \begin{pmatrix} 1/2 & 1/2 \\ 1/3 & 2/3 \end{pmatrix} , \text{ ومنتجه الإحتمالات الابتدائية } \pi_0 = (2/5 \quad 3/5)$$

	المقرر: تحليل عددي (٣٢٣) الفرقة: المستوى الثالث الدرجة: ٥٠ درجة التاريخ: ٢٠١٨/٥/٢٩ الزمن: ثلاث ساعات	جامعة أسيوط كلية العلوم - قسم الرياضيات امتحان نهائي الفصل الدراسي الثاني للعام الجامعي ٢٠١٧/٢٠١٨
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Answer five questions only :- (10 marks for every question)

1-a) If the function $g \in C[a, b]$ and $g(x) \in [a, b] \forall x \in [a, b]$ and $g'(x)$ exist with $|g'(x)| \leq k < 1 \forall x \in [a, b]$ prove that the sequence defined by $P_n = g(P_{n-1}), n \geq 1$ will converge to the unique fixed point P and also $|P_{n+1} - P_n| \leq k^n |P_1 - P_0|$.

1-b) Verify that when Newton's method is used to compute $\sqrt{A}, A > 0$ (By solving the equation : $f(x) = x^2 - A$). The sequence of iterates is defined by : $x_{n+1} = (x_n + \frac{A}{x_n})/2$, and show that if the sequence $\{x_n\}$ is defined as the previous problem, then this method is quadratically convergence.

2-a) Derive Lagrange interpolation formula of degree n and write the error of the method.

2-b) For the given function $f(x) = \cos \pi x$ let $x_0 = -1, x_1 = 0, x_2 = 1$ construct the suitable interpolation polynomial and find the actual error.

3) Derive the formula of the Newton's interpolatory divided difference method and use this formula to obtain a polynomial of least degree that fits the values shown:

x	0	1	2	4	6
$f(x)$	1	9	23	93	259

من فضلك انظر خلف الورقة

السؤال الرابع :-

أ) يعرف الطي للدالتين $f(x)$, $g(x)$ كالآتي

$$f * g = \int_{-\infty}^{\infty} f(u) g(x-u) du$$

برهن علي أن تحويل فوريير للطرف الأيمن هو حاصل ضرب تحويل فوريير للدالتين $f(x)$, $g(x)$

ب) أوجد تحويل فوريير للدالة $f(x) = \begin{cases} 1 & |x| < a \\ 0 & |x| > a \end{cases}$ وأرسم $f(x)$ كذلك تحويلها عند $a = 3$ وأوجد

$$\int_{-\infty}^{\infty} \frac{\sin u}{u} du \quad \text{كذلك} \quad \int_{-\infty}^{\infty} \frac{\sin \alpha a \cos \alpha x}{\alpha} d\alpha$$

ج) ترك خيط لانهائي من السكون وكانت أزاحته الابتدائية عن محور x هي $f(x)$ أوجد الإزاحه عند أي زمن .

انتهت الأسئلة مع تمنياتنا بالتوفيق ،،،،

لجنة الممتحنين :- أ.د/ نجاه عبد الرحمن حسين ، أ.د/ فاروق علي السيد



الامتحان النهائي للفصل الدراسي الثاني للعام الجامعي ٢٠١٧/٢٠١٨ م
 للفرقة : الثالثة : الشعبة : الرياضيات التاريخ : ٢٠١٨/٥/٢٤ م

الزمن : ساعتان

الدرجة الكلية : ٥٠ درجة

درجة كل سؤال : ١٧ درجة

أسم المقرر : الطرق الرياضية
 رقم المقرر ورمزه : ٣٣٤ ر

أجب عن ثلاثة أسئلة فقط مما يأتي :-

السؤال الأول :-

أوجد تحويل لابلاس للمشتقة التفاضلية للدالة $F(t)$ عند نقط الاتصال والانفصال للدالة .

أبرهن علي أن

$$\lim_{t \rightarrow 0} F(t) = \lim_{s \rightarrow \infty} s f(s)$$

$$\lim_{t \rightarrow \infty} F(t) = \lim_{s \rightarrow 0} s f(s)$$

$$\Gamma\left(\frac{1}{2}\right) = \sqrt{\pi}, \quad \int_0^{\infty} \delta(t) dt = 1, \quad L \sin \sqrt{t} = \frac{\sqrt{\pi}}{3} e^{-\frac{1}{4s}} s^{\frac{3}{2}}$$

السؤال الثاني :-

حل المعادلات الآتية :

$$t Y''(t) + Y'(t) + 4t Y(t) = 0, \quad y(0) = 3, y'(0) = 0$$

$$\frac{\partial U}{\partial x} = 2 \frac{\partial U}{\partial t} + U, \quad x > 0, t > 0 \quad U(x, 0) = 6 e^{-3x}$$

$$\int_0^t Y(u) Y(t-u) du = 16 \sin 4t$$

السؤال الثالث :-

(أ) فك الدالة $f(x) = x^2$, $0 < x < 2\pi$ بدلالة متسلسلة فوريير ثم أحسب المجموع

$$1 + \frac{1}{2^2} + \frac{1}{3^2} + \frac{1}{4^2} + \dots$$

(ب) صفيحة علي شكل دائري نصف قطرها الوحدة ووجهيها معزولين ونصف محيطها محفوظ عند درجة حرارة u_1

والآخر عند u_2 أوجد حالة الأتزان الحراري .

من فضلك أنظر بقية الأسئلة خلف الورقة ،،،،،



Answer the following questions (50 marks)

Q1.	Complete the following: (1)..... is a representation of a two-dimensional image as a finite set of digital values, called picture elements or pixels - Common image formats include.....(2).... ,(3)..... ,(4)..... (5)..... creates a Distance tool a draggable, resizable line that measures the distance between its endpoints. (6)..... These are the result of objects that are self-luminous, such as stars and light bulbs. (7).....the resulting output pixel is computed as a sum of products of the pixel values and mask coefficients in the pixel's neighborhood in the original image. - The Sobel operators used to compute edges are(8)..... ,(9)..... - Edge detector should have:(10)..... ,(11)..... - Types of noise are(12)..... ,(13)....	(13 marks)
Q2.	a) Compute Z from the following matlab script (6 marks) <pre> x = [150 10 90;80 50 60;121 160 20] y = [-1 0 1;-2 0 2;-1 0 1] z = imfilter(x,y,'corr') </pre> b) What is the Delta compression and compute the compressed data of the data (6 marks) 220 321 335 211 250 200 233 214 232 212	(12 marks)
Q3.	a) Write the MATLAB code used to: (4 marks) - Read any image then use affine transformation matrix for each of the operations below: - Flip the image right to left - Translation by [25, 15] pixels b) What are the main differences between: (8 marks) - Global thresholding and optimal thresholding. - Raster and vector image . - Interpixel redundancy and Psychovisual redundancy	(12 marks)

(Q5) (i) Assume that U, V are open intervals and let $f : U \rightarrow \mathbb{R}$ and $g : V \rightarrow \mathbb{R}$ be two differentiable functions such that $f(U) \subset V$. Prove that $g \circ f$ is differentiable on U and that $(g \circ f)' = (g' \circ f) \cdot f'$ [5 marks]

(ii) Prove that the function $f(x) := \frac{1}{x}$ is differentiable on $]0, \infty[$ but not uniformly continuous therein. [5 marks]

(Q6) (i) State and prove Rolle's theorem then use it to prove the mean value theorem. [6 marks]

(ii) Let I be an open interval. Apply the mean value theorem to prove that a function differentiable on I is

1. increasing if and only if $f' \geq 0$ on I ,

2. decreasing if and only if $f' \leq 0$ on I .

[4 marks]

With the best of luck,

Prof. Rashwan A. Rashwan,

Dr. Ahmed A. Abdelhakim



Time: 3 hours

Total mark: 50

Answer *only five* of the following questions:

(Q1) (i) Suppose that O_i , $i \geq 1$, are open subsets of $\mathbb{R}$. Prove that $\cup_{i \geq 1} O_i$ is also open in $\mathbb{R}$. [5 marks]

(ii) Let $S \subset \mathbb{R}$. Show that S is closed if and only if S contains the limit point of every convergent sequence of elements of S . [5 marks]

(Q2) (i) Prove that a sequence of real numbers converges if and only if it is a Cauchy sequence. [6 marks]

(ii) Show that if $(x_n)_{n \geq 1} \subset \mathbb{R}$ is a monotonically increasing sequence that is bounded above, then $x_n \rightarrow \sup_{n \geq 1} x_n$, as $n \rightarrow \infty$. [4 marks]

(Q3) (i) Show that $f : D \subset \mathbb{R} \rightarrow \mathbb{R}$ is continuous at $x_0 \in D$ if and only if the sequence $(f(x_n))_{n \geq 1}$ converges to $f(x_0)$ whenever $(x_n)_{n \geq 1}$ is a sequence in D that converges to x_0 . [6 marks]

(ii) Use the characterization given in (i) to prove the discontinuity at the origin of the function $f(x) = \begin{cases} \cos \frac{1}{x}, & x \neq 0; \\ 0, & x = 0. \end{cases}$ [4 marks]

(Q4) (i) Assume that D is a closed bounded subset of $\mathbb{R}$. Prove that if $f : D \rightarrow \mathbb{R}$ is continuous then f is bounded on D , and there exist $\alpha, \beta \in D$ such that $f(\alpha) = \max_{x \in D} f(x)$ and $f(\beta) = \min_{x \in D} f(x)$. [5 marks]

(ii) Argue by contradiction to demonstrate that if $f : [a, b] \rightarrow \mathbb{R}$ is continuous then it is uniformly continuous on $[a, b]$. [5 marks]

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أجب عن أسئلة الآتية :- (كل سؤال ١٠ درجات)

(١) (أ) أثبت قاعدة التضعيف لدالة جاما $\sqrt{\pi} \Gamma(2x) = 2^{2x-1} \Gamma(x) \Gamma\left(x + \frac{1}{2}\right), x > 0$

ثم استخدمها فى إثبات أن: $\Gamma\left(\frac{5}{6}\right) \left[\Gamma\left(\frac{1}{3}\right)\right]^2 = 2 \sqrt[3]{2} \sqrt{\frac{\pi^3}{3}}$

(ب) باستخدام دوال جاما و بيتا أوجد التكاملات الآتية: (i) $\int_0^{\frac{\pi}{2}} \sqrt{\tan \theta} d\theta$ (ii) $\int_0^{\infty} \frac{\sqrt{x}}{e^{x^3}} dx$

(٢) (أ) أثبت أن: $\Gamma(x) \Gamma(1-x) = \frac{\pi}{\sin \pi x}, 0 < x < 1$ ومن ثم أثبت أن

$\Gamma\left(x + \frac{1}{2}\right) \Gamma\left(\frac{1}{2} - x\right) = \frac{\pi}{\cos \pi x}$

(ب) أثبت أن:

(i) $\sqrt{1-x^2} T_n(x) = U_{n+1}(x) - x U_n(x),$

(ii) $(1-x^2) U'_n(x) = -n x U_n(x) + n U_{n-1}(x)$

(٣) أثبت أن:

(i) ${}_2F_1(\alpha, \beta; \gamma, x) = (1-x)^{-\beta} {}_2F_1\left(\gamma - \alpha, \beta; \gamma, \frac{x}{x-1}\right)$

(ii) ${}_1F_1\left(\frac{1}{2}; \frac{3}{2}, -x^2\right) = \frac{\sqrt{\pi}}{2x} \operatorname{erf}(x)$ حيث أن: $\operatorname{erf}(x) = \frac{2}{\sqrt{\pi}} \int_0^x e^{-t^2} dt$ هى دالة الخطأ

(iii) ${}_1F_1(\alpha + 1; \gamma, x) - {}_1F_1(\alpha; \gamma, x) - \frac{x}{\gamma} {}_1F_1(\alpha + 1; \gamma + 1, x) = 0$

(٤) (أ) أوجد مفكوك ليجندر للدالة: $f(x) = x^3$

(ب) أثبت أن: $H_n(x) = (-1)^n e^{x^2} \frac{d^n}{dx^n} (e^{-x^2})$ حيث $H_n(x)$ كثيرة حدود هيرميت.

(ج) أثبت أن: $J_{\frac{1}{2}}(x) = \sqrt{\frac{2}{\pi}} \frac{\sin x}{\sqrt{x}}$

(٥) (أ) باستخدام الصيغة التكاملية لدوال بسل أثبت أن: $\int_0^{\infty} e^{-3x} J_0(4x) dx = \frac{1}{5}$

(ب) أوجد الحل العام لمعادلة بسل التفاضلية:

$x^2 \frac{d^2 y}{dx^2} + x \frac{dy}{dx} + (x^2 - n^2)y = 0$

CS12	CS11	CS10	Description
0	0	0	No clock source (Timer/Counter stopped).
0	0	1	clk _{IO} /1 (No prescaling)
0	1	0	clk _{IO} /8 (From prescaler)
0	1	1	clk _{IO} /64 (From prescaler)
1	0	0	clk _{IO} /256 (From prescaler)
1	0	1	clk _{IO} /1024 (From prescaler)
1	1	0	External clock source on T1 pin. Clock on falling edge.
1	1	1	External clock source on T1 pin. Clock on rising edge.

Timer/Counter1 – TCNT1H and TCNT1L

Bit	7	6	5	4	3	2	1	0	
	TCNT1[15:8]								TCNT1H
	TCNT1[7:0]								TCNT1L
Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

Output Compare Register 1 B – OCR1BH and OCR1BL

Bit	7	6	5	4	3	2	1	0	
	OCR1B[15:8]								OCR1BH
	OCR1B[7:0]								OCR1BL
Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

Input Capture Register 1 – ICR1H and ICR1L

Bit	7	6	5	4	3	2	1	0	
	ICR1[15:8]								ICR1H
	ICR1[7:0]								ICR1L
Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

Timer/Counter Interrupt Mask Register – TIMSK⁽¹⁾

Bit	7	6	5	4	3	2	1	0	
	OCIE2	OCIE1	OCIE1A	OCIE1B	TOIE1	OCIE0	TOIE0		TIMSK
Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

- Bit 5 – OCIE1: Timer/Counter1, Input Capture Interrupt Enable
 Bit 4 – OCIE1A: Timer/Counter1, Output Compare A Match Interrupt Enable
 Bit 3 – OCIE1B: Timer/Counter1, Output Compare B Match Interrupt Enable
 Bit 2 – TOIE1: Timer/Counter1, Overflow Interrupt Enable

Timer/Counter Interrupt Flag Register – TIFR

Bit	7	6	5	4	3	2	1	0	
	OCF2	TOV2	ICF1	OCF1A	OCF1B	TOV1	OCF0	TOV0	TIFR
Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

- Bit 5 – ICF1: Timer/Counter1, Input Capture Flag
 Bit 4 – OCF1A: Timer/Counter1, Output Compare A Match Flag
 Bit 3 – OCF1B: Timer/Counter1, Output Compare B Match Flag
 Bit 2 – TOV1: Timer/Counter1, Overflow Flag

USART

Operating Mode	Equation for Calculating Baud Rate ⁽¹⁾	Equation for Calculating UBRR Value
Asynchronous Normal Mode (U2X = 0)	$BAUD = \frac{f_{osc}}{16(UBRR + 1)}$	$UBRR = \frac{f_{osc}}{16BAUD} - 1$
Asynchronous Double Speed Mode (U2X = 1)	$BAUD = \frac{f_{osc}}{8(UBRR + 1)}$	$UBRR = \frac{f_{osc}}{8BAUD} - 1$
Synchronous Master Mode	$BAUD = \frac{f_{osc}}{2(UBRR + 1)}$	$UBRR = \frac{f_{osc}}{2BAUD} - 1$

USART I/O Data Register – UDR

Bit	7	6	5	4	3	2	1	0	
	RXB[7:0]								UDR (Read)
	TXB[7:0]								UDR (Write)
Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

Timer/Counter
Interrupt Mask
Register – TIMSK

Bit	7	6	5	4	3	2	1	0	
	OCIE2	TOIE2	OCIE1	OCIE1A	OCIE1B	TOIE1	OCIE0	TOIE0	TIMSK
Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

Bit 1 – OCIE0: Timer/Counter0 Output Compare Match Interrupt Enable
Bit 0 – TOIE0: Timer/Counter0 Overflow Interrupt Enable

Timer/Counter
Interrupt Flag Register
– TIFR

Bit	7	6	5	4	3	2	1	0	
	OCF2	TOV2	OCF1	OCF1A	OCF1B	TOV1	OCF0	TOV0	TIFR
Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

Bit 1 – OCF0: Output Compare Flag 0
Bit 0 – TOV0: Timer/Counter0 Overflow Flag

Timer/Counter1
Control Register A –
TCCR1A

Bit	7	6	5	4	3	2	1	0	
	COM1A1	COM1A0	COM1B1	COM1B0	FOC1A	FOC1B	WGM11	WGM10	TCCR1A
Read/Write	R/W	R/W	R/W	R/W	W	W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

Bit 7:6 – COM1A1:0: Compare Output Mode for Compare unit A
Bit 5:4 – COM1B1:0: Compare Output Mode for Compare unit B
Bit 3 – FOC1A: Force Output Compare for Compare unit A
Bit 2 – FOC1B: Force Output Compare for Compare unit B
Bit 1:0 – WGM11:0: Waveform Generation Mode

CS02	CS01	CS00	Description
0	0	0	No clock source (Timer/Counter stopped).
0	0	1	$clk_{IO}/2$ (No prescaling)
0	1	0	$clk_{IO}/8$ (From prescaler)
0	1	1	$clk_{IO}/64$ (From prescaler)
1	0	0	$clk_{IO}/256$ (From prescaler)
1	0	1	$clk_{IO}/1024$ (From prescaler)
1	1	0	External clock source on T0 pin, Clock on falling edge.
1	1	1	External clock source on T0 pin, Clock on rising edge.

COM1A1/COM1B1	COM1A0/COM1B0	Description
0	0	Normal port operation, OC1A/OC1B disconnected.
0	1	Toggle OC1A/OC1B on compare match
1	0	Clear OC1A/OC1B on compare match (Set output to low level)
1	1	Set OC1A/OC1B on compare match (Set output to high level)

Mode	WGM13	WGM12 (CTC1)	WGM11 (PWM11)	WGM10 (PWM10)	Timer/Counter Mode of Operation	TOP	Update of OCR1x	TOV1 Flag Set on
0	0	0	0	0	Normal	0xFFFF	Immediate	MAX
1	0	0	0	1	PWM, Phase Correct, 8-bit	0x00FF	TOP	BOTTOM
2	0	0	1	0	PWM, Phase Correct, 9-bit	0x01FF	TOP	BOTTOM
3	0	0	1	1	PWM, Phase Correct, 10-bit	0x03FF	TOP	BOTTOM
4	0	1	0	0	CTC	OCR1A	Immediate	MAX
5	0	1	0	1	Fast PWM, 8-bit	0x00FF	BOTTOM	TOP
6	0	1	1	0	Fast PWM, 9-bit	0x01FF	BOTTOM	TOP
7	0	1	1	1	Fast PWM, 10-bit	0x03FF	BOTTOM	TOP
8	1	0	0	0	PWM, Phase and Frequency Correct	ICR1	BOTTOM	BOTTOM
9	1	0	0	1	PWM, Phase and Frequency Correct	OCR1A	BOTTOM	BOTTOM
10	1	0	1	0	PWM, Phase Correct	ICR1	TOP	BOTTOM
11	1	0	1	1	PWM, Phase Correct	OCR1A	TOP	BOTTOM
12	1	1	0	0	CTC	ICR1	Immediate	MAX
13	1	1	0	1	Reserved	–	–	–
14	1	1	1	0	Fast PWM	ICR1	BOTTOM	TOP
15	1	1	1	1	Fast PWM	OCR1A	BOTTOM	TOP

Timer/Counter1
Control Register B –
TCCR1B

Bit	7	6	5	4	3	2	1	0	
	ICNC1	ICES1	–	WGM13	WGM12	CS12	CS11	CS10	TCCR1B
Read/Write	R/W	R/W	R	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

Bit 7 – ICNC1: Input Capture Noise Canceler
Bit 6 – ICES1: Input Capture Edge Select
Bit 5 – Reserved Bit
Bit 4:3 – WGM13:2: Waveform Generation Mode
Bit 2:0 – CS12:0: Clock Select

CS12	CS11	CS10	Description
0	0	0	No clock source (Timer/Counter stopped).
0	0	1	$clk_{IO}/1$ (No prescaling)
0	1	0	$clk_{IO}/8$ (From prescaler)
0	1	1	$clk_{IO}/64$ (From prescaler)
1	0	0	$clk_{IO}/256$ (From prescaler)
1	0	1	$clk_{IO}/1024$ (From prescaler)
1	1	0	External clock source on T1 pin. Clock on falling edge.
1	1	1	External clock source on T1 pin. Clock on rising edge.

Timer/Counter1 – TCNT1H and TCNT1L

Bit	7	6	5	4	3	2	1	0	
	TCNT1[15:8]								TCNT1H
	TCNT1[7:0]								TCNT1L
Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

Output Compare Register 1 B – OCR1BH and OCR1BL

Bit	7	6	5	4	3	2	1	0	
	OCR1B[15:8]								OCR1BH
	OCR1B[7:0]								OCR1BL
Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

Input Capture Register 1 – ICR1H and ICR1L

Bit	7	6	5	4	3	2	1	0	
	ICR1[15:8]								ICR1H
	ICR1[7:0]								ICR1L
Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

Timer/Counter Interrupt Mask Register – TIMSK⁽¹⁾

Bit	7	6	5	4	3	2	1	0	
	OCIE2	TOIE2	TICIE1	OCIE1A	OCIE1B	TOIE1	OCIE0	TOIE0	TIMSK
Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

- Bit 5 – TICIE1: Timer/Counter1, Input Capture Interrupt Enable
 Bit 4 – OCIE1A: Timer/Counter1, Output Compare A Match Interrupt Enable
 Bit 3 – OCIE1B: Timer/Counter1, Output Compare B Match Interrupt Enable
 Bit 2 – TOIE1: Timer/Counter1, Overflow Interrupt Enable

Timer/Counter Interrupt Flag Register – TIFR

Bit	7	6	5	4	3	2	1	0	
	OCF2	TOV2	ICF1	OCF1A	OCF1B	TOV1	OCF0	TOV0	TIFR
Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

- Bit 5 – ICF1: Timer/Counter1, Input Capture Flag
 Bit 4 – OCF1A: Timer/Counter1, Output Compare A Match Flag
 Bit 3 – OCF1B: Timer/Counter1, Output Compare B Match Flag
 Bit 2 – TOV1: Timer/Counter1, Overflow Flag

USART

Operating Mode	Equation for Calculating Baud Rate ⁽¹⁾	Equation for Calculating UBRR Value
Asynchronous Normal Mode (U2X = 0)	$BAUD = \frac{f_{osc}}{16(UBRR + 1)}$	$UBRR = \frac{f_{osc}}{16BAUD} - 1$
Asynchronous Double Speed Mode (U2X = 1)	$BAUD = \frac{f_{osc}}{8(UBRR + 1)}$	$UBRR = \frac{f_{osc}}{8BAUD} - 1$
Synchronous Master Mode	$BAUD = \frac{f_{osc}}{2(UBRR + 1)}$	$UBRR = \frac{f_{osc}}{2BAUD} - 1$

USART I/O Data Register – UDR

Bit	7	6	5	4	3	2	1	0	
	RXB[7:0]								UDR (Read)
	TXB[7:0]								UDR (Write)
Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

USART Control and Status Register A – UCSRA

Bit	7	6	5	4	3	2	1	0	
	RXC	TXC	UDRE	FE	DOR	PE	U2X	MPCM	UCSRA
Read/Write	R	R/W	R	R	R	R	R/W	R/W	
Initial Value	0	0	1	0	0	0	0	0	

- Bit 7 – RXC: USART Receive Complete
- Bit 6 – TXC: USART Transmit Complete
- Bit 5 – UDRE: USART Data Register Empty
- Bit 4 – FE: Frame Error
- Bit 3 – DOR: Data OverRun
- Bit 2 – PE: Parity Error
- Bit 1 – U2X: Double the USART Transmission Speed
- Bit 0 – MPCM: Multi-processor Communication Mode

USART Control and Status Register B – UCSRB

Bit	7	6	5	4	3	2	1	0	
	RXCIE	TXCIE	UDRIE	RXEN	TXEN	UCSZ2	RXB8	TXB8	UCSRB
Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R	R/W	
Initial Value	0	0	0	0	0	0	0	0	

- Bit 7 – RXCIE: RX Complete Interrupt Enable
- Bit 6 – TXCIE: TX Complete Interrupt Enable
- Bit 5 – UDRIE: USART Data Register Empty Interrupt Enable
- Bit 4 – RXEN: Receiver Enable
- Bit 3 – TXEN: Transmitter Enable
- Bit 2 – UCSZ2: Character Size
- Bit 1 – RXB8: Receive Data Bit 8
- Bit 0 – TXB8: Transmit Data Bit 8

USART Control and Status Register C – UCSRC

Bit	7	6	5	4	3	2	1	0	
	URSEL	UMSEL	UPM1	UPM0	USBS	UCSZ1	UCSZ0	UCPOL	UCSRC
Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	
Initial Value	1	0	0	0	0	1	1	0	

- Bit 7 – URSEL: Register Select
- Bit 6 – UMSEL: USART Mode Select
- Bit 5:4 – UPM1:0: Parity Mode
- Bit 3 – USBS: Stop Bit Select
- Bit 2:1 – UCSZ1:0: Character Size
- Bit 0 – UCPOL: Clock Polarity

UMSEL	Mode
0	Asynchronous Operation
1	Synchronous Operation

USBS	Stop Bit(s)
0	1-bit
1	2-bit

UPM1	UPM0	Parity Mode
0	0	Disabled
0	1	Reserved
1	0	Enabled, Even Parity
1	1	Enabled, Odd Parity

UCPOL	Transmitted Data Changed (Output of Tx D Pin)	Received Data Sampled (Input on Rx D Pin)
0	Rising XCK Edge	Falling XCK Edge
1	Falling XCK Edge	Rising XCK Edge

Table 66. UCSZ Bits Settings

UCSZ2	UCSZ1	UCSZ0	Character Size
0	0	0	5-bit
0	0	1	6-bit
0	1	0	7-bit
0	1	1	8-bit
1	0	0	Reserved
1	0	1	Reserved
1	1	0	Reserved
1	1	1	9-bit

USART Baud Rate Registers – UBRRL and UBRRH

Bit	15	14	13	12	11	10	9	8	
	URSEL	-	-	-	-	UBRR[11:9]	-	-	UBRRH
	-	-	-	-	-	UBRR[7:0]	-	-	UBRRL
Read/Write	R/W	R	R	R	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	



Operation Research326 R

11-5-2018

Third Level: Computer Science Section

Time: 3 hours

Total Degree (50 marks)

Science Faculty

Mathematical Department

Answer the following Questions:

1-Use the Simplex method to solve the following linear programming

Maximize $Z = 10x_1 + 11x_2$

Subject to $x_1 + 2x_2 \leq 150$, $3x_1 + 4x_2 \leq 200$, $6x_1 + x_2 \leq 175$

and $x_1, x_2 \geq 0$

(10 marks)

2) Use the graphical and the algebraic method to solve the problem

Max $f(\underline{x}) = 5x_1 + 7x_2$ Subject to $5x_1 + 8x_2 \leq 24$, $x_1 + x_2 \leq 4$,

$10x_1 + 7x_2 \leq 35$ and $x_1, x_2 \geq 0$

(12.5marks)

3) Use the Lagrange multiplier method to find the extreme points of the problem

Minimize $f(\underline{x}) = x_1^2 + x_2^2 - 3x_1x_2$

Subject to $g(\underline{x}) = x_1^2 + x_2^2 - 8 = 0$.

(12.5marks)

4) Use the Hessian Matrix to find the local points of the problem

$f(\underline{x}) = f(x_1, x_2) = x_1^3 + x_2^3 + 2x_1^2 + 4x_2^2 + 6$

(10marks)

5) Find the local Points

$f(x) = 3x^4 - 20x^3 + 36x^2 + 16$ (5marks)

Best Wishes

Dr. Alaa Fahim

Question No. 6 (10 Marks).

It is required to design a sliding door controlled by Atmega32. The store also counts the number of people entered in its EEPROM (\$000) and display it on LCD (PORT A). When user press a push button (ETX INT2), it activate a DC motor to open the door in one direction and increment the number stored in EEPROM. When the door is fully opened, another switch is activated (EXT INT1) to stop the motor for 5 seconds (use TIMER0), then the motor rotate in the reverse direction to close. When the door is fully closed, it activate another switch (EXT INT0) to stop the motor. The motor works according to the below table:

	PORTC.0	PORTC.1
Stop	0	0
Opening the door	1	0
Closing the door	1	1

- a) Draw the general layout of the embedded system. (4 marks)

- b) Write an AVR C program to control the sliding door and, count the number of visitors and display it on LCD. (6 marks)

Best Wishes

----- End of Questions -----

Dr. Osama Haraz

(XCK/T0) PB0	1	40	PA0 (ADC0)
(T1) PB1	2	39	PA1 (ADC1)
(INT2/AIN0) PB2	3	38	PA2 (ADC2)
(OC0/AIN1) PB3	4	37	PA3 (ADC3)
(SS) PB4	5	36	PA4 (ADC4)
(MOSI) PB5	6	35	PA5 (ADC5)
(MISO) PB6	7	34	PA6 (ADC6)
(SCK) PB7	8	33	PA7 (ADC7)
RESET	9	32	AREF
VCC	10	31	GND
GND	11	30	AVCC
XTAL2	12	29	PC7 (TOSC2)
XTAL1	13	28	PC6 (TOSC1)
(RXD) PD0	14	27	PC5 (TDI)
(TXD) PD1	15	26	PC4 (TDO)
(INT0) PD2	16	25	PC3 (TMS)
(INT1) PD3	17	24	PC2 (TCK)
(OC1B) PD4	18	23	PC1 (SDA)
(OC1A) PD5	19	22	PC0 (SCL)
(ICP1) PD6	20	21	PD7 (OC2)

Status Register

Bit	7	6	5	4	3	2	1	0	
	I	T	H	S	V	N	Z	C	SREG
Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

Bit 7 – I: Global Interrupt Enable
 Bit 6 – T: Bit Copy Storage
 Bit 5 – H: Half Carry Flag
 Bit 4 – S: Sign Bit, $S = N \oplus V$

Bit 3 – V: Two's Complement Overflow Flag
 Bit 2 – N: Negative Flag
 Bit 1 – Z: Zero Flag

The EEPROM Address Register – EEARH and EEARL

Bit	15	14	13	12	11	10	9	8	
	–	–	–	–	–	–	EEAR9	EEAR8	EEARH
	EEAR7	EEAR6	EEAR5	EEAR4	EEAR3	EEAR2	EEAR1	EEAR0	EEARL
Read/Write	R	R	R	R	R	R	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	X	

The EEPROM Data Register – EEDR

Bit	7	6	5	4	3	2	1	0	
	MSB							LSB	EEDR
Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

The EEPROM Control Register – EECR

Bit	7	6	5	4	3	2	1	0	
	–	–	–	–	EERIE	EEMWE	EEWE	EERE	EECR
Read/Write	R	R	R	R	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	X	0	

Bit 3 – EERIE: EEPROM Ready Interrupt Enable
 Bit 2 – EEMWE: EEPROM Master Write Enable

Bit 1 – EEWE: EEPROM Write Enable
 Bit 0 – EERE: EEPROM Read Enable

Interrupts

MCU Control Register – MCUCR

The MCU Control Register contains control bits for interrupt sense control and general MCU functions.

Bit	7	6	5	4	3	2	1	0	
	SE	SM2	SM1	SM0	ISC11	ISC10	ISC01	ISC00	MCUCR
Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

Bit 3, 2 – ISC11, ISC10: Interrupt Sense Control 1 Bit 1 and Bit 0

Bit 1, 0 – ISC01, ISC00: Interrupt Sense Control 0 Bit 1 and Bit 0

ISC11	ISC10	Description
0	0	The low level of INT1 generates an interrupt request.
0	1	Any logical change on INT1 generates an interrupt request.
1	0	The falling edge of INT1 generates an interrupt request.
1	1	The rising edge of INT1 generates an interrupt request.

ISC01	ISC00	Description
0	0	The low level of INT0 generates an interrupt request.
0	1	Any logical change on INT0 generates an interrupt request.
1	0	The falling edge of INT0 generates an interrupt request.
1	1	The rising edge of INT0 generates an interrupt request.

MCU Control and Status Register – MCUCSR

Bit	7	6	5	4	3	2	1	0	
	JTD	ISC2	–	JTRF	WDRF	BORF	EXTRF	PORF	MCUCSR
Read/Write	R/W	R/W	R	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0						See Bit Description

Bit 6 – ISC2: Interrupt Sense Control 2

General Interrupt Control Register – GICR

Bit	7	6	5	4	3	2	1	0	
	INT1	INT0	INT2	–	–	–	IVSEL	IVCE	GICR
Read/Write	R/W	R/W	R/W	R	R	R	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

Bit 7 – INT1: External Interrupt Request 1 Enable

Bit 5 – INT2: External Interrupt Request 2 Enable

Bit 6 – INT0: External Interrupt Request 0 Enable

General Interrupt Flag Register – GIFR

Bit	7	6	5	4	3	2	1	0	
	INTF1	INTF0	INTF2	–	–	–	–	–	GIFR
Read/Write	R/W	R/W	R/W	R	R	R	R	R	
Initial Value	0	0	0	0	0	0	0	0	

Bit 7 – INTF1: External Interrupt Flag 1

Bit 5 – INTF2: External Interrupt Flag 2

Bit 6 – INTF0: External Interrupt Flag 0

Port A Data Register – PORTA

Bit	7	6	5	4	3	2	1	0	
	PORTA7	PORTA6	PORTA5	PORTA4	PORTA3	PORTA2	PORTA1	PORTA0	PORTA
Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

Port A Data Direction Register – DDRA

Bit	7	6	5	4	3	2	1	0	
	DDA7	DDA6	DDA5	DDA4	DDA3	DDA2	DDA1	DDA0	DDRA
Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

Port A Input Pins Address – PINA

Bit	7	6	5	4	3	2	1	0	
	PINA7	PINA6	PINA5	PINA4	PINA3	PINA2	PINA1	PINA0	PINA
Read/Write	R	R	R	R	R	R	R	R	
Initial Value	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	

Time/Counter Control Register – TCCR0

Bit	7	6	5	4	3	2	1	0	
	FOC0	WGM00	COM01	COM00	WGM01	CS02	CS01	CS00	TCCR0
Read/Write	W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

Bit 7 – FOC0: Force Output Compare

Bit 5:4 – COM01:0: Compare Match Output Mode

Bit 6, 3 – WGM01:0: Waveform Generation Mode

Bit 2:0 – CS02:0: Clock Select

Mode	WGM01 (CTC0)	WGM00 (PWM0)	Timer/Counter Mode of Operation	TOP	Update of OCR0	TOV0 Flag Set-on	COM01	COM00	Description
0	0	0	Normal	0xFF	Immediate	MAX	0	0	Normal port operation, OC0 disconnected.
1	0	1	PWM, Phase Correct	0xFF	TOP	BOTTOM	0	1	Toggle OC0 on compare match
2	1	0	CTC	OCR0	Immediate	MAX	1	0	Clear OC0 on compare match
3	1	1	Fast PWM	0xFF	BOTTOM	MAX	1	1	Set OC0 on compare match

Timer/Counter Register – TCNT0

Bit	7	6	5	4	3	2	1	0	
	TCNT0[7:0]								TCNT0
Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

Output Compare Register – OCR0

Bit	7	6	5	4	3	2	1	0	
	OCR0[7:0]								OCR0
Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

Timer/Counter
Interrupt Mask
Register – TIMSK

Bit	7	6	5	4	3	2	1	0	
	OCIE2	TOIE2	OCIE1	OCIE1A	OCIE1B	TOIE1	OCIE0	TOIE0	TIMSK
Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

Bit 1 – OCIE0: Timer/Counter0 Output Compare Match Interrupt Enable
Bit 0 – TOIE0: Timer/Counter0 Overflow Interrupt Enable

Timer/Counter
Interrupt Flag Register
– TIFR

Bit	7	6	5	4	3	2	1	0	
	OCF2	TOV2	ICF1	OCF1A	OCF1B	TOV1	OCF0	TOV0	TIFR
Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

Bit 1 – OCF0: Output Compare Flag 0
Bit 0 – TOV0: Timer/Counter0 Overflow Flag

Timer/Counter1
Control Register A –
TCCR1A

Bit	7	6	5	4	3	2	1	0	
	COM1A1	COM1A0	COM1B1	COM1B0	FOC1A	FOC1B	WGM11	WGM10	TCCR1A
Read/Write	R/W	R/W	R/W	R/W	W	W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

Bit 7:6 – COM1A1:0: Compare Output Mode for Compare unit A
Bit 5:4 – COM1B1:0: Compare Output Mode for Compare unit B
Bit 3 – FOC1A: Force Output Compare for Compare unit A
Bit 2 – FOC1B: Force Output Compare for Compare unit B
Bit 1:0 – WGM11:0: Waveform Generation Mode

CS02	CS01	CS00	Description
0	0	0	No clock source (Timer/Counter stopped).
0	0	1	clk_{RCY} (No prescaling)
0	1	0	$clk_{RCY}/8$ (From prescaler)
0	1	1	$clk_{RCY}/64$ (From prescaler)
1	0	0	$clk_{RCY}/256$ (From prescaler)
1	0	1	$clk_{RCY}/1024$ (From prescaler)
1	1	0	External clock source on T0 pin. Clock on falling edge.
1	1	1	External clock source on T0 pin. Clock on rising edge.

COM1A1/COM1B1	COM1A0/COM1B0	Description
0	0	Normal port operation, OC1A/OC1B disconnected.
0	1	Toggle OC1A/OC1B on compare match
1	0	Clear OC1A/OC1B on compare match (Set output to low level)
1	1	Set OC1A/OC1B on compare match (Set output to high level)

Mode	WGM13	WGM12 (CTC1)	WGM11 (PWM11)	WGM10 (PWM10)	Timer/Counter Mode of Operation	TOP	Update of OCR1x	TOV1 Flag Set on
0	0	0	0	0	Normal	0xFFFF	Immediate	MAX
1	0	0	0	1	PWM, Phase Correct, 8-bit	0x00FF	TOP	BOTTOM
2	0	0	1	0	PWM, Phase Correct, 9-bit	0x01FF	TOP	BOTTOM
3	0	0	1	1	PWM, Phase Correct, 10-bit	0x03FF	TOP	BOTTOM
4	0	1	0	0	CTC	OCR1A	Immediate	MAX
5	0	1	0	1	Fast PWM, 8-bit	0x00FF	BOTTOM	TOP
6	0	1	1	0	Fast PWM, 9-bit	0x01FF	BOTTOM	TOP
7	0	1	1	1	Fast PWM, 10-bit	0x03FF	BOTTOM	TOP
8	1	0	0	0	PWM, Phase and Frequency Correct	ICR1	BOTTOM	BOTTOM
9	1	0	0	1	PWM, Phase and Frequency Correct	OCR1A	BOTTOM	BOTTOM
10	1	0	1	0	PWM, Phase Correct	ICR1	TOP	BOTTOM
11	1	0	1	1	PWM, Phase Correct	OCR1A	TOP	BOTTOM
12	1	1	0	0	CTC	ICR1	Immediate	MAX
13	1	1	0	1	Reserved	–	–	–
14	1	1	1	0	Fast PWM	ICR1	BOTTOM	TOP
15	1	1	1	1	Fast PWM	OCR1A	BOTTOM	TOP

Timer/Counter1
Control Register B –
TCCR1B

Bit	7	6	5	4	3	2	1	0	
	ICNC1	ICES1	–	WGM13	WGM12	CS12	CS11	CS10	TCCR1B
Read/Write	R/W	R/W	R	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

Bit 7 – ICNC1: Input Capture Noise Canceler
Bit 6 – ICES1: Input Capture Edge Select
Bit 5 – Reserved Bit
Bit 4:3 – WGM13:2: Waveform Generation Mode
Bit 2:0 – CS12:0: Clock Select



Operation Research326 R

11-5-2018

Third Level: Computer Science Section

Time: 3 hours

Total Degree (50 marks)

Science Faculty

Mathematical Department

Answer the following Questions:

1-Use the Simplex method to solve the following linear programming

Maximize $Z = 10x_1 + 11x_2$

Subject to $x_1 + 2x_2 \leq 150$, $3x_1 + 4x_2 \leq 200$, $6x_1 + x_2 \leq 175$

and $x_1, x_2 \geq 0$

(10 marks)

2) Use the graphical and the algebraic method to solve the problem

Max $f(\underline{x}) = 5x_1 + 7x_2$ Subject to $5x_1 + 8x_2 \leq 24$, $x_1 + x_2 \leq 4$,

$10x_1 + 7x_2 \leq 35$ and $x_1, x_2 \geq 0$

(12.5marks)

3) Use the Lagrange multiplier method to find the extreme points of the problem

Minimize $f(\underline{x}) = x_1^2 + x_2^2 - 3x_1x_2$

Subject to $g(\underline{x}) = x_1^2 + x_2^2 - 8 = 0$.

(12.5marks)

4) Use the Hessian Matrix to find the local points of the problem

$f(\underline{x}) = f(x_1, x_2) = x_1^3 + x_2^3 + 2x_1^2 + 4x_2^2 + 6$

(10marks)

5) Find the local Points

$f(x) = 3x^4 - 20x^3 + 36x^2 + 16$ (5marks)

Best Wishes

Dr. Alaa Fahim

اجب عن خمسة فقط من الاسئلة الاتية :- (10 درجات لكل سؤال : بواقع 5 درجات لكل فقرة)

(1) (i) اوجد الحل العام للمعادلة : $p_1 + 3p_2 + 2p_3(1 + \sqrt{x_1 + x_2 + x_3 - u}) = 6$
(ii) اوجد الحل الخاص للمعادلة : $(y - z)[2xyp + (x^2 - y^2)q] + z(x^2 - y^2) = 0$
الذي يمر خلال المنحنى $y = 0, x^3 = z^2$

(2) اوجد الحل العام لكل من المعادلتين التفاضليتين الجزئيتين الاتيتين :-
(i) $(D_1^3 - D_1^2 D_2 - D_1 D_2^2 + D_2^3)z = \log(x + y)$
(ii) $(D_1^2 - a^2 D_2^2)z = x^2 + y^2$, ثابت مطلق a

(3) اوجد الحل العام لكل من المعادلتين التفاضليتين الجزئيتين الاتيتين :-
(i) $(D_1^2 D_2 + D_2^2 - 2)z = e^{2y} \sin 3x - e^x \cos 2y$
(ii) $(D_1^2 - D_2^2 - D_1 - 3D_2 - 2)z = e^{2x-3y} + x + y + 1$

(4) (i) احسب التكاملات الاتية :-
(a) $\int_0^{\infty} x^{-\frac{1}{3}}(1 + 2x)^{-3} dx$ (b) $\int_0^1 \sqrt{\log \frac{1}{x}} dx$

(ii) اثبت ان :-
(a) $\tan^{-1} x = x {}_2F_1(1, \frac{1}{2}; \frac{3}{2}; -x^2)$
(b) $(a - b) {}_2F_1(a, b; c; x) = a {}_2F_1(a + 1, b; c; x) - b {}_2F_1(a, b + 1; c; x)$

(5) اثبت ان دوال بسل من النوع الاول $J_n(x)$ تحقق الاتي :-
(i) $J_{-\frac{1}{2}}(x) = \sqrt{\frac{2}{\pi x}} \cos x$, (ii) $\int x^n J_{n-1}(x) dx = x^n J_n(x) + c$

(6) (i) اثبت ان كثيرات حدود لجندر $P_n(x)$ تحقق :-
(ii) احسب التكاملات الاتية :-
(a) $\int_{-1}^1 x P_n(x) P_{n+1}(x) dx$, (b) $\int_{-1}^1 x^2 P_n(x) P_{n+1}(x) dx$, (c) $\int_{-1}^1 x^2 P_n(x) dx$

	Assiut University Faculty of Science Mathematics Dept.	Final Exam 2017-2018 Course: Mathematical and Statistical Packages Course code: MC300	Date: 14/5/2018 Level: Three Time: 2 Hours	
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Question 1: Put True or False for each of the following items (30 marks)

1. To enter a formula into a cell, begin by typing an equal sign.
2. Functions are pre-defined worksheet formulas.
3. Formulas in Excel must be written in a very specific format, referred to as syntax.
4. The second order of precedence is for exponentiation.
5. When the formula in cell **B7 =B4+B5+B6** is copied into cell **C7** the formula will be changed to **= C4+C5+C6**.
6. The error "#####" means Data being referenced is not available.
7. The range **B2:B7** is a range down a column.
8. To keep things clear and simple only add an absolute (\$) cell reference if absolutely necessary.
9. The formula **=ROUND(78.686788,-1)** results in the value 80 .
10. Placing an absolute sign in front of a ranged name (**\$budget**) is incorrect syntax.
11. The columns of the worksheet are named with Numbers.
12. Cells may contain only Labels and Values.
13. The cell address first lists the row name and then the column name.
14. This selected cell is referred to as the **active cell**.
15. The contents of the active cell will also be displayed on the **formula bar**.
16. A cell that is on sheet 3, in the second column third row would be referred to as **Sheet3@B3**.
17. Formatted Display is the number of decimal places that appear in a cell.
18. Formulas can be copied to perform different operations on a corresponding set of data.
19. The function **COUNT(value1,[value2],...)** counts non-blank cells.
20. The Average function ignore the blank cells.
21. TRUE and FALSE are called Boolean Values.
22. SPSS stands for Statistical Package for the Social Sciences.
23. SPSS is capable of handling large amounts of data.
24. SPSS has only two windows Data view and Output view.
25. **Transform** menu includes several options to change current variables.
26. In SPSS, Each column typically represents the data from 1 case.
27. In SPSS, The first column of variable view is Name.
28. In SPSS, you can sort data from **Transform** menu then **Sort Cases**.
29. Descriptive statistics are calculated using the **Analyze** menu.
30. Correlation is used to test the degree of association between variables.

Answer Sheet		
	True	False
1		
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Question 2: (10 marks)

	A	B	C	D	E	F	G
1		MT1	MT2	Final	Total	Honors	Passed
2	Possible points	100	100	200	400		320
3							
4	Blue	79	89	169	337	FALSE	TRUE
5	Jones	85	65	195	345	FALSE	TRUE
6	Grey	60	97	187	344	TRUE	TRUE
7	Mary	10	30	50	90	TRUE	FALSE
8							

Write the following Boolean functions

1. Blue's total and Jones' total are greater than Grey's:
2. Grey's total is not the maximum grade:
3. None of the students passed the course
4. Blue is not an Honors student
5. Blue didn't get a passing grade (320)

Question 3: (10 marks)

1. What are the difference between Data View, Variable View and Output View in SPSS?
2. Some significance tests are very restrictive about the form of data they can accept. What are the different types of measurement?
3. Describe how to test the degree of association between variables by SPSS.
4. Explain how to use SPSS to calculate the frequency and percent of females and males who did and did not have social problems.

Q2.

- a. Maintain two different Algorithm of crossover process with mention the probability of crossover (5 marks)
- b. Maintain two different Algorithm of mutation process with mention the probability of mutation. (5 marks)

Q3. a. Maintain tree type representation of solutions in genetic algorithm. (3 marks)

b. Using genetic algorithm to find the maximum value of the function $(15x - x^2)$ where parameter x varies between 0 and 15. For simplicity, we may assume that x takes only integer values. Using the genetic algorithm procedure in one step and begin with four solutions in initial solutions. (10 marks)

Q4. Discuss the internal structure of Taxi driver Robot. (7 marks)

Q5. Discuss the Tabu search method and maintain the type of memory using in this method and maintain the Tabu search algorithm. (10 marks)

==best wishes==

Dr. Alaa F. Mohamed

Answer the following questions: (50 Marks)

Question 1: Answer the following points (10 Marks)

- 1- Explain the internet "nuts and bolts"?
- 2- Explain the sources of packet delay?
- 3- What are protocols?
- 4- Explain Access network: digital subscriber line (DSL)?

Question 2: Answer the following points (10 Marks)

- 1- What is the network core?
- 2- Explain Packet Switching: queueing delay, loss?
- 3- Define throughput?
- 4- Define and explain traffic intensity?

Question 3: Answer the following points (10 Marks)

- 1- Explain the Internet protocol stack?
- 2- Mention some network applications?
- 3- Explain the application client-server architecture?
- 4- Explain P2P architecture?

Question 4: Answer the following points (10 Marks)

- 1- HTTP is "stateless". What does that mean?
- 2- Compare between persistent HTTP and non-persistent HTTP?
- 3- Give examples of HTTP response status codes?
- 4- Explain the term (web caches) and how it is useful?

Question 5: Answer the following points (10 Marks)

- 1- Give a DNS name resolution example?
- 2- Compare between multiplexing and demultiplexing? Support your answer with a diagram?
- 3- Define and explain the use of ACKs and NAKs?
- 4- Define and explain HOL? Support your answer with a diagram?

جامعة أسيوط	مايو 2018	كود المقرر: 356 رك
كلية العلوم		المقرر : مقدمة فى الحسابات العلمية
قسم الرياضيات		الزمن : ساعتان

Answer the following questions by using MATLAB language: (50 marks)

1- Using Newton's forward difference formula, find $y(0.1)$ using the table below:

x	0.0	0.2	0.4	0.6	0.8
y	1.000	1.22140	1.49182	1.82212	2.22554

2- Solve the differential equation by Adams method (without using nested for loops) at $x=0.2$:

$$\frac{dy}{dt} = t^2 - y, \quad y(0) = 1, \quad h = 0.05.$$

and compare it with the analytic solution $y = -e^{-t} + t^2 - 2t + 2$.

3- Solve the following initial value problem:

$$\frac{d^2u}{dt^2} + 4\frac{du}{dt} + 3u = 0, \quad u(0) = 1, \quad \frac{du}{dt}(0) = 0.$$

4- Let $f(x) = \cos 2x$ and $x_0 = 0$. Determine

- The third Taylor polynomial for f about x_0 .
- Find error bound at $x = 0.2$ and compare it to the actual error.

5- For the well-known Chua's circuit equation in chaotic studies that

$$\dot{x} = \alpha[y - x - f(x)], \quad \dot{y} = x - y + z, \quad \dot{z} = -\beta y - \gamma z, \quad t \in (0, 10),$$

where the nonlinear function $f(x)$ is described by

$$f(x) = bx + 0.5(a-b)(|x+1| - |x-1|) \text{ and } a < b < 0.$$

Write an M-function to describe the equation, and draw the phase trajectory for the parameters $\alpha = 9$, $\beta = 100/7$, $\gamma = 0$, $a = -8/7$, $b = -5/7$, and initial conditions

$$x(0) = -2.121304, \quad y(0) = -0.066170, \quad z(0) = 2.881090.$$

Good Luck

Dr. Tarek Aboelenen



امتحان الفرقة الثالثة شعبة الرياضيات

الزمن : ثلاث ساعات

رقم المقرر ورمزه : ١٣٤٦

المقرر : عمليات عشوائية وتطبيقاتها

أجب عن خمسة أسئلة فقط مما يأتي :- درجة جزء كل سؤال (خمس درجات)

١- (أ) لمجموعة المتغيرات العشوائية المستقلة $X_1, X_2, X_3, \dots$ بفرض أن التوقع الرياضي $E(X_i) = m$ والتباين $V(X_i)$ لكل منها محدود عرف كل من التقارب عن طريق الإحتمال وقانون الأعداد الكبرى (الضعيف).
(ب) بفرض أن $f f s s f s f f s s s f f s f f s$ هي إحدى النتائج الممكنة في محاولات برنولي العشوائية المستقلة بحيث أن $P(s) = p, P(f) = q, p + q = 1$ عرف عملية عشوائية في الفراغ R^2 موضحا ذلك بيانيا .

٢- (أ) في عملية برنولي العشوائية $\{X_n; n > 0\}$ بالإحتمال $p = 0.6$ إذا كان $X = X_1 + X_2$ ، $Y = X_1 + X_3$ احسب الإحتمالات الآتية : $P(X < 2, Y \leq 1)$ ، $P(2X < 3Y)$ ، $P(Y = X)$.
(ب) في السؤال (٢-أ) أوجد العزم الارتباطي بين X ، Y موضحا العلاقة بينهما .

٣- (أ) وضح العلاقة بين عملية برنولي العشوائية $\{X_n; n > 0\}$ و العملية العشوائية $\{Y_n; n \geq 0\}$ حيث أن المتغير Y_n يخضع لتوزيع ذي الحدين واذكر صفات كل منهما ثم عبر مع الإستنتاج عن إحتمال الحادث $(Y_{n+1} = k)$ من خلال إحتمالات الحوادث : $(Y_n = k)$ ، $(Y_n = k - 1)$ لأي عدد صحيح $k > 0$.
(ب) في العملية العشوائية $\{Y_n; n \geq 0\}$ أوجد كل من $E(Y_5)$ ، $E(Y_4^2)$ ، $P(Y_5 = 3, Y_7 = 4, Y_{14} = 9)$.

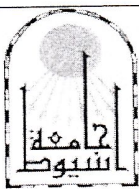
٤- (أ) عرف أزمنة النجاح T_k كعملية عشوائية موضحا العلاقة بينها وبين العملية العشوائية $\{Y_n; n \geq 0\}$ ثم اذكر فقط توزيع المتغير العشوائي T_k .
(ب) - في عملية بواسون العشوائية $\{N_t; t \geq 0\}$ بالمعدل $\lambda = 4$ احسب كل من الإحتمالات الآتية :
 $P(N_{1.5} = 2, N_4 = 5, N_{6.8} = 9)$ ، $P(N_3 = 5, N_7 = 9)$

٥- (أ) في عملية بواسون أو عملية الوصول المعودة $\{N_t; t \geq 0\}$ بالمعدل λ إثبت أن الإحتمال المشروط لعدد الوصول N_t بالنسبة إلى عدد الوصول N_{t+s} لكل $t > 0, s > 0$ يمثل توزيع ذي الحدين.
(ب) عرف العمليات العشوائية المستقلة ثم اثبت أن أي عمليتين مستقلتين لبواسون هو أيضا عملية بواسون .

٦- (أ) في عملية التجديد العشوائية $R = \{R_n; n \in N\}$ حيث N هي فئة الأعداد الصحيحة غير السالبة عرف دالة التجديد ثم عبر عنها من خلال توزيع المتغير R_n مع الإستنتاج .

(ب) في سلسلة ماركوف العشوائية المتقطعة $\{X_n; n \geq 0\}$ عرف مصفوفة الإحتمالات الإنتقالية بصفاتها المعروفة ثم احسب الإحتمال : $P(X_0 = 1, X_1 = 1, X_2 = 0, X_3 = 1, X_4 = 0, X_6 = 0)$ بفرض أن حالات الفراغ $(0, 1)$ والمصفوفة العشوائية

$$P = \begin{pmatrix} 1/2 & 1/2 \\ 1/3 & 2/3 \end{pmatrix} , \text{ ومنتجه الإحتمالات الابتدائية } \pi_0 = (2/5 \quad 3/5)$$

	المقرر: تحليل عددي (٣٢٣) الفرقة: المستوى الثالث الدرجة: ٥٠ درجة التاريخ: ٢٠١٨/٥/٢٩ الزمن: ثلاث ساعات	جامعة أسيوط كلية العلوم - قسم الرياضيات امتحان نهائي الفصل الدراسي الثاني للعام الجامعي ٢٠١٧/٢٠١٨
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Answer five questions only :- (10 marks for every question)

1-a) If the function $g \in C[a, b]$ and $g(x) \in [a, b] \forall x \in [a, b]$ and $g'(x)$ exist with $|g'(x)| \leq k < 1 \forall x \in [a, b]$ prove that the sequence defined by $P_n = g(P_{n-1}), n \geq 1$ will converge to the unique fixed point P and also $|P_{n+1} - P_n| \leq k^n |P_1 - P_0|$.

1-b) Verify that when Newton's method is used to compute $\sqrt{A}, A > 0$ (By solving the equation : $f(x) = x^2 - A$). The sequence of iterates is defined by : $x_{n+1} = (x_n + \frac{A}{x_n})/2$, and show that if the sequence $\{x_n\}$ is defined as the previous problem, then this method is quadratically convergence.

2-a) Derive Lagrange interpolation formula of degree n and write the error of the method.

2-b) For the given function $f(x) = \cos \pi x$ let $x_0 = -1, x_1 = 0, x_2 = 1$ construct the suitable interpolation polynomial and find the actual error.

3) Derive the formula of the Newton's interpolatory divided difference method and use this formula to obtain a polynomial of least degree that fits the values shown:

x	0	1	2	4	6
$f(x)$	1	9	23	93	259

من فضلك انظر خلف الورقة

السؤال الرابع :-

أ) يعرف الطي للدالتين $f(x)$, $g(x)$ كالآتي

$$f * g = \int_{-\infty}^{\infty} f(u) g(x-u) du$$

برهن علي أن تحويل فوريير للطرف الأيمن هو حاصل ضرب تحويلي فوريير للدالتين $f(x)$, $g(x)$

ب) أوجد تحويل فوريير للدالة $f(x) = \begin{cases} 1 & |x| < a \\ 0 & |x| > a \end{cases}$ وأرسم $f(x)$ كذلك تحويلها عند $a = 3$ وأوجد

$$\int_{-\infty}^{\infty} \frac{\sin u}{u} du \quad \text{كذلك} \quad \int_{-\infty}^{\infty} \frac{\sin \alpha a \cos \alpha x}{\alpha} d\alpha$$

ج) ترك خيط لانهائي من السكون وكانت أزاحته الابتدائية عن محور x هي $f(x)$ أوجد الإزاحه عند أي زمن .

انتهت الأسئلة مع تمنياتنا بالتوفيق ،،،،

لجنة الممتحنين :- أ.د/ نجاه عبد الرحمن حسين ، أ.د/ فاروق علي السيد



الامتحان النهائي للفصل الدراسي الثاني للعام الجامعي ٢٠١٧/٢٠١٨ م
 للفرقة : الثالثة : الشعبة : الرياضيات التاريخ : ٢٠١٨/٥/٢٤ م

الزمن : ساعتان

الدرجة الكلية : ٥٠ درجة

أسم المقرر : الطرق الرياضية
 رقم المقرر ورمزه : ٣٣٤ ر

درجة كل سؤال : ١٧ درجة

أجب عن ثلاثة أسئلة فقط مما يأتي :-

السؤال الأول :-

أوجد تحويل لابلاس للمشتقة التفاضلية للدالة $F(t)$ عند نقط الاتصال والانفصال للدالة .

أبرهن علي أن

$$\lim_{t \rightarrow 0} F(t) = \lim_{s \rightarrow \infty} s f(s)$$

$$\lim_{t \rightarrow \infty} F(t) = \lim_{s \rightarrow 0} s f(s)$$

$$\Gamma\left(\frac{1}{2}\right) = \sqrt{\pi}, \quad \int_0^{\infty} \delta(t) dt = 1, \quad L \sin \sqrt{t} = \frac{\sqrt{\pi}}{3} e^{-\frac{1}{4s}} s^{\frac{3}{2}}$$

السؤال الثاني :-

حل المعادلات الآتية :

$$t Y''(t) + Y'(t) + 4t Y(t) = 0, \quad y(0) = 3, y'(0) = 0$$

$$\frac{\partial U}{\partial x} = 2 \frac{\partial U}{\partial t} + U, \quad x > 0, t > 0 \quad U(x, 0) = 6 e^{-3x}$$

$$\int_0^t Y(u) Y(t-u) du = 16 \sin 4t$$

السؤال الثالث :-

(أ) فك الدالة $f(x) = x^2$, $0 < x < 2\pi$ بدلالة متسلسلة فوريير ثم أحسب المجموع

$$1 + \frac{1}{2^2} + \frac{1}{3^2} + \frac{1}{4^2} + \dots$$

(ب) صفيحة علي شكل دائري نصف قطرها الوحدة ووجهيها معزولين ونصف محيطها محفوظ عند درجة حرارة u_1

والآخر عند u_2 أوجد حالة الأتزان الحراري .

من فضلك أنظر بقية الأسئلة خلف الورقة ،،،،،



Answer the following questions (50 marks)

Q1.	Complete the following: (1)..... is a representation of a two-dimensional image as a finite set of digital values, called picture elements or pixels - Common image formats include.....(2).... ,(3)..... ,(4)..... (5)..... creates a Distance tool a draggable, resizable line that measures the distance between its endpoints. (6)..... These are the result of objects that are self-luminous, such as stars and light bulbs. (7).....the resulting output pixel is computed as a sum of products of the pixel values and mask coefficients in the pixel's neighborhood in the original image. - The Sobel operators used to compute edges are(8)..... ,(9)..... - Edge detector should have:(10)..... ,(11)..... - Types of noise are(12)..... ,(13)....	(13 marks)
Q2.	a) Compute Z from the following matlab script (6 marks) <pre> x = [150 10 90;80 50 60;121 160 20] y = [-1 0 1;-2 0 2;-1 0 1] z = imfilter(x,y,'corr') </pre> b) What is the Delta compression and compute the compressed data of the data (6 marks) 220 321 335 211 250 200 233 214 232 212	(12 marks)
Q3.	a) Write the MATLAB code used to: (4 marks) - Read any image then use affine transformation matrix for each of the operations below: - Flip the image right to left - Translation by [25, 15] pixels b) What are the main differences between: (8 marks) - Global thresholding and optimal thresholding. - Raster and vector image . - Interpixel redundancy and Psychovisual redundancy	(12 marks)

(Q5) (i) Assume that U, V are open intervals and let $f : U \rightarrow \mathbb{R}$ and $g : V \rightarrow \mathbb{R}$ be two differentiable functions such that $f(U) \subset V$. Prove that $g \circ f$ is differentiable on U and that $(g \circ f)' = (g' \circ f) \cdot f'$ [5 marks]

(ii) Prove that the function $f(x) := \frac{1}{x}$ is differentiable on $]0, \infty[$ but not uniformly continuous therein. [5 marks]

(Q6) (i) State and prove Rolle's theorem then use it to prove the mean value theorem. [6 marks]

(ii) Let I be an open interval. Apply the mean value theorem to prove that a function differentiable on I is

1. increasing if and only if $f' \geq 0$ on I ,

2. decreasing if and only if $f' \leq 0$ on I .

[4 marks]

With the best of luck,

Prof. Rashwan A. Rashwan,

Dr. Ahmed A. Abdelhakim



Time: 3 hours

Total mark: 50

Answer *only five* of the following questions:

(Q1) (i) Suppose that O_i , $i \geq 1$, are open subsets of $\mathbb{R}$. Prove that $\cup_{i \geq 1} O_i$ is also open in $\mathbb{R}$. [5 marks]

(ii) Let $S \subset \mathbb{R}$. Show that S is closed if and only if S contains the limit point of every convergent sequence of elements of S . [5 marks]

(Q2) (i) Prove that a sequence of real numbers converges if and only if it is a Cauchy sequence. [6 marks]

(ii) Show that if $(x_n)_{n \geq 1} \subset \mathbb{R}$ is a monotonically increasing sequence that is bounded above, then $x_n \rightarrow \sup_{n \geq 1} x_n$, as $n \rightarrow \infty$. [4 marks]

(Q3) (i) Show that $f : D \subset \mathbb{R} \rightarrow \mathbb{R}$ is continuous at $x_0 \in D$ if and only if the sequence $(f(x_n))_{n \geq 1}$ converges to $f(x_0)$ whenever $(x_n)_{n \geq 1}$ is a sequence in D that converges to x_0 . [6 marks]

(ii) Use the characterization given in (i) to prove the discontinuity at the origin of the function $f(x) = \begin{cases} \cos \frac{1}{x}, & x \neq 0; \\ 0, & x = 0. \end{cases}$ [4 marks]

(Q4) (i) Assume that D is a closed bounded subset of $\mathbb{R}$. Prove that if $f : D \rightarrow \mathbb{R}$ is continuous then f is bounded on D , and there exist $\alpha, \beta \in D$ such that $f(\alpha) = \max_{x \in D} f(x)$ and $f(\beta) = \min_{x \in D} f(x)$. [5 marks]

(ii) Argue by contradiction to demonstrate that if $f : [a, b] \rightarrow \mathbb{R}$ is continuous then it is uniformly continuous on $[a, b]$. [5 marks]

Please Turn over the page



أجب عن أسئلة الآتية :- (كل سؤال ١٠ درجات)

(١) (أ) أثبت قاعدة التضعيف لدالة جاما $\sqrt{\pi} \Gamma(2x) = 2^{2x-1} \Gamma(x) \Gamma\left(x + \frac{1}{2}\right)$, $x > 0$

ثم استخدمها فى إثبات أن: $\Gamma\left(\frac{5}{6}\right) \left[\Gamma\left(\frac{1}{3}\right)\right]^2 = 2 \sqrt[3]{2} \sqrt{\frac{\pi^3}{3}}$

(ب) باستخدام دوال جاما و بيتا أوجد التكاملات الآتية: (i) $\int_0^{\frac{\pi}{2}} \sqrt{\tan \theta} d\theta$ (ii) $\int_0^{\infty} \frac{\sqrt{x}}{e^{x^3}} dx$

(٢) (أ) أثبت أن: $\Gamma(x) \Gamma(1-x) = \frac{\pi}{\sin \pi x}$, $0 < x < 1$ ومن ثم أثبت أن

$\Gamma\left(x + \frac{1}{2}\right) \Gamma\left(\frac{1}{2} - x\right) = \frac{\pi}{\cos \pi x}$

(ب) أثبت أن:

(i) $\sqrt{1-x^2} T_n(x) = U_{n+1}(x) - x U_n(x)$,

(ii) $(1-x^2) U'_n(x) = -n x U_n(x) + n U_{n-1}(x)$

(٣) أثبت أن:

(i) ${}_2F_1(\alpha, \beta; \gamma, x) = (1-x)^{-\beta} {}_2F_1\left(\gamma - \alpha, \beta; \gamma, \frac{x}{x-1}\right)$

(ii) ${}_1F_1\left(\frac{1}{2}; \frac{3}{2}, -x^2\right) = \frac{\sqrt{\pi}}{2x} \operatorname{erf}(x)$ حيث أن: $\operatorname{erf}(x) = \frac{2}{\sqrt{\pi}} \int_0^x e^{-t^2} dt$ هى دالة الخطأ

(iii) ${}_1F_1(\alpha + 1; \gamma, x) - {}_1F_1(\alpha; \gamma, x) - \frac{x}{\gamma} {}_1F_1(\alpha + 1; \gamma + 1, x) = 0$

(٤) (أ) أوجد مفكوك ليجندر للدالة: $f(x) = x^3$

(ب) أثبت أن: $H_n(x) = (-1)^n e^{x^2} \frac{d^n}{dx^n} (e^{-x^2})$ حيث $H_n(x)$ كثيرة حدود هيرميت.

(ج) أثبت أن: $J_{\frac{1}{2}}(x) = \sqrt{\frac{2}{\pi}} \frac{\sin x}{\sqrt{x}}$

(٥) (أ) باستخدام الصيغة التكاملية لدوال بسل أثبت أن: $\int_0^{\infty} e^{-3x} J_0(4x) dx = \frac{1}{5}$

(ب) أوجد الحل العام لمعادلة بسل التفاضلية:

$x^2 \frac{d^2 y}{dx^2} + x \frac{dy}{dx} + (x^2 - n^2)y = 0$

CS12	CS11	CS10	Description
0	0	0	No clock source (Timer/Counter stopped).
0	0	1	clk _{IO} /1 (No prescaling)
0	1	0	clk _{IO} /8 (From prescaler)
0	1	1	clk _{IO} /64 (From prescaler)
1	0	0	clk _{IO} /256 (From prescaler)
1	0	1	clk _{IO} /1024 (From prescaler)
1	1	0	External clock source on T1 pin. Clock on falling edge.
1	1	1	External clock source on T1 pin. Clock on rising edge.

Timer/Counter1 – TCNT1H and TCNT1L

Bit	7	6	5	4	3	2	1	0	
	TCNT1[15:8]								TCNT1H
	TCNT1[7:0]								TCNT1L
Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

Output Compare Register 1 B – OCR1BH and OCR1BL

Bit	7	6	5	4	3	2	1	0	
	OCR1B[15:8]								OCR1BH
	OCR1B[7:0]								OCR1BL
Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

Input Capture Register 1 – ICR1H and ICR1L

Bit	7	6	5	4	3	2	1	0	
	ICR1[15:8]								ICR1H
	ICR1[7:0]								ICR1L
Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

Timer/Counter Interrupt Mask Register – TIMSK⁽¹⁾

Bit	7	6	5	4	3	2	1	0	
	OCIE2	OCIE1	OCIE1A	OCIE1B	TOIE1	OCIE0	TOIE0		TIMSK
Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

- Bit 5 – OCIE1: Timer/Counter1, Input Capture Interrupt Enable
 Bit 4 – OCIE1A: Timer/Counter1, Output Compare A Match Interrupt Enable
 Bit 3 – OCIE1B: Timer/Counter1, Output Compare B Match Interrupt Enable
 Bit 2 – TOIE1: Timer/Counter1, Overflow Interrupt Enable

Timer/Counter Interrupt Flag Register – TIFR

Bit	7	6	5	4	3	2	1	0	
	OCF2	TOV2	ICF1	OCF1A	OCF1B	TOV1	OCF0	TOV0	TIFR
Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

- Bit 5 – ICF1: Timer/Counter1, Input Capture Flag
 Bit 4 – OCF1A: Timer/Counter1, Output Compare A Match Flag
 Bit 3 – OCF1B: Timer/Counter1, Output Compare B Match Flag
 Bit 2 – TOV1: Timer/Counter1, Overflow Flag

USART

Operating Mode	Equation for Calculating Baud Rate ⁽¹⁾	Equation for Calculating UBRR Value
Asynchronous Normal Mode (U2X = 0)	$BAUD = \frac{f_{osc}}{16(UBRR + 1)}$	$UBRR = \frac{f_{osc}}{16BAUD} - 1$
Asynchronous Double Speed Mode (U2X = 1)	$BAUD = \frac{f_{osc}}{8(UBRR + 1)}$	$UBRR = \frac{f_{osc}}{8BAUD} - 1$
Synchronous Master Mode	$BAUD = \frac{f_{osc}}{2(UBRR + 1)}$	$UBRR = \frac{f_{osc}}{2BAUD} - 1$

USART I/O Data Register – UDR

Bit	7	6	5	4	3	2	1	0	
	RXB[7:0]								UDR (Read)
	TXB[7:0]								UDR (Write)
Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

Timer/Counter
Interrupt Mask
Register – TIMSK

Bit	7	6	5	4	3	2	1	0	
	OCIE2	TOIE2	OCIE1	OCIE1A	OCIE1B	TOIE1	OCIE0	TOIE0	TIMSK
Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

Bit 1 – OCIE0: Timer/Counter0 Output Compare Match Interrupt Enable
Bit 0 – TOIE0: Timer/Counter0 Overflow Interrupt Enable

Timer/Counter
Interrupt Flag Register
– TIFR

Bit	7	6	5	4	3	2	1	0	
	OCF2	TOV2	ICF1	OCF1A	OCF1B	TOV1	OCF0	TOV0	TIFR
Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

Bit 1 – OCF0: Output Compare Flag 0
Bit 0 – TOV0: Timer/Counter0 Overflow Flag

Timer/Counter1
Control Register A –
TCCR1A

Bit	7	6	5	4	3	2	1	0	
	COM1A1	COM1A0	COM1B1	COM1B0	FOC1A	FOC1B	WGM11	WGM10	TCCR1A
Read/Write	R/W	R/W	R/W	R/W	W	W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

Bit 7:6 – COM1A1:0: Compare Output Mode for Compare unit A
Bit 5:4 – COM1B1:0: Compare Output Mode for Compare unit B
Bit 3 – FOC1A: Force Output Compare for Compare unit A
Bit 2 – FOC1B: Force Output Compare for Compare unit B
Bit 1:0 – WGM11:0: Waveform Generation Mode

CS02	CS01	CS00	Description
0	0	0	No clock source (Timer/Counter stopped).
0	0	1	$clk_{IO}/1$ (No prescaling)
0	1	0	$clk_{IO}/8$ (From prescaler)
0	1	1	$clk_{IO}/64$ (From prescaler)
1	0	0	$clk_{IO}/256$ (From prescaler)
1	0	1	$clk_{IO}/1024$ (From prescaler)
1	1	0	External clock source on T0 pin, Clock on falling edge.
1	1	1	External clock source on T0 pin, Clock on rising edge.

COM1A1/COM1B1	COM1A0/COM1B0	Description
0	0	Normal port operation, OC1A/OC1B disconnected.
0	1	Toggle OC1A/OC1B on compare match
1	0	Clear OC1A/OC1B on compare match (Set output to low level)
1	1	Set OC1A/OC1B on compare match (Set output to high level)

Mode	WGM13	WGM12 (CTC1)	WGM11 (PWM11)	WGM10 (PWM10)	Timer/Counter Mode of Operation	TOP	Update of OCR1x	TOV1 Flag Set on
0	0	0	0	0	Normal	0xFFFF	Immediate	MAX
1	0	0	0	1	PWM, Phase Correct, 8-bit	0x00FF	TOP	BOTTOM
2	0	0	1	0	PWM, Phase Correct, 9-bit	0x01FF	TOP	BOTTOM
3	0	0	1	1	PWM, Phase Correct, 10-bit	0x03FF	TOP	BOTTOM
4	0	1	0	0	CTC	OCR1A	Immediate	MAX
5	0	1	0	1	Fast PWM, 8-bit	0x00FF	BOTTOM	TOP
6	0	1	1	0	Fast PWM, 9-bit	0x01FF	BOTTOM	TOP
7	0	1	1	1	Fast PWM, 10-bit	0x03FF	BOTTOM	TOP
8	1	0	0	0	PWM, Phase and Frequency Correct	ICR1	BOTTOM	BOTTOM
9	1	0	0	1	PWM, Phase and Frequency Correct	OCR1A	BOTTOM	BOTTOM
10	1	0	1	0	PWM, Phase Correct	ICR1	TOP	BOTTOM
11	1	0	1	1	PWM, Phase Correct	OCR1A	TOP	BOTTOM
12	1	1	0	0	CTC	ICR1	Immediate	MAX
13	1	1	0	1	Reserved	–	–	–
14	1	1	1	0	Fast PWM	ICR1	BOTTOM	TOP
15	1	1	1	1	Fast PWM	OCR1A	BOTTOM	TOP

Timer/Counter1
Control Register B –
TCCR1B

Bit	7	6	5	4	3	2	1	0	
	ICNC1	ICES1	–	WGM13	WGM12	CS12	CS11	CS10	TCCR1B
Read/Write	R/W	R/W	R	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

Bit 7 – ICNC1: Input Capture Noise Canceler
Bit 6 – ICES1: Input Capture Edge Select
Bit 5 – Reserved Bit
Bit 4:3 – WGM13:2: Waveform Generation Mode
Bit 2:0 – CS12:0: Clock Select

CS12	CS11	CS10	Description
0	0	0	No clock source (Timer/Counter stopped).
0	0	1	$clk_{IO}/1$ (No prescaling)
0	1	0	$clk_{IO}/8$ (From prescaler)
0	1	1	$clk_{IO}/64$ (From prescaler)
1	0	0	$clk_{IO}/256$ (From prescaler)
1	0	1	$clk_{IO}/1024$ (From prescaler)
1	1	0	External clock source on T1 pin. Clock on falling edge.
1	1	1	External clock source on T1 pin. Clock on rising edge.

Timer/Counter1 – TCNT1H and TCNT1L

Bit	7	6	5	4	3	2	1	0	
	TCNT1[15:8]								TCNT1H
	TCNT1[7:0]								TCNT1L
Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

Output Compare Register 1 B – OCR1BH and OCR1BL

Bit	7	6	5	4	3	2	1	0	
	OCR1B[15:8]								OCR1BH
	OCR1B[7:0]								OCR1BL
Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

Input Capture Register 1 – ICR1H and ICR1L

Bit	7	6	5	4	3	2	1	0	
	ICR1[15:8]								ICR1H
	ICR1[7:0]								ICR1L
Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

Timer/Counter Interrupt Mask Register – TIMSK⁽¹⁾

Bit	7	6	5	4	3	2	1	0	
	OCIE2	TOIE2	TICIE1	OCIE1A	OCIE1B	TOIE1	OCIE0	TOIE0	TIMSK
Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

- Bit 5 – TICIE1: Timer/Counter1, Input Capture Interrupt Enable
 Bit 4 – OCIE1A: Timer/Counter1, Output Compare A Match Interrupt Enable
 Bit 3 – OCIE1B: Timer/Counter1, Output Compare B Match Interrupt Enable
 Bit 2 – TOIE1: Timer/Counter1, Overflow Interrupt Enable

Timer/Counter Interrupt Flag Register – TIFR

Bit	7	6	5	4	3	2	1	0	
	OCF2	TOV2	ICF1	OCF1A	OCF1B	TOV1	OCF0	TOV0	TIFR
Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

- Bit 5 – ICF1: Timer/Counter1, Input Capture Flag
 Bit 4 – OCF1A: Timer/Counter1, Output Compare A Match Flag
 Bit 3 – OCF1B: Timer/Counter1, Output Compare B Match Flag
 Bit 2 – TOV1: Timer/Counter1, Overflow Flag

USART

Operating Mode	Equation for Calculating Baud Rate ⁽¹⁾	Equation for Calculating UBRR Value
Asynchronous Normal Mode (U2X = 0)	$BAUD = \frac{f_{osc}}{16(UBRR + 1)}$	$UBRR = \frac{f_{osc}}{16BAUD} - 1$
Asynchronous Double Speed Mode (U2X = 1)	$BAUD = \frac{f_{osc}}{8(UBRR + 1)}$	$UBRR = \frac{f_{osc}}{8BAUD} - 1$
Synchronous Master Mode	$BAUD = \frac{f_{osc}}{2(UBRR + 1)}$	$UBRR = \frac{f_{osc}}{2BAUD} - 1$

USART I/O Data Register – UDR

Bit	7	6	5	4	3	2	1	0	
	RXB[7:0]								UDR (Read)
	TXB[7:0]								UDR (Write)
Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

USART Control and Status Register A – UCSRA

Bit	7	6	5	4	3	2	1	0	
	RXC	TXC	UDRE	FE	DOR	PE	U2X	MPCM	UCSRA
Read/Write	R	R/W	R	R	R	R	R/W	R/W	
Initial Value	0	0	1	0	0	0	0	0	

- Bit 7 – RXC: USART Receive Complete
- Bit 6 – TXC: USART Transmit Complete
- Bit 5 – UDRE: USART Data Register Empty
- Bit 4 – FE: Frame Error
- Bit 3 – DOR: Data OverRun
- Bit 2 – PE: Parity Error
- Bit 1 – U2X: Double the USART Transmission Speed
- Bit 0 – MPCM: Multi-processor Communication Mode

USART Control and Status Register B – UCSRB

Bit	7	6	5	4	3	2	1	0	
	RXCIE	TXCIE	UDRIE	RXEN	TXEN	UCSZ2	RXB8	TXB8	UCSRB
Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R	R/W	
Initial Value	0	0	0	0	0	0	0	0	

- Bit 7 – RXCIE: RX Complete Interrupt Enable
- Bit 6 – TXCIE: TX Complete Interrupt Enable
- Bit 5 – UDRIE: USART Data Register Empty Interrupt Enable
- Bit 4 – RXEN: Receiver Enable
- Bit 3 – TXEN: Transmitter Enable
- Bit 2 – UCSZ2: Character Size
- Bit 1 – RXB8: Receive Data Bit 8
- Bit 0 – TXB8: Transmit Data Bit 8

USART Control and Status Register C – UCSRC

Bit	7	6	5	4	3	2	1	0	
	URSEL	UMSEL	UPM1	UPM0	USBS	UCSZ1	UCSZ0	UCPOL	UCSRC
Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	
Initial Value	1	0	0	0	0	1	1	0	

- Bit 7 – URSEL: Register Select
- Bit 6 – UMSEL: USART Mode Select
- Bit 5:4 – UPM1:0: Parity Mode
- Bit 3 – USBS: Stop Bit Select
- Bit 2:1 – UCSZ1:0: Character Size
- Bit 0 – UCPOL: Clock Polarity

UMSEL	Mode
0	Asynchronous Operation
1	Synchronous Operation

USBS	Stop Bit(s)
0	1-bit
1	2-bit

UPM1	UPM0	Parity Mode
0	0	Disabled
0	1	Reserved
1	0	Enabled, Even Parity
1	1	Enabled, Odd Parity

UCPOL	Transmitted Data Changed (Output of TxD Pin)	Received Data Sampled (Input on RxD Pin)
0	Rising XCK Edge	Falling XCK Edge
1	Falling XCK Edge	Rising XCK Edge

Table 66. UCSZ Bits Settings

UCSZ2	UCSZ1	UCSZ0	Character Size
0	0	0	5-bit
0	0	1	6-bit
0	1	0	7-bit
0	1	1	8-bit
1	0	0	Reserved
1	0	1	Reserved
1	1	0	Reserved
1	1	1	9-bit

USART Baud Rate Registers – UBRRL and UBRRH

Bit	15	14	13	12	11	10	9	8	
	URSEL	-	-	-	-	UBRR[11:9]	-	-	UBRRH
	-	-	-	-	-	UBRR[7:0]	-	-	UBRRH
	-	-	-	-	-	-	-	-	UBRRH
Read/Write	R/W	R	R	R	R/W	R/W	R/W	R/W	
	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	



Operation Research326 R

11-5-2018

Third Level: Computer Science Section

Time: 3 hours

Total Degree (50 marks)

Science Faculty

Mathematical Department

Answer the following Questions:

1-Use the Simplex method to solve the following linear programming

Maximize $Z = 10x_1 + 11x_2$

Subject to $x_1 + 2x_2 \leq 150$, $3x_1 + 4x_2 \leq 200$, $6x_1 + x_2 \leq 175$

and $x_1, x_2 \geq 0$

(10 marks)

2) Use the graphical and the algebraic method to solve the problem

Max $f(\underline{x}) = 5x_1 + 7x_2$ Subject to $5x_1 + 8x_2 \leq 24$, $x_1 + x_2 \leq 4$,

$10x_1 + 7x_2 \leq 35$ and $x_1, x_2 \geq 0$

(12.5marks)

3) Use the Lagrange multiplier method to find the extreme points of the problem

Minimize $f(\underline{x}) = x_1^2 + x_2^2 - 3x_1x_2$

Subject to $g(\underline{x}) = x_1^2 + x_2^2 - 8 = 0$.

(12.5marks)

4) Use the Hessian Matrix to find the local points of the problem

$f(\underline{x}) = f(x_1, x_2) = x_1^3 + x_2^3 + 2x_1^2 + 4x_2^2 + 6$

(10marks)

5) Find the local Points

$f(x) = 3x^4 - 20x^3 + 36x^2 + 16$ (5marks)

Best Wishes

Dr. Alaa Fahim



ASSIUT UNIVERSITY

Faculty of Engineering
Electrical Engineering Department

H325 – Microprocessors

Third Year, Mathematics Department
Bylaw: 2014

Academic year 2017/2018 – Final Exam

Time Allowed: 3 Hours

Total Marks: 50

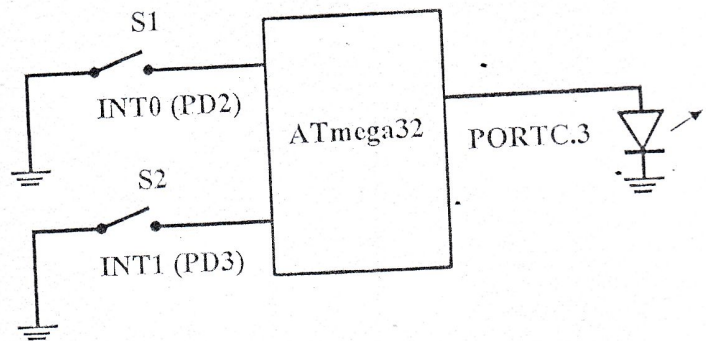
This exam consists of 6 problems. The total number of pages is 9, including the cover page. You have 3 hours to solve the problems. Put your final answer in the specified space for that.

Please note:

- This is a **CLOSED** book exam; however, students may bring their own ATmega32 Microcontroller datasheet.
- Consider ATmega32 Microcontroller running from 8 MHz crystal frequency.
- Use the free space after each assignment for your answer.

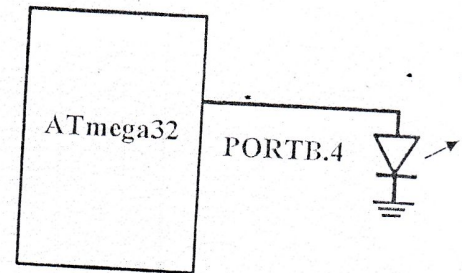
Question No. 2 (5 marks).

Assume that the INT0 and INT1 are connected to two SWITCHES named S1 and S2. Write a program in which, whenever S1 goes low, the content of EEPROM memory location 0x005F increases by one; and when S2 goes low, the content of EEPROM decreases by one. When the value stored in the EEPROM memory is bigger than 100, turn on the LED connected to PC3; otherwise, it is turned off. Use the external interrupt in level-triggered mode.



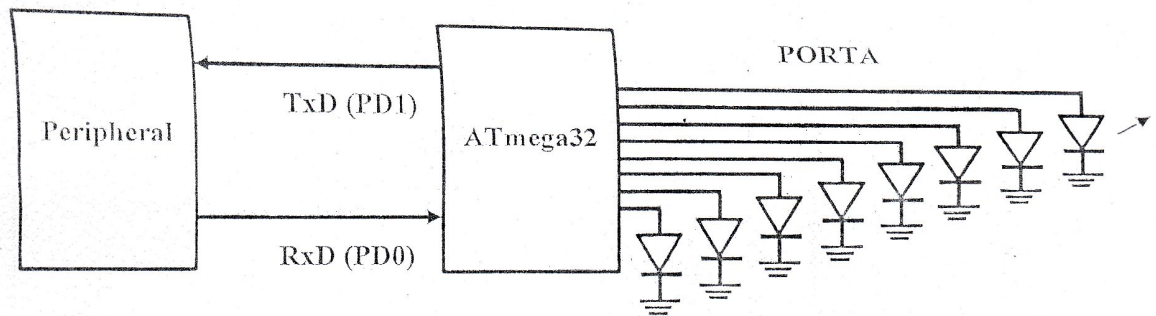
Question No. 3 (5 Marks).

Write a C program to toggle the LED connected to only the PORTB.4 bit continuously every second. Use TIMER1, Normal mode, and 1:256 prescaler to create the delay. Assume $XTAL = 8\text{ MHz}$.



Question No. 4 (5 marks).

Use the UART communication tool to transfer the letter 'Z' serially at 9600 baud, continuously and receive bytes of data serially and put them on Port A. Set the frame format to be 8-bit data, 1 stop bit, no parity bits. Assume XTAL = 8 MHz.



Question No. 5 (10 marks, 2 ½ each part).

Read the following program codes carefully, and write the function of each program code in the blank space provided:

C Program # 1	Function
<pre>#include <avr/io.h> int main (void) { while (EECR & (1 << EEWE)); EEAR = 0x5F; EEDR = 'G'; EECR = (1 << EEMWE); EECR = (1 << EEWE); return 0; }</pre>	

C Program # 2	Function
<pre>#include <avr/io.h> #define LED 7 #define SENSOR 1 int main (void) { DDRB = DDRB & ~(1 << SENSOR); DDRC = DDRC (1 << LED); while (1) { if (PINB & (1 << SENSOR)) PORTC = PORTC (1 << LED); else PORTC = PORTC & ~(1 << LED); } return 0; }</pre>	

C Program # 3	Function
<pre> #include <avr/io.h> int main (void) { DDRB = 0xFF; while (1) { T0Delay (); PORTB = PORTB ^ 0x10; } } void T0Delay () { TCNT0 = 186; TCCR0 = 0x02; while ((TIFR & (1 << TOV0)) == 0); TCCR0 = 0; TIFR = 0x1; } </pre>	

C Program # 4	Function
<pre> #include <avr/io.h> #include <avr/interrupt.h> int main () { DDRC = 0x08; PORTD = 1 << 2; GICR = (1 << INT0); sei (); while (1) { ISR (INT0_vect) { PORTC = ~(1 << 3); } } } </pre>	

Question No. 6 (10 Marks).

It is required to design a sliding door controlled by Atmega32. The store also counts the number of people entered in its EEPROM (\$000) and display it on LCD (PORT A). When user press a push button (ETX INT2), it activate a DC motor to open the door in one direction and increment the number stored in EEPROM. When the door is fully opened, another switch is activated (EXT INT1) to stop the motor for 5 seconds (use TIMER0), then the motor rotate in the reverse direction to close. When the door is fully closed, it activate another switch (EXT INT0) to stop the motor. The motor works according to the below table:

	PORTC.0	PORTC.1
Stop	0	0
Opening the door	1	0
Closing the door	1	1

- a) Draw the general layout of the embedded system. (4 marks)

- b) Write an AVR C program to control the sliding door and, count the number of visitors and display it on LCD. (6 marks)

Best Wishes

----- End of Questions -----

Dr. Osama Haraz

(XCK/T0) PB0	1	40	PA0 (ADC0)
(T1) PB1	2	39	PA1 (ADC1)
(INT2/AIN0) PB2	3	38	PA2 (ADC2)
(OC0/AIN1) PB3	4	37	PA3 (ADC3)
(SS) PB4	5	36	PA4 (ADC4)
(MOSI) PB5	6	35	PA5 (ADC5)
(MISO) PB6	7	34	PA6 (ADC6)
(SCK) PB7	8	33	PA7 (ADC7)
RESET	9	32	AREF
VCC	10	31	GND
GND	11	30	AVCC
XTAL2	12	29	PC7 (TOSC2)
XTAL1	13	28	PC6 (TOSC1)
(RXD) PD0	14	27	PC5 (TDI)
(TXD) PD1	15	26	PC4 (TDO)
(INT0) PD2	16	25	PC3 (TMS)
(INT1) PD3	17	24	PC2 (TCK)
(OC1B) PD4	18	23	PC1 (SDA)
(OC1A) PD5	19	22	PC0 (SCL)
(ICP1) PD6	20	21	PD7 (OC2)

Status Register

Bit	7	6	5	4	3	2	1	0	
	I	T	H	S	V	N	Z	C	SREG
Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

Bit 7 – I: Global Interrupt Enable
 Bit 6 – T: Bit Copy Storage
 Bit 5 – H: Half Carry Flag
 Bit 4 – S: Sign Bit, $S = N \oplus V$

Bit 3 – V: Two's Complement Overflow Flag
 Bit 2 – N: Negative Flag
 Bit 1 – Z: Zero Flag

The EEPROM Address Register – EEARH and EEARL

Bit	15	14	13	12	11	10	9	8	
	–	–	–	–	–	–	EEAR9	EEAR8	EEARH
	EEAR7	EEAR6	EEAR5	EEAR4	EEAR3	EEAR2	EEAR1	EEAR0	EEARL
Read/Write	R	R	R	R	R	R	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	X	

The EEPROM Data Register – EEDR

Bit	7	6	5	4	3	2	1	0	
	MSB							LSB	EEDR
Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

The EEPROM Control Register – EECR

Bit	7	6	5	4	3	2	1	0	
	–	–	–	–	EERIE	EEMWE	EEWE	EERE	EECR
Read/Write	R	R	R	R	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	X	0	

Bit 3 – EERIE: EEPROM Ready Interrupt Enable
 Bit 2 – EEMWE: EEPROM Master Write Enable

Bit 1 – EEWE: EEPROM Write Enable
 Bit 0 – EERE: EEPROM Read Enable

Interrupts

MCU Control Register – MCUCR

The MCU Control Register contains control bits for interrupt sense control and general MCU functions.

Bit	7	6	5	4	3	2	1	0	
	SE	SM2	SM1	SM0	ISC11	ISC10	ISC01	ISC00	MCUCR
Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

Bit 3, 2 – ISC11, ISC10: Interrupt Sense Control 1 Bit 1 and Bit 0

Bit 1, 0 – ISC01, ISC00: Interrupt Sense Control 0 Bit 1 and Bit 0

ISC11	ISC10	Description
0	0	The low level of INT1 generates an interrupt request.
0	1	Any logical change on INT1 generates an interrupt request.
1	0	The falling edge of INT1 generates an interrupt request.
1	1	The rising edge of INT1 generates an interrupt request.

ISC01	ISC00	Description
0	0	The low level of INT0 generates an interrupt request.
0	1	Any logical change on INT0 generates an interrupt request.
1	0	The falling edge of INT0 generates an interrupt request.
1	1	The rising edge of INT0 generates an interrupt request.

MCU Control and Status Register – MCUCSR

Bit	7	6	5	4	3	2	1	0	
	JTD	ISC2	–	JTRF	WDRF	BORF	EXTRF	PORF	MCUCSR
Read/Write	R/W	R/W	R	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0						See Bit Description

Bit 6 – ISC2: Interrupt Sense Control 2

General Interrupt Control Register – GICR

Bit	7	6	5	4	3	2	1	0	
	INT1	INT0	INT2	–	–	–	IVSEL	IVCE	GICR
Read/Write	R/W	R/W	R/W	R	R	R	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

Bit 7 – INT1: External Interrupt Request 1 Enable

Bit 5 – INT2: External Interrupt Request 2 Enable

Bit 6 – INT0: External Interrupt Request 0 Enable

General Interrupt Flag Register – GIFR

Bit	7	6	5	4	3	2	1	0	
	INTF1	INTF0	INTF2	–	–	–	–	–	GIFR
Read/Write	R/W	R/W	R/W	R	R	R	R	R	
Initial Value	0	0	0	0	0	0	0	0	

Bit 7 – INTF1: External Interrupt Flag 1

Bit 5 – INTF2: External Interrupt Flag 2

Bit 6 – INTF0: External Interrupt Flag 0

Port A Data Register – PORTA

Bit	7	6	5	4	3	2	1	0	
	PORTA7	PORTA6	PORTA5	PORTA4	PORTA3	PORTA2	PORTA1	PORTA0	PORTA
Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

Port A Data Direction Register – DDRA

Bit	7	6	5	4	3	2	1	0	
	DDA7	DDA6	DDA5	DDA4	DDA3	DDA2	DDA1	DDA0	DDRA
Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

Port A Input Pins Address – PINA

Bit	7	6	5	4	3	2	1	0	
	PINA7	PINA6	PINA5	PINA4	PINA3	PINA2	PINA1	PINA0	PINA
Read/Write	R	R	R	R	R	R	R	R	
Initial Value	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	

Time/Counter Control Register – TCCR0

Bit	7	6	5	4	3	2	1	0	
	FOC0	WGM00	COM01	COM00	WGM01	CS02	CS01	CS00	TCCR0
Read/Write	W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

Bit 7 – FOC0: Force Output Compare

Bit 5:4 – COM01:0: Compare Match Output Mode

Bit 6, 3 – WGM01:0: Waveform Generation Mode

Bit 2:0 – CS02:0: Clock Select

Mode	WGM01 (CTC0)	WGM00 (PWM0)	Timer/Counter Mode of Operation	TOP	Update of OCR0	TOV0 Flag Set-on	COM01	COM00	Description
0	0	0	Normal	0xFF	Immediate	MAX	0	0	Normal port operation, OC0 disconnected.
1	0	1	PWM, Phase Correct	0xFF	TOP	BOTTOM	0	1	Toggle OC0 on compare match
2	1	0	CTC	OCR0	Immediate	MAX	1	0	Clear OC0 on compare match
3	1	1	Fast PWM	0xFF	BOTTOM	MAX	1	1	Set OC0 on compare match

Timer/Counter Register – TCNT0

Bit	7	6	5	4	3	2	1	0	
	TCNT0[7:0]								TCNT0
Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

Output Compare Register – OCR0

Bit	7	6	5	4	3	2	1	0	
	OCR0[7:0]								OCR0
Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

Timer/Counter
Interrupt Mask
Register – TIMSK

Bit	7	6	5	4	3	2	1	0	
	OCIE2	TOIE2	OCIE1	OCIE1A	OCIE1B	TOIE1	OCIE0	TOIE0	TIMSK
Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

Bit 1 – OCIE0: Timer/Counter0 Output Compare Match Interrupt Enable
Bit 0 – TOIE0: Timer/Counter0 Overflow Interrupt Enable

Timer/Counter
Interrupt Flag Register
– TIFR

Bit	7	6	5	4	3	2	1	0	
	OCF2	TOV2	ICF1	OCF1A	OCF1B	TOV1	OCF0	TOV0	TIFR
Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

Bit 1 – OCF0: Output Compare Flag 0
Bit 0 – TOV0: Timer/Counter0 Overflow Flag

Timer/Counter1
Control Register A –
TCCR1A

Bit	7	6	5	4	3	2	1	0	
	COM1A1	COM1A0	COM1B1	COM1B0	FOC1A	FOC1B	WGM11	WGM10	TCCR1A
Read/Write	R/W	R/W	R/W	R/W	W	W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

Bit 7:6 – COM1A1:0: Compare Output Mode for Compare unit A
Bit 5:4 – COM1B1:0: Compare Output Mode for Compare unit B
Bit 3 – FOC1A: Force Output Compare for Compare unit A
Bit 2 – FOC1B: Force Output Compare for Compare unit B
Bit 1:0 – WGM11:0: Waveform Generation Mode

CS02	CS01	CS00	Description
0	0	0	No clock source (Timer/Counter stopped).
0	0	1	clk_{RCY} (No prescaling)
0	1	0	$clk_{RCY}/8$ (From prescaler)
0	1	1	$clk_{RCY}/64$ (From prescaler)
1	0	0	$clk_{RCY}/256$ (From prescaler)
1	0	1	$clk_{RCY}/1024$ (From prescaler)
1	1	0	External clock source on T0 pin. Clock on falling edge.
1	1	1	External clock source on T0 pin. Clock on rising edge.

COM1A1/COM1B1	COM1A0/COM1B0	Description
0	0	Normal port operation, OC1A/OC1B disconnected.
0	1	Toggle OC1A/OC1B on compare match
1	0	Clear OC1A/OC1B on compare match (Set output to low level)
1	1	Set OC1A/OC1B on compare match (Set output to high level)

Mode	WGM13	WGM12 (CTC1)	WGM11 (PWM11)	WGM10 (PWM10)	Timer/Counter Mode of Operation	TOP	Update of OCR1x	TOV1 Flag Set on
0	0	0	0	0	Normal	0xFFFF	Immediate	MAX
1	0	0	0	1	PWM, Phase Correct, 8-bit	0x00FF	TOP	BOTTOM
2	0	0	1	0	PWM, Phase Correct, 9-bit	0x01FF	TOP	BOTTOM
3	0	0	1	1	PWM, Phase Correct, 10-bit	0x03FF	TOP	BOTTOM
4	0	1	0	0	CTC	OCR1A	Immediate	MAX
5	0	1	0	1	Fast PWM, 8-bit	0x00FF	BOTTOM	TOP
6	0	1	1	0	Fast PWM, 9-bit	0x01FF	BOTTOM	TOP
7	0	1	1	1	Fast PWM, 10-bit	0x03FF	BOTTOM	TOP
8	1	0	0	0	PWM, Phase and Frequency Correct	ICR1	BOTTOM	BOTTOM
9	1	0	0	1	PWM, Phase and Frequency Correct	OCR1A	BOTTOM	BOTTOM
10	1	0	1	0	PWM, Phase Correct	ICR1	TOP	BOTTOM
11	1	0	1	1	PWM, Phase Correct	OCR1A	TOP	BOTTOM
12	1	1	0	0	CTC	ICR1	Immediate	MAX
13	1	1	0	1	Reserved	–	–	–
14	1	1	1	0	Fast PWM	ICR1	BOTTOM	TOP
15	1	1	1	1	Fast PWM	OCR1A	BOTTOM	TOP

Timer/Counter1
Control Register B –
TCCR1B

Bit	7	6	5	4	3	2	1	0	
	ICNC1	ICES1	–	WGM13	WGM12	CS12	CS11	CS10	TCCR1B
Read/Write	R/W	R/W	R	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

Bit 7 – ICNC1: Input Capture Noise Canceler
Bit 6 – ICES1: Input Capture Edge Select
Bit 5 – Reserved Bit
Bit 4:3 – WGM13:2: Waveform Generation Mode
Bit 2:0 – CS12:0: Clock Select



Operation Research326 R

11-5-2018

Third Level: Computer Science Section

Time: 3 hours

Total Degree (50 marks)

Science Faculty

Mathematical Department

Answer the following Questions:

1-Use the Simplex method to solve the following linear programming

Maximize $Z = 10x_1 + 11x_2$

Subject to $x_1 + 2x_2 \leq 150$, $3x_1 + 4x_2 \leq 200$, $6x_1 + x_2 \leq 175$

and $x_1, x_2 \geq 0$

(10 marks)

2) Use the graphical and the algebraic method to solve the problem

Max $f(\underline{x}) = 5x_1 + 7x_2$ Subject to $5x_1 + 8x_2 \leq 24$, $x_1 + x_2 \leq 4$,

$10x_1 + 7x_2 \leq 35$ and $x_1, x_2 \geq 0$

(12.5marks)

3) Use the Lagrange multiplier method to find the extreme points of the problem

Minimize $f(\underline{x}) = x_1^2 + x_2^2 - 3x_1x_2$

Subject to $g(\underline{x}) = x_1^2 + x_2^2 - 8 = 0$.

(12.5marks)

4) Use the Hessian Matrix to find the local points of the problem

$f(\underline{x}) = f(x_1, x_2) = x_1^3 + x_2^3 + 2x_1^2 + 4x_2^2 + 6$

(10marks)

5) Find the local Points

$f(x) = 3x^4 - 20x^3 + 36x^2 + 16$ (5marks)

Best Wishes

Dr. Alaa Fahim

اجب عن خمسة فقط من الاسئلة الاتية :- (10 درجات لكل سؤال : بواقع 5 درجات لكل فقرة)

(1) (i) اوجد الحل العام للمعادلة : $p_1 + 3p_2 + 2p_3(1 + \sqrt{x_1 + x_2 + x_3 - u}) = 6$
(ii) اوجد الحل الخاص للمعادلة : $(y - z)[2xyp + (x^2 - y^2)q] + z(x^2 - y^2) = 0$
الذي يمر خلال المنحنى $y = 0, x^3 = z^2$

(2) اوجد الحل العام لكل من المعادلتين التفاضليتين الجزئيتين الاتيتين :-
(i) $(D_1^3 - D_1^2 D_2 - D_1 D_2^2 + D_2^3)z = \log(x + y)$
(ii) $(D_1^2 - a^2 D_2^2)z = x^2 + y^2$, ثابت مطلق a

(3) اوجد الحل العام لكل من المعادلتين التفاضليتين الجزئيتين الاتيتين :-
(i) $(D_1^2 D_2 + D_2^2 - 2)z = e^{2y} \sin 3x - e^x \cos 2y$
(ii) $(D_1^2 - D_2^2 - D_1 - 3D_2 - 2)z = e^{2x-3y} + x + y + 1$

(4) (i) احسب التكاملات الاتية :-
(a) $\int_0^{\infty} x^{-\frac{1}{3}}(1 + 2x)^{-3} dx$ (b) $\int_0^1 \sqrt{\log \frac{1}{x}} dx$

(ii) اثبت ان :-
(a) $\tan^{-1} x = x {}_2F_1(1, \frac{1}{2}; \frac{3}{2}; -x^2)$
(b) $(a - b) {}_2F_1(a, b; c; x) = a {}_2F_1(a + 1, b; c; x) - b {}_2F_1(a, b + 1; c; x)$

(5) اثبت ان دوال بسل من النوع الاول $J_n(x)$ تحقق الاتي :-
(i) $J_{-\frac{1}{2}}(x) = \sqrt{\frac{2}{\pi x}} \cos x$, (ii) $\int x^n J_{n-1}(x) dx = x^n J_n(x) + c$

(6) (i) اثبت ان كثيرات حدود لجندر $P_n(x)$ تحقق :-
(ii) احسب التكاملات الاتية :-
(a) $\int_{-1}^1 x P_n(x) P_{n+1}(x) dx$, (b) $\int_{-1}^1 x^2 P_n(x) P_{n+1}(x) dx$, (c) $\int_{-1}^1 x^2 P_n(x) dx$

	Assiut University Faculty of Science Mathematics Dept.	Final Exam 2017-2018 Course: Mathematical and Statistical Packages Course code: MC300	Date: 14/5/2018 Level: Three Time: 2 Hours	
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Question 1: Put True or False for each of the following items (30 marks)

1. To enter a formula into a cell, begin by typing an equal sign.
2. Functions are pre-defined worksheet formulas.
3. Formulas in Excel must be written in a very specific format, referred to as syntax.
4. The second order of precedence is for exponentiation.
5. When the formula in cell **B7 =B4+B5+B6** is copied into cell **C7** the formula will be changed to **= C4+C5+C6**.
6. The error "#####" means Data being referenced is not available.
7. The range **B2:B7** is a range down a column.
8. To keep things clear and simple only add an absolute (\$) cell reference if absolutely necessary.
9. The formula **=ROUND(78.686788,-1)** results in the value 80 .
10. Placing an absolute sign in front of a ranged name (**\$budget**) is incorrect syntax.
11. The columns of the worksheet are named with Numbers.
12. Cells may contain only Labels and Values.
13. The cell address first lists the row name and then the column name.
14. This selected cell is referred to as the **active cell**.
15. The contents of the active cell will also be displayed on the **formula bar**.
16. A cell that is on sheet 3, in the second column third row would be referred to as **Sheet3@B3**.
17. Formatted Display is the number of decimal places that appear in a cell.
18. Formulas can be copied to perform different operations on a corresponding set of data.
19. The function **COUNT(value1,[value2],...)** counts non-blank cells.
20. The Average function ignore the blank cells.
21. TRUE and FALSE are called Boolean Values.
22. SPSS stands for Statistical Package for the Social Sciences.
23. SPSS is capable of handling large amounts of data.
24. SPSS has only two windows Data view and Output view.
25. **Transform** menu includes several options to change current variables.
26. In SPSS, Each column typically represents the data from 1 case.
27. In SPSS, The first column of variable view is Name.
28. In SPSS, you can sort data from **Transform** menu then **Sort Cases**.
29. Descriptive statistics are calculated using the **Analyze** menu.
30. Correlation is used to test the degree of association between variables.

Answer Sheet		
	True	False
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Question 2: (10 marks)

	A	B	C	D	E	F	G
1		MT1	MT2	Final	Total	Honors	Passed
2	Possible points	100	100	200	400		320
3							
4	Blue	79	89	169	337	FALSE	TRUE
5	Jones	85	65	195	345	FALSE	TRUE
6	Grey	60	97	187	344	TRUE	TRUE
7	Mary	10	30	50	90	TRUE	FALSE
8							

Write the following Boolean functions

1. Blue's total and Jones' total are greater than Grey's:
2. Grey's total is not the maximum grade:
3. None of the students passed the course
4. Blue is not an Honors student
5. Blue didn't get a passing grade (320)

Question 3: (10 marks)

1. What are the difference between Data View, Variable View and Output View in SPSS?
2. Some significance tests are very restrictive about the form of data they can accept. What are the different types of measurement?
3. Describe how to test the degree of association between variables by SPSS.
4. Explain how to use SPSS to calculate the frequency and percent of females and males who did and did not have social problems.

Q2.

- a. Maintain two different Algorithm of crossover process with mention the probability of crossover (5 marks)
- b. Maintain two different Algorithm of mutation process with mention the probability of mutation. (5 marks)

Q3. a. Maintain tree type representation of solutions in genetic algorithm. (3 marks)

b. Using genetic algorithm to find the maximum value of the function $(15x - x^2)$ where parameter x varies between 0 and 15. For simplicity, we may assume that x takes only integer values. Using the genetic algorithm procedure in one step and begin with four solutions in initial solutions. (10 marks)

Q4. Discuss the internal structure of Taxi driver Robot. (7 marks)

Q5. Discuss the Tabu search method and maintain the type of memory using in this method and maintain the Tabu search algorithm. (10 marks)

==best wishes==

Dr. Alaa F. Mohamed

Answer the following questions: (50 Marks)

Question 1: Answer the following points (10 Marks)

- 1- Explain the internet "nuts and bolts"?
- 2- Explain the sources of packet delay?
- 3- What are protocols?
- 4- Explain Access network: digital subscriber line (DSL)?

Question 2: Answer the following points (10 Marks)

- 1- What is the network core?
- 2- Explain Packet Switching: queueing delay, loss?
- 3- Define throughput?
- 4- Define and explain traffic intensity?

Question 3: Answer the following points (10 Marks)

- 1- Explain the Internet protocol stack?
- 2- Mention some network applications?
- 3- Explain the application client-server architecture?
- 4- Explain P2P architecture?

Question 4: Answer the following points (10 Marks)

- 1- HTTP is "stateless". What does that mean?
- 2- Compare between persistent HTTP and non-persistent HTTP?
- 3- Give examples of HTTP response status codes?
- 4- Explain the term (web caches) and how it is useful?

Question 5: Answer the following points (10 Marks)

- 1- Give a DNS name resolution example?
- 2- Compare between multiplexing and demultiplexing? Support your answer with a diagram?
- 3- Define and explain the use of ACKs and NAKs?
- 4- Define and explain HOL? Support your answer with a diagram?

جامعة أسيوط	مايو 2018	كود المقرر: 356 رك
كلية العلوم		المقرر : مقدمة فى الحسابات العلمية
قسم الرياضيات		الزمن : ساعتان

Answer the following questions by using MATLAB language: (50 marks)

1- Using Newton's forward difference formula, find $y(0.1)$ using the table below:

x	0.0	0.2	0.4	0.6	0.8
y	1.000	1.22140	1.49182	1.82212	2.22554

2- Solve the differential equation by Adams method (without using nested for loops) at $x=0.2$:

$$\frac{dy}{dt} = t^2 - y, \quad y(0) = 1, \quad h = 0.05.$$

and compare it with the analytic solution $y = -e^{-t} + t^2 - 2t + 2$.

3- Solve the following initial value problem:

$$\frac{d^2u}{dt^2} + 4\frac{du}{dt} + 3u = 0, \quad u(0) = 1, \quad \frac{du}{dt}(0) = 0.$$

4- Let $f(x) = \cos 2x$ and $x_0 = 0$. Determine

a) The third Taylor polynomial for f about x_0 .

b) Find error bound at $x = 0.2$ and compare it to the actual error.

5- For the well-known Chua's circuit equation in chaotic studies that

$$\dot{x} = \alpha[y - x - f(x)], \quad \dot{y} = x - y + z, \quad \dot{z} = -\beta y - \gamma z, \quad t \in (0, 10),$$

where the nonlinear function $f(x)$ is described by

$$f(x) = bx + 0.5(a-b)(|x+1| - |x-1|) \text{ and } a < b < 0.$$

Write an M-function to describe the equation, and draw the phase trajectory for the parameters $\alpha = 9$, $\beta = 100/7$, $\gamma = 0$, $a = -8/7$, $b = -5/7$, and initial conditions

$$x(0) = -2.121304, \quad y(0) = -0.066170, \quad z(0) = 2.881090.$$

Good Luck

Dr. Tarek Aboelenen



امتحان الفرقة الثالثة شعبة الرياضيات

المقرر : عمليات عشوائية وتطبيقاتها
رقم المقرر ورمزه : ١٣٤٦
الزمن : ثلاث ساعات

أجب عن خمسة أسئلة فقط مما يأتي :- درجة جزء كل سؤال (خمس درجات)

١- (أ) لمجموعة المتغيرات العشوائية المستقلة $X_1, X_2, X_3, \dots$ بفرض أن التوقع الرياضي $E(X_i) = m$ والتباين $V(X_i)$ لكل منها محدود عرف كل من التقارب عن طريق الإحتمال وقانون الأعداد الكبرى (الضعيف).
(ب) بفرض أن $f f s s f s f f s s s f f s f f s$ هي إحدى النتائج الممكنة في محاولات برنولي العشوائية المستقلة بحيث أن $P(s) = p, P(f) = q, p + q = 1$ عرف عملية عشوائية في الفراغ R^2 موضحا ذلك بيانيا .

٢- (أ) في عملية برنولي العشوائية $\{X_n; n > 0\}$ بالإحتمال $p = 0.6$ إذا كان $X = X_1 + X_2$ ، $Y = X_1 + X_3$ احسب الإحتمالات الآتية : $P(X < 2, Y \leq 1)$ ، $P(2X < 3Y)$ ، $P(Y = X)$.
(ب) في السؤال (٢-أ) أوجد العزم الارتباطي بين X ، Y موضحا العلاقة بينهما .

٣- (أ) وضح العلاقة بين عملية برنولي العشوائية $\{X_n; n > 0\}$ و العملية العشوائية $\{Y_n; n \geq 0\}$ حيث أن المتغير Y_n يخضع لتوزيع ذي الحدين واذكر صفات كل منهما ثم عبر مع الإستنتاج عن إحتمال الحادث $(Y_{n+1} = k)$ من خلال إحتمالات الحوادث : $(Y_n = k)$ ، $(Y_n = k - 1)$ لأي عدد صحيح $k > 0$.
(ب) في العملية العشوائية $\{Y_n; n \geq 0\}$ أوجد كل من $E(Y_5)$ ، $E(Y_4^2)$ ، $P(Y_5 = 3, Y_7 = 4, Y_{14} = 9)$.

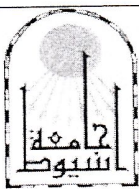
٤- (أ) عرف أزمنة النجاح T_k كعملية عشوائية موضحا العلاقة بينها وبين العملية العشوائية $\{Y_n; n \geq 0\}$ ثم اذكر فقط توزيع المتغير العشوائي T_k .
(ب) - في عملية بواسون العشوائية $\{N_t; t \geq 0\}$ بالمعدل $\lambda = 4$ احسب كل من الإحتمالات الآتية :
 $P(N_{1.5} = 2, N_4 = 5, N_{6.8} = 9)$ ، $P(N_3 = 5, N_7 = 9)$

٥- (أ) في عملية بواسون أو عملية الوصول المعودة $\{N_t; t \geq 0\}$ بالمعدل λ إثبت أن الإحتمال المشروط لعدد الوصول N_t بالنسبة إلى عدد الوصول N_{t+s} لكل $t > 0, s > 0$ يمثل توزيع ذي الحدين.
(ب) عرف العمليات العشوائية المستقلة ثم اثبت أن أي عمليتين مستقلتين لبواسون هو أيضا عملية بواسون .

٦- (أ) في عملية التجديد العشوائية $R = \{R_n; n \in N\}$ حيث N هي فئة الأعداد الصحيحة غير السالبة عرف دالة التجديد ثم عبر عنها من خلال توزيع المتغير R_n مع الإستنتاج .

(ب) في سلسلة ماركوف العشوائية المتقطعة $\{X_n; n \geq 0\}$ عرف مصفوفة الإحتمالات الإنتقالية بصفاتها المعروفة ثم احسب الإحتمال : $P(X_0 = 1, X_1 = 1, X_2 = 0, X_3 = 1, X_4 = 0, X_6 = 0)$ بفرض أن حالات الفراغ $(0, 1)$ والمصفوفة العشوائية

$$P = \begin{pmatrix} 1/2 & 1/2 \\ 1/3 & 2/3 \end{pmatrix} , \text{ ومنتجه الإحتمالات الابتدائية } \pi_0 = (2/5 \quad 3/5)$$

	المقرر: تحليل عددي (٣٢٣) الفرقة: المستوى الثالث الدرجة: ٥٠ درجة التاريخ: ٢٠١٨/٥/٢٩ الزمن: ثلاث ساعات	جامعة أسيوط كلية العلوم - قسم الرياضيات امتحان نهائي الفصل الدراسي الثاني للعام الجامعي ٢٠١٧/٢٠١٨
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Answer five questions only :- (10 marks for every question)

1-a) If the function $g \in C[a, b]$ and $g(x) \in [a, b] \forall x \in [a, b]$ and $g'(x)$ exist with $|g'(x)| \leq k < 1 \forall x \in [a, b]$ prove that the sequence defined by $P_n = g(P_{n-1}), n \geq 1$ will converge to the unique fixed point P and also $|P_{n+1} - P_n| \leq k^n |P_1 - P_0|$.

1-b) Verify that when Newton's method is used to compute $\sqrt{A}, A > 0$ (By solving the equation : $f(x) = x^2 - A$). The sequence of iterates is defined by : $x_{n+1} = (x_n + \frac{A}{x_n})/2$, and show that if the sequence $\{x_n\}$ is defined as the previous problem, then this method is quadratically convergence.

2-a) Derive Lagrange interpolation formula of degree n and write the error of the method.

2-b) For the given function $f(x) = \cos \pi x$ let $x_0 = -1, x_1 = 0, x_2 = 1$ construct the suitable interpolation polynomial and find the actual error.

3) Derive the formula of the Newton's interpolatory divided difference method and use this formula to obtain a polynomial of least degree that fits the values shown:

x	0	1	2	4	6
$f(x)$	1	9	23	93	259

من فضلك انظر خلف الورقة

السؤال الرابع :-

أ) يعرف الطي للدالتين $f(x)$, $g(x)$ كالآتي

$$f * g = \int_{-\infty}^{\infty} f(u) g(x-u) du$$

برهن علي أن تحويل فوريير للطرف الأيمن هو حاصل ضرب تحويلي فوريير للدالتين $f(x)$, $g(x)$

ب) أوجد تحويل فوريير للدالة $f(x) = \begin{cases} 1 & |x| < a \\ 0 & |x| > a \end{cases}$ وأرسم $f(x)$ كذلك تحويلها عند $a = 3$ وأوجد

$$\int_{-\infty}^{\infty} \frac{\sin u}{u} du \quad \text{كذلك} \quad \int_{-\infty}^{\infty} \frac{\sin \alpha a \cos \alpha x}{\alpha} d\alpha$$

ج) ترك خيط لانهائي من السكون وكانت أزاحته الابتدائية عن محور x هي $f(x)$ أوجد الإزاحه عند أي زمن .

انتهت الأسئلة مع تمنياتنا بالتوفيق ،،،،

لجنة الممتحنين :- أ. د/ نجاه عبد الرحمن حسين ، أ. د/ فاروق علي السيد



الامتحان النهائي للفصل الدراسي الثاني للعام الجامعي ٢٠١٧/٢٠١٨ م
 للفرقة : الثالثة شعبة : الرياضيات التاريخ : ٢٠١٨/٥/٢٤ م

الزمن : ساعتان

الدرجة الكلية : ٥٠ درجة

أسم المقرر : الطرق الرياضية
 رقم المقرر ورمزه : ٣٣٤ ر

درجة كل سؤال : ١٧ درجة

أجب عن ثلاثة أسئلة فقط مما يأتي :-

السؤال الأول :-

أوجد تحويل لابلاس للمشتقة التفاضلية للدالة $F(t)$ عند نقط الاتصال والانفصال للدالة .

أبرهن علي أن

$$\lim_{t \rightarrow 0} F(t) = \lim_{s \rightarrow \infty} s f(s)$$

$$\lim_{t \rightarrow \infty} F(t) = \lim_{s \rightarrow 0} s f(s)$$

$$\Gamma\left(\frac{1}{2}\right) = \sqrt{\pi}, \quad \int_0^{\infty} \delta(t) dt = 1, \quad L \sin \sqrt{t} = \frac{\sqrt{\pi}}{3} e^{-\frac{1}{4s}} s^{\frac{3}{2}}$$

السؤال الثاني :-

حل المعادلات الآتية :

$$t Y''(t) + Y'(t) + 4t Y(t) = 0, \quad y(0) = 3, y'(0) = 0$$

$$\frac{\partial U}{\partial x} = 2 \frac{\partial U}{\partial t} + U, \quad x > 0, t > 0 \quad U(x, 0) = 6 e^{-3x}$$

$$\int_0^t Y(u) Y(t-u) du = 16 \sin 4t$$

السؤال الثالث :-

(أ) فك الدالة $f(x) = x^2$, $0 < x < 2\pi$ بدلالة متسلسلة فوريير ثم أحسب المجموع

$$1 + \frac{1}{2^2} + \frac{1}{3^2} + \frac{1}{4^2} + \dots$$

(ب) صفيحة علي شكل دائري نصف قطرها الوحدة ووجهيها معزولين ونصف محيطها محفوظ عند درجة حرارة u_1

والآخر عند u_2 أوجد حالة الأتزان الحراري .

من فضلك أنظر بقية الأسئلة خلف الورقة ،،،،،



Answer the following questions (50 marks)

Q1.	Complete the following: (1)..... is a representation of a two-dimensional image as a finite set of digital values, called picture elements or pixels - Common image formats include.....(2).... ,(3)..... ,(4)..... (5)..... creates a Distance tool a draggable, resizable line that measures the distance between its endpoints. (6)..... These are the result of objects that are self-luminous, such as stars and light bulbs. (7).....the resulting output pixel is computed as a sum of products of the pixel values and mask coefficients in the pixel's neighborhood in the original image. - The Sobel operators used to compute edges are(8)..... ,(9)..... - Edge detector should have:(10)..... ,(11)..... - Types of noise are(12)..... ,(13)....	(13 marks)
Q2.	a) Compute Z from the following matlab script (6 marks) <pre> x = [150 10 90;80 50 60;121 160 20] y = [-1 0 1;-2 0 2;-1 0 1] z = imfilter(x,y,'corr') </pre> b) What is the Delta compression and compute the compressed data of the data (6 marks) 220 321 335 211 250 200 233 214 232 212	(12 marks)
Q3.	a) Write the MATLAB code used to: (4 marks) - Read any image then use affine transformation matrix for each of the operations below: - Flip the image right to left - Translation by [25, 15] pixels b) What are the main differences between: (8 marks) - Global thresholding and optimal thresholding. - Raster and vector image . - Interpixel redundancy and Psychovisual redundancy	(12 marks)

(Q5) (i) Assume that U, V are open intervals and let $f : U \rightarrow \mathbb{R}$ and $g : V \rightarrow \mathbb{R}$ be two differentiable functions such that $f(U) \subset V$. Prove that $g \circ f$ is differentiable on U and that $(g \circ f)' = (g' \circ f) \cdot f'$ [5 marks]

(ii) Prove that the function $f(x) := \frac{1}{x}$ is differentiable on $]0, \infty[$ but not uniformly continuous therein. [5 marks]

(Q6) (i) State and prove Rolle's theorem then use it to prove the mean value theorem. [6 marks]

(ii) Let I be an open interval. Apply the mean value theorem to prove that a function differentiable on I is

1. increasing if and only if $f' \geq 0$ on I ,

2. decreasing if and only if $f' \leq 0$ on I .

[4 marks]

With the best of luck,

Prof. Rashwan A. Rashwan,

Dr. Ahmed A. Abdelhakim



Time: 3 hours

Total mark: 50

Answer *only five* of the following questions:

(Q1) (i) Suppose that O_i , $i \geq 1$, are open subsets of $\mathbb{R}$. Prove that $\cup_{i \geq 1} O_i$ is also open in $\mathbb{R}$. [5 marks]

(ii) Let $S \subset \mathbb{R}$. Show that S is closed if and only if S contains the limit point of every convergent sequence of elements of S . [5 marks]

(Q2) (i) Prove that a sequence of real numbers converges if and only if it is a Cauchy sequence. [6 marks]

(ii) Show that if $(x_n)_{n \geq 1} \subset \mathbb{R}$ is a monotonically increasing sequence that is bounded above, then $x_n \rightarrow \sup_{n \geq 1} x_n$, as $n \rightarrow \infty$. [4 marks]

(Q3) (i) Show that $f : D \subset \mathbb{R} \rightarrow \mathbb{R}$ is continuous at $x_0 \in D$ if and only if the sequence $(f(x_n))_{n \geq 1}$ converges to $f(x_0)$ whenever $(x_n)_{n \geq 1}$ is a sequence in D that converges to x_0 . [6 marks]

(ii) Use the characterization given in (i) to prove the discontinuity at the origin of the function $f(x) = \begin{cases} \cos \frac{1}{x}, & x \neq 0; \\ 0, & x = 0. \end{cases}$ [4 marks]

(Q4) (i) Assume that D is a closed bounded subset of $\mathbb{R}$. Prove that if $f : D \rightarrow \mathbb{R}$ is continuous then f is bounded on D , and there exist $\alpha, \beta \in D$ such that $f(\alpha) = \max_{x \in D} f(x)$ and $f(\beta) = \min_{x \in D} f(x)$. [5 marks]

(ii) Argue by contradiction to demonstrate that if $f : [a, b] \rightarrow \mathbb{R}$ is continuous then it is uniformly continuous on $[a, b]$. [5 marks]

Please Turn over the page



أجب عن أسئلة الآتية :- (كل سؤال ١٠ درجات)

(١) (أ) أثبت قاعدة التضعيف لدالة جاما $\sqrt{\pi} \Gamma(2x) = 2^{2x-1} \Gamma(x) \Gamma\left(x + \frac{1}{2}\right), x > 0$

ثم استخدمها فى إثبات أن: $\Gamma\left(\frac{5}{6}\right) \left[\Gamma\left(\frac{1}{3}\right)\right]^2 = 2 \sqrt[3]{2} \sqrt{\frac{\pi^3}{3}}$

(ب) باستخدام دوال جاما و بيتا أوجد التكاملات الآتية: (i) $\int_0^{\frac{\pi}{2}} \sqrt{\tan \theta} d\theta$ (ii) $\int_0^{\infty} \frac{\sqrt{x}}{e^{x^3}} dx$

(٢) (أ) أثبت أن: $\Gamma(x) \Gamma(1-x) = \frac{\pi}{\sin \pi x}, 0 < x < 1$ ومن ثم أثبت أن

$\Gamma\left(x + \frac{1}{2}\right) \Gamma\left(\frac{1}{2} - x\right) = \frac{\pi}{\cos \pi x}$

(ب) أثبت أن:

(i) $\sqrt{1-x^2} T_n(x) = U_{n+1}(x) - x U_n(x),$

(ii) $(1-x^2) U'_n(x) = -n x U_n(x) + n U_{n-1}(x)$

(٣) أثبت أن:

(i) ${}_2F_1(\alpha, \beta; \gamma, x) = (1-x)^{-\beta} {}_2F_1\left(\gamma - \alpha, \beta; \gamma, \frac{x}{x-1}\right)$

(ii) ${}_1F_1\left(\frac{1}{2}; \frac{3}{2}, -x^2\right) = \frac{\sqrt{\pi}}{2x} \operatorname{erf}(x)$ حيث أن: $\operatorname{erf}(x) = \frac{2}{\sqrt{\pi}} \int_0^x e^{-t^2} dt$ هى دالة الخطأ

(iii) ${}_1F_1(\alpha + 1; \gamma, x) - {}_1F_1(\alpha; \gamma, x) - \frac{x}{\gamma} {}_1F_1(\alpha + 1; \gamma + 1, x) = 0$

(٤) (أ) أوجد مفكوك ليجندر للدالة: $f(x) = x^3$

(ب) أثبت أن: $H_n(x) = (-1)^n e^{x^2} \frac{d^n}{dx^n} (e^{-x^2})$ حيث $H_n(x)$ كثيرة حدود هيرميت.

(ج) أثبت أن: $J_{\frac{1}{2}}(x) = \sqrt{\frac{2}{\pi}} \frac{\sin x}{\sqrt{x}}$

(٥) (أ) باستخدام الصيغة التكاملية لدوال بسل أثبت أن: $\int_0^{\infty} e^{-3x} J_0(4x) dx = \frac{1}{5}$

(ب) أوجد الحل العام لمعادلة بسل التفاضلية:

$x^2 \frac{d^2 y}{dx^2} + x \frac{dy}{dx} + (x^2 - n^2)y = 0$

CS12	CS11	CS10	Description
0	0	0	No clock source (Timer/Counter stopped).
0	0	1	clk _{IO} /1 (No prescaling)
0	1	0	clk _{IO} /8 (From prescaler)
0	1	1	clk _{IO} /64 (From prescaler)
1	0	0	clk _{IO} /256 (From prescaler)
1	0	1	clk _{IO} /1024 (From prescaler)
1	1	0	External clock source on T1 pin. Clock on falling edge.
1	1	1	External clock source on T1 pin. Clock on rising edge.

Timer/Counter1 – TCNT1H and TCNT1L

Bit	7	6	5	4	3	2	1	0	
	TCNT1[15:8]								TCNT1H
	TCNT1[7:0]								TCNT1L
Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

Output Compare Register 1 B – OCR1BH and OCR1BL

Bit	7	6	5	4	3	2	1	0	
	OCR1B[15:8]								OCR1BH
	OCR1B[7:0]								OCR1BL
Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

Input Capture Register 1 – ICR1H and ICR1L

Bit	7	6	5	4	3	2	1	0	
	ICR1[15:8]								ICR1H
	ICR1[7:0]								ICR1L
Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

Timer/Counter Interrupt Mask Register – TIMSK⁽¹⁾

Bit	7	6	5	4	3	2	1	0	
	OCIE2	OCIE1	OCIE1A	OCIE1B	TOIE1	OCIE0	TOIE0		TIMSK
Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

- Bit 5 – OCIE1: Timer/Counter1, Input Capture Interrupt Enable
 Bit 4 – OCIE1A: Timer/Counter1, Output Compare A Match Interrupt Enable
 Bit 3 – OCIE1B: Timer/Counter1, Output Compare B Match Interrupt Enable
 Bit 2 – TOIE1: Timer/Counter1, Overflow Interrupt Enable

Timer/Counter Interrupt Flag Register – TIFR

Bit	7	6	5	4	3	2	1	0	
	OCF2	TOV2	ICF1	OCF1A	OCF1B	TOV1	OCF0	TOV0	TIFR
Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

- Bit 5 – ICF1: Timer/Counter1, Input Capture Flag
 Bit 4 – OCF1A: Timer/Counter1, Output Compare A Match Flag
 Bit 3 – OCF1B: Timer/Counter1, Output Compare B Match Flag
 Bit 2 – TOV1: Timer/Counter1, Overflow Flag

USART

Operating Mode	Equation for Calculating Baud Rate ⁽¹⁾	Equation for Calculating UBRR Value
Asynchronous Normal Mode (U2X = 0)	$BAUD = \frac{f_{osc}}{16(UBRR + 1)}$	$UBRR = \frac{f_{osc}}{16BAUD} - 1$
Asynchronous Double Speed Mode (U2X = 1)	$BAUD = \frac{f_{osc}}{8(UBRR + 1)}$	$UBRR = \frac{f_{osc}}{8BAUD} - 1$
Synchronous Master Mode	$BAUD = \frac{f_{osc}}{2(UBRR + 1)}$	$UBRR = \frac{f_{osc}}{2BAUD} - 1$

USART I/O Data Register – UDR

Bit	7	6	5	4	3	2	1	0	
	RXB[7:0]								UDR (Read)
	TXB[7:0]								UDR (Write)
Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

Timer/Counter
Interrupt Mask
Register – TIMSK

Bit	7	6	5	4	3	2	1	0	
	OCIE2	TOIE2	OCIE1	OCIE1A	OCIE1B	TOIE1	OCIE0	TOIE0	TIMSK
Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

Bit 1 – OCIE0: Timer/Counter0 Output Compare Match Interrupt Enable
Bit 0 – TOIE0: Timer/Counter0 Overflow Interrupt Enable

Timer/Counter
Interrupt Flag Register
– TIFR

Bit	7	6	5	4	3	2	1	0	
	OCF2	TOV2	ICF1	OCF1A	OCF1B	TOV1	OCF0	TOV0	TIFR
Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

Bit 1 – OCF0: Output Compare Flag 0
Bit 0 – TOV0: Timer/Counter0 Overflow Flag

Timer/Counter1
Control Register A –
TCCR1A

Bit	7	6	5	4	3	2	1	0	
	COM1A1	COM1A0	COM1B1	COM1B0	FOC1A	FOC1B	WGM11	WGM10	TCCR1A
Read/Write	R/W	R/W	R/W	R/W	W	W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

Bit 7:6 – COM1A1:0: Compare Output Mode for Compare unit A
Bit 5:4 – COM1B1:0: Compare Output Mode for Compare unit B
Bit 3 – FOC1A: Force Output Compare for Compare unit A
Bit 2 – FOC1B: Force Output Compare for Compare unit B
Bit 1:0 – WGM11:0: Waveform Generation Mode

CS02	CS01	CS00	Description
0	0	0	No clock source (Timer/Counter stopped).
0	0	1	$clk_{IO}/1$ (No prescaling)
0	1	0	$clk_{IO}/8$ (From prescaler)
0	1	1	$clk_{IO}/64$ (From prescaler)
1	0	0	$clk_{IO}/256$ (From prescaler)
1	0	1	$clk_{IO}/1024$ (From prescaler)
1	1	0	External clock source on T0 pin, Clock on falling edge.
1	1	1	External clock source on T0 pin, Clock on rising edge.

COM1A1/COM1B1	COM1A0/COM1B0	Description
0	0	Normal port operation, OC1A/OC1B disconnected.
0	1	Toggle OC1A/OC1B on compare match
1	0	Clear OC1A/OC1B on compare match (Set output to low level)
1	1	Set OC1A/OC1B on compare match (Set output to high level)

Mode	WGM13	WGM12 (CTC1)	WGM11 (PWM11)	WGM10 (PWM10)	Timer/Counter Mode of Operation	TOP	Update of OCR1x	TOV1 Flag Set on
0	0	0	0	0	Normal	0xFFFF	Immediate	MAX
1	0	0	0	1	PWM, Phase Correct, 8-bit	0x00FF	TOP	BOTTOM
2	0	0	1	0	PWM, Phase Correct, 9-bit	0x01FF	TOP	BOTTOM
3	0	0	1	1	PWM, Phase Correct, 10-bit	0x03FF	TOP	BOTTOM
4	0	1	0	0	CTC	OCR1A	Immediate	MAX
5	0	1	0	1	Fast PWM, 8-bit	0x00FF	BOTTOM	TOP
6	0	1	1	0	Fast PWM, 9-bit	0x01FF	BOTTOM	TOP
7	0	1	1	1	Fast PWM, 10-bit	0x03FF	BOTTOM	TOP
8	1	0	0	0	PWM, Phase and Frequency Correct	ICR1	BOTTOM	BOTTOM
9	1	0	0	1	PWM, Phase and Frequency Correct	OCR1A	BOTTOM	BOTTOM
10	1	0	1	0	PWM, Phase Correct	ICR1	TOP	BOTTOM
11	1	0	1	1	PWM, Phase Correct	OCR1A	TOP	BOTTOM
12	1	1	0	0	CTC	ICR1	Immediate	MAX
13	1	1	0	1	Reserved	–	–	–
14	1	1	1	0	Fast PWM	ICR1	BOTTOM	TOP
15	1	1	1	1	Fast PWM	OCR1A	BOTTOM	TOP

Timer/Counter1
Control Register B –
TCCR1B

Bit	7	6	5	4	3	2	1	0	
	ICNC1	ICES1	–	WGM13	WGM12	CS12	CS11	CS10	TCCR1B
Read/Write	R/W	R/W	R	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

Bit 7 – ICNC1: Input Capture Noise Canceler
Bit 6 – ICES1: Input Capture Edge Select
Bit 5 – Reserved Bit
Bit 4:3 – WGM13:2: Waveform Generation Mode
Bit 2:0 – CS12:0: Clock Select

CS12	CS11	CS10	Description
0	0	0	No clock source (Timer/Counter stopped).
0	0	1	$clk_{IO}/1$ (No prescaling)
0	1	0	$clk_{IO}/8$ (From prescaler)
0	1	1	$clk_{IO}/64$ (From prescaler)
1	0	0	$clk_{IO}/256$ (From prescaler)
1	0	1	$clk_{IO}/1024$ (From prescaler)
1	1	0	External clock source on T1 pin. Clock on falling edge.
1	1	1	External clock source on T1 pin. Clock on rising edge.

Timer/Counter1 – TCNT1H and TCNT1L

Bit	7	6	5	4	3	2	1	0	
	TCNT1[15:8]								TCNT1H
	TCNT1[7:0]								TCNT1L
Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

Output Compare Register 1 B – OCR1BH and OCR1BL

Bit	7	6	5	4	3	2	1	0	
	OCR1B[15:8]								OCR1BH
	OCR1B[7:0]								OCR1BL
Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

Input Capture Register 1 – ICR1H and ICR1L

Bit	7	6	5	4	3	2	1	0	
	ICR1[15:8]								ICR1H
	ICR1[7:0]								ICR1L
Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

Timer/Counter Interrupt Mask Register – TIMSK⁽¹⁾

Bit	7	6	5	4	3	2	1	0	
	OCIE2	TOIE2	TICIE1	OCIE1A	OCIE1B	TOIE1	OCIE0	TOIE0	TIMSK
Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

Bit 5 – TICIE1: Timer/Counter1, Input Capture Interrupt Enable

Bit 4 – OCIE1A: Timer/Counter1, Output Compare A Match Interrupt Enable

Bit 3 – OCIE1B: Timer/Counter1, Output Compare B Match Interrupt Enable

Bit 2 – TOIE1: Timer/Counter1, Overflow Interrupt Enable

Timer/Counter Interrupt Flag Register – TIFR

Bit	7	6	5	4	3	2	1	0	
	OCF2	TOV2	ICF1	OCF1A	OCF1B	TOV1	OCF0	TOV0	TIFR
Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

Bit 5 – ICF1: Timer/Counter1, Input Capture Flag

Bit 4 – OCF1A: Timer/Counter1, Output Compare A Match Flag

Bit 3 – OCF1B: Timer/Counter1, Output Compare B Match Flag

Bit 2 – TOV1: Timer/Counter1, Overflow Flag

USART

Operating Mode	Equation for Calculating Baud Rate ⁽¹⁾	Equation for Calculating UBRR Value
Asynchronous Normal Mode (U2X = 0)	$BAUD = \frac{f_{osc}}{16(UBRR + 1)}$	$UBRR = \frac{f_{osc}}{16BAUD} - 1$
Asynchronous Double Speed Mode (U2X = 1)	$BAUD = \frac{f_{osc}}{8(UBRR + 1)}$	$UBRR = \frac{f_{osc}}{8BAUD} - 1$
Synchronous Master Mode	$BAUD = \frac{f_{osc}}{2(UBRR + 1)}$	$UBRR = \frac{f_{osc}}{2BAUD} - 1$

USART I/O Data Register – UDR

Bit	7	6	5	4	3	2	1	0	
	RXB[7:0]								UDR (Read)
	TXB[7:0]								UDR (Write)
Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

USART Control and Status Register A – UCSRA

Bit	7	6	5	4	3	2	1	0	
	RXC	TXC	UDRE	FE	DOR	PE	U2X	MPCM	UCSRA
Read/Write	R	R/W	R	R	R	R	R/W	R/W	
Initial Value	0	0	1	0	0	0	0	0	

- Bit 7 – RXC: USART Receive Complete
- Bit 6 – TXC: USART Transmit Complete
- Bit 5 – UDRE: USART Data Register Empty
- Bit 4 – FE: Frame Error
- Bit 3 – DOR: Data OverRun
- Bit 2 – PE: Parity Error
- Bit 1 – U2X: Double the USART Transmission Speed
- Bit 0 – MPCM: Multi-processor Communication Mode

USART Control and Status Register B – UCSRB

Bit	7	6	5	4	3	2	1	0	
	RXCIE	TXCIE	UDRIE	RXEN	TXEN	UCSZ2	RXB8	TXB8	UCSRB
Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R	R/W	
Initial Value	0	0	0	0	0	0	0	0	

- Bit 7 – RXCIE: RX Complete Interrupt Enable
- Bit 6 – TXCIE: TX Complete Interrupt Enable
- Bit 5 – UDRIE: USART Data Register Empty Interrupt Enable
- Bit 4 – RXEN: Receiver Enable
- Bit 3 – TXEN: Transmitter Enable
- Bit 2 – UCSZ2: Character Size
- Bit 1 – RXB8: Receive Data Bit 8
- Bit 0 – TXB8: Transmit Data Bit 8

USART Control and Status Register C – UCSRC

Bit	7	6	5	4	3	2	1	0	
	URSEL	UMSEL	UPM1	UPM0	USBS	UCSZ1	UCSZ0	UCPOL	UCSRC
Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	
Initial Value	1	0	0	0	0	1	1	0	

- Bit 7 – URSEL: Register Select
- Bit 6 – UMSEL: USART Mode Select
- Bit 5:4 – UPM1:0: Parity Mode
- Bit 3 – USBS: Stop Bit Select
- Bit 2:1 – UCSZ1:0: Character Size
- Bit 0 – UCPOL: Clock Polarity

UMSEL	Mode
0	Asynchronous Operation
1	Synchronous Operation

USBS	Stop Bit(s)
0	1-bit
1	2-bit

UPM1	UPM0	Parity Mode
0	0	Disabled
0	1	Reserved
1	0	Enabled, Even Parity
1	1	Enabled, Odd Parity

UCPOL	Transmitted Data Changed (Output of Tx D Pin)	Received Data Sampled (Input on Rx D Pin)
0	Rising XCK Edge	Falling XCK Edge
1	Falling XCK Edge	Rising XCK Edge

Table 66. UCSZ Bits Settings

UCSZ2	UCSZ1	UCSZ0	Character Size
0	0	0	5-bit
0	0	1	6-bit
0	1	0	7-bit
0	1	1	8-bit
1	0	0	Reserved
1	0	1	Reserved
1	1	0	Reserved
1	1	1	9-bit

USART Baud Rate Registers – UBRRL and UBRRH

Bit	15	14	13	12	11	10	9	8	
	URSEL	-	-	-	-	UBRR[11:9]	-	-	UBRRH
	-	-	-	-	-	UBRR[7:0]	-	-	UBRRL
Read/Write	R/W	R	R	R	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	



Operation Research326 R

11-5-2018

Third Level: Computer Science Section

Time: 3 hours

Total Degree (50 marks)

Science Faculty

Mathematical Department

Answer the following Questions:

1-Use the Simplex method to solve the following linear programming

Maximize $Z = 10x_1 + 11x_2$

Subject to $x_1 + 2x_2 \leq 150$, $3x_1 + 4x_2 \leq 200$, $6x_1 + x_2 \leq 175$

and $x_1, x_2 \geq 0$

(10 marks)

2) Use the graphical and the algebraic method to solve the problem

Max $f(\underline{x}) = 5x_1 + 7x_2$ Subject to $5x_1 + 8x_2 \leq 24$, $x_1 + x_2 \leq 4$,

$10x_1 + 7x_2 \leq 35$ and $x_1, x_2 \geq 0$

(12.5marks)

3) Use the Lagrange multiplier method to find the extreme points of the problem

Minimize $f(\underline{x}) = x_1^2 + x_2^2 - 3x_1x_2$

Subject to $g(\underline{x}) = x_1^2 + x_2^2 - 8 = 0$.

(12.5marks)

4) Use the Hessian Matrix to find the local points of the problem

$f(\underline{x}) = f(x_1, x_2) = x_1^3 + x_2^3 + 2x_1^2 + 4x_2^2 + 6$

(10marks)

5) Find the local Points

$f(x) = 3x^4 - 20x^3 + 36x^2 + 16$ (5marks)

Best Wishes

Dr. Alaa Fahim

C Program # 3	Function
<pre> #include <avr/io.h> int main (void) { DDRB = 0xFF; while (1) { T0Delay (); PORTB = PORTB ^ 0x10; } } void T0Delay () { TCNT0 = 186; TCCR0 = 0x02; while ((TIFR & (1 << TOV0)) == 0); TCCR0 = 0; TIFR = 0x1; } </pre>	

C Program # 4	Function
<pre> #include <avr/io.h> #include <avr/interrupt.h> int main () { DDRC = 0x08; PORTD = 1 << 2; GICR = (1 << INT0); sei (); while (1) { ISR (INT0_vect) { PORTC = ~(1 << 3); } } } </pre>	

Question No. 6 (10 Marks).

It is required to design a sliding door controlled by Atmega32. The store also counts the number of people entered in its EEPROM (\$000) and display it on LCD (PORT A). When user press a push button (ETX INT2), it activate a DC motor to open the door in one direction and increment the number stored in EEPROM. When the door is fully opened, another switch is activated (EXT INT1) to stop the motor for 5 seconds (use TIMER0), then the motor rotate in the reverse direction to close. When the door is fully closed, it activate another switch (EXT INT0) to stop the motor. The motor works according to the below table:

	PORTC.0	PORTC.1
Stop	0	0
Opening the door	1	0
Closing the door	1	1

- a) Draw the general layout of the embedded system. (4 marks)

- b) Write an AVR C program to control the sliding door and, count the number of visitors and display it on LCD. (6 marks)

Best Wishes

----- End of Questions -----

Dr. Osama Haraz

(XCK/T0) PB0	1	40	PA0 (ADC0)
(T1) PB1	2	39	PA1 (ADC1)
(INT2/AIN0) PB2	3	38	PA2 (ADC2)
(OC0/AIN1) PB3	4	37	PA3 (ADC3)
(SS) PB4	5	36	PA4 (ADC4)
(MOSI) PB5	6	35	PA5 (ADC5)
(MISO) PB6	7	34	PA6 (ADC6)
(SCK) PB7	8	33	PA7 (ADC7)
RESET	9	32	AREF
VCC	10	31	GND
GND	11	30	AVCC
XTAL2	12	29	PC7 (TOSC2)
XTAL1	13	28	PC6 (TOSC1)
(RXD) PD0	14	27	PC5 (TDI)
(TXD) PD1	15	26	PC4 (TDO)
(INT0) PD2	16	25	PC3 (TMS)
(INT1) PD3	17	24	PC2 (TCK)
(OC1B) PD4	18	23	PC1 (SDA)
(OC1A) PD5	19	22	PC0 (SCL)
(ICP1) PD6	20	21	PD7 (OC2)

Status Register

Bit	7	6	5	4	3	2	1	0	
	I	T	H	S	V	N	Z	C	SREG
Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

Bit 7 – I: Global Interrupt Enable
 Bit 6 – T: Bit Copy Storage
 Bit 5 – H: Half Carry Flag
 Bit 4 – S: Sign Bit, $S = N \oplus V$

Bit 3 – V: Two's Complement Overflow Flag
 Bit 2 – N: Negative Flag
 Bit 1 – Z: Zero Flag

The EEPROM Address Register – EEARH and EEARL

Bit	15	14	13	12	11	10	9	8	
	–	–	–	–	–	–	EEAR9	EEAR8	EEARH
	EEAR7	EEAR6	EEAR5	EEAR4	EEAR3	EEAR2	EEAR1	EEAR0	EEARL
Read/Write	R	R	R	R	R	R	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	X	

The EEPROM Data Register – EEDR

Bit	7	6	5	4	3	2	1	0	
	MSB							LSB	EEDR
Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

The EEPROM Control Register – EECR

Bit	7	6	5	4	3	2	1	0	
	–	–	–	–	EERIE	EEMWE	EEWE	EERE	EECR
Read/Write	R	R	R	R	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	X	0	

Bit 3 – EERIE: EEPROM Ready Interrupt Enable
 Bit 2 – EEMWE: EEPROM Master Write Enable

Bit 1 – EEWE: EEPROM Write Enable
 Bit 0 – EERE: EEPROM Read Enable

Interrupts

MCU Control Register – MCUCR

The MCU Control Register contains control bits for interrupt sense control and general MCU functions.

Bit	7	6	5	4	3	2	1	0	
	SE	SM2	SM1	SM0	ISC11	ISC10	ISC01	ISC00	MCUCR
Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

Bit 3, 2 – ISC11, ISC10: Interrupt Sense Control 1 Bit 1 and Bit 0

Bit 1, 0 – ISC01, ISC00: Interrupt Sense Control 0 Bit 1 and Bit 0

ISC11	ISC10	Description
0	0	The low level of INT1 generates an interrupt request.
0	1	Any logical change on INT1 generates an interrupt request.
1	0	The falling edge of INT1 generates an interrupt request.
1	1	The rising edge of INT1 generates an interrupt request.

ISC01	ISC00	Description
0	0	The low level of INT0 generates an interrupt request.
0	1	Any logical change on INT0 generates an interrupt request.
1	0	The falling edge of INT0 generates an interrupt request.
1	1	The rising edge of INT0 generates an interrupt request.

MCU Control and Status Register – MCUCSR

Bit	7	6	5	4	3	2	1	0	
	JTD	ISC2	–	JTRF	WDRF	BORF	EXTRF	PORF	MCUCSR
Read/Write	R/W	R/W	R	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0						See Bit Description

Bit 6 – ISC2: Interrupt Sense Control 2

General Interrupt Control Register – GICR

Bit	7	6	5	4	3	2	1	0	
	INT1	INT0	INT2	–	–	–	IVSEL	IVCE	GICR
Read/Write	R/W	R/W	R/W	R	R	R	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

Bit 7 – INT1: External Interrupt Request 1 Enable
Bit 6 – INT0: External Interrupt Request 0 Enable

Bit 5 – INT2: External Interrupt Request 2 Enable

General Interrupt Flag Register – GIFR

Bit	7	6	5	4	3	2	1	0	
	INTF1	INTF0	INTF2	–	–	–	–	–	GIFR
Read/Write	R/W	R/W	R/W	R	R	R	R	R	
Initial Value	0	0	0	0	0	0	0	0	

Bit 7 – INTF1: External Interrupt Flag 1
Bit 6 – INTF0: External Interrupt Flag 0

Bit 5 – INTF2: External Interrupt Flag 2

Port A Data Register – PORTA

Bit	7	6	5	4	3	2	1	0	
	PORTA7	PORTA6	PORTA5	PORTA4	PORTA3	PORTA2	PORTA1	PORTA0	PORTA
Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

Port A Data Direction Register – DDRA

Bit	7	6	5	4	3	2	1	0	
	DDA7	DDA6	DDA5	DDA4	DDA3	DDA2	DDA1	DDA0	DDRA
Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

Port A Input Pins Address – PINA

Bit	7	6	5	4	3	2	1	0	
	PINA7	PINA6	PINA5	PINA4	PINA3	PINA2	PINA1	PINA0	PINA
Read/Write	R	R	R	R	R	R	R	R	
Initial Value	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	

Time/Counter Control Register – TCCR0

Bit	7	6	5	4	3	2	1	0	
	FOC0	WGM00	COM01	COM00	WGM01	CS02	CS01	CS00	TCCR0
Read/Write	W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

Bit 7 – FOC0: Force Output Compare

Bit 6, 3 – WGM01:0: Waveform Generation Mode

Bit 5:4 – COM01:0: Compare Match Output Mode
Bit 2:0 – CS02:0: Clock Select

Mode	WGM01 (CTC0)	WGM00 (PWM0)	Timer/Counter Mode of Operation	TOP	Update of OCR0	TOV0 Flag Set-on	COM01	COM00	Description
0	0	0	Normal	0xFF	Immediate	MAX	0	0	Normal port operation, OC0 disconnected.
1	0	1	PWM, Phase Correct	0xFF	TOP	BOTTOM	0	1	Toggle OC0 on compare match
2	1	0	CTC	OCR0	Immediate	MAX	1	0	Clear OC0 on compare match
3	1	1	Fast PWM	0xFF	BOTTOM	MAX	1	1	Set OC0 on compare match

Timer/Counter Register – TCNT0

Bit	7	6	5	4	3	2	1	0	
	TCNT0[7:0]								TCNT0
Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

Output Compare Register – OCR0

Bit	7	6	5	4	3	2	1	0	
	OCR0[7:0]								OCR0
Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

Timer/Counter
Interrupt Mask
Register – TIMSK

Bit	7	6	5	4	3	2	1	0	
	OCIE2	TOIE2	OCIE1	OCIE1A	OCIE1B	TOIE1	OCIE0	TOIE0	TIMSK
Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

Bit 1 – OCIE0: Timer/Counter0 Output Compare Match Interrupt Enable
Bit 0 – TOIE0: Timer/Counter0 Overflow Interrupt Enable

Timer/Counter
Interrupt Flag Register
– TIFR

Bit	7	6	5	4	3	2	1	0	
	OCF2	TOV2	ICF1	OCF1A	OCF1B	TOV1	OCF0	TOV0	TIFR
Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

Bit 1 – OCF0: Output Compare Flag 0
Bit 0 – TOV0: Timer/Counter0 Overflow Flag

Timer/Counter1
Control Register A –
TCCR1A

Bit	7	6	5	4	3	2	1	0	
	COM1A1	COM1A0	COM1B1	COM1B0	FOC1A	FOC1B	WGM11	WGM10	TCCR1A
Read/Write	R/W	R/W	R/W	R/W	W	W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

Bit 7:6 – COM1A1:0: Compare Output Mode for Compare unit A
Bit 5:4 – COM1B1:0: Compare Output Mode for Compare unit B
Bit 3 – FOC1A: Force Output Compare for Compare unit A
Bit 2 – FOC1B: Force Output Compare for Compare unit B
Bit 1:0 – WGM11:0: Waveform Generation Mode

CS02	CS01	CS00	Description
0	0	0	No clock source (Timer/Counter stopped).
0	0	1	clk_{RCY} (No prescaling)
0	1	0	$clk_{RCY}/8$ (From prescaler)
0	1	1	$clk_{RCY}/64$ (From prescaler)
1	0	0	$clk_{RCY}/256$ (From prescaler)
1	0	1	$clk_{RCY}/1024$ (From prescaler)
1	1	0	External clock source on T0 pin. Clock on falling edge.
1	1	1	External clock source on T0 pin. Clock on rising edge.

COM1A1/COM1B1	COM1A0/COM1B0	Description
0	0	Normal port operation, OC1A/OC1B disconnected.
0	1	Toggle OC1A/OC1B on compare match
1	0	Clear OC1A/OC1B on compare match (Set output to low level)
1	1	Set OC1A/OC1B on compare match (Set output to high level)

Mode	WGM13	WGM12 (CTC1)	WGM11 (PWM11)	WGM10 (PWM10)	Timer/Counter Mode of Operation	TOP	Update of OCR1x	TOV1 Flag Set on
0	0	0	0	0	Normal	0xFFFF	Immediate	MAX
1	0	0	0	1	PWM, Phase Correct, 8-bit	0x00FF	TOP	BOTTOM
2	0	0	1	0	PWM, Phase Correct, 9-bit	0x01FF	TOP	BOTTOM
3	0	0	1	1	PWM, Phase Correct, 10-bit	0x03FF	TOP	BOTTOM
4	0	1	0	0	CTC	OCR1A	Immediate	MAX
5	0	1	0	1	Fast PWM, 8-bit	0x00FF	BOTTOM	TOP
6	0	1	1	0	Fast PWM, 9-bit	0x01FF	BOTTOM	TOP
7	0	1	1	1	Fast PWM, 10-bit	0x03FF	BOTTOM	TOP
8	1	0	0	0	PWM, Phase and Frequency Correct	ICR1	BOTTOM	BOTTOM
9	1	0	0	1	PWM, Phase and Frequency Correct	OCR1A	BOTTOM	BOTTOM
10	1	0	1	0	PWM, Phase Correct	ICR1	TOP	BOTTOM
11	1	0	1	1	PWM, Phase Correct	OCR1A	TOP	BOTTOM
12	1	1	0	0	CTC	ICR1	Immediate	MAX
13	1	1	0	1	Reserved	–	–	–
14	1	1	1	0	Fast PWM	ICR1	BOTTOM	TOP
15	1	1	1	1	Fast PWM	OCR1A	BOTTOM	TOP

Timer/Counter1
Control Register B –
TCCR1B

Bit	7	6	5	4	3	2	1	0	
	ICNC1	ICES1	–	WGM13	WGM12	CS12	CS11	CS10	TCCR1B
Read/Write	R/W	R/W	R	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

Bit 7 – ICNC1: Input Capture Noise Canceler
Bit 6 – ICES1: Input Capture Edge Select
Bit 5 – Reserved Bit
Bit 4:3 – WGM13:2: Waveform Generation Mode
Bit 2:0 – CS12:0: Clock Select



Operation Research326 R

11-5-2018

Third Level: Computer Science Section

Time: 3 hours

Total Degree (50 marks)

Science Faculty

Mathematical Department

Answer the following Questions:

1-Use the Simplex method to solve the following linear programming

Maximize $Z = 10x_1 + 11x_2$

Subject to $x_1 + 2x_2 \leq 150$, $3x_1 + 4x_2 \leq 200$, $6x_1 + x_2 \leq 175$

and $x_1, x_2 \geq 0$

(10 marks)

2) Use the graphical and the algebraic method to solve the problem

Max $f(\underline{x}) = 5x_1 + 7x_2$ Subject to $5x_1 + 8x_2 \leq 24$, $x_1 + x_2 \leq 4$,

$10x_1 + 7x_2 \leq 35$ and $x_1, x_2 \geq 0$

(12.5marks)

3) Use the Lagrange multiplier method to find the extreme points of the problem

Minimize $f(\underline{x}) = x_1^2 + x_2^2 - 3x_1x_2$

Subject to $g(\underline{x}) = x_1^2 + x_2^2 - 8 = 0$.

(12.5marks)

4) Use the Hessian Matrix to find the local points of the problem

$f(\underline{x}) = f(x_1, x_2) = x_1^3 + x_2^3 + 2x_1^2 + 4x_2^2 + 6$

(10marks)

5) Find the local Points

$f(x) = 3x^4 - 20x^3 + 36x^2 + 16$ (5marks)

Best Wishes

Dr. Alaa Fahim

اجب عن خمسة فقط من الاسئلة الاتية :- (10 درجات لكل سؤال : بواقع 5 درجات لكل فقرة)

(1) (i) اوجد الحل العام للمعادلة : $p_1 + 3p_2 + 2p_3(1 + \sqrt{x_1 + x_2 + x_3 - u}) = 6$
(ii) اوجد الحل الخاص للمعادلة : $(y - z)[2xyp + (x^2 - y^2)q] + z(x^2 - y^2) = 0$
الذي يمر خلال المنحنى $y = 0, x^3 = z^2$

(2) اوجد الحل العام لكل من المعادلتين التفاضليتين الجزئيتين الاتيتين :-
(i) $(D_1^3 - D_1^2 D_2 - D_1 D_2^2 + D_2^3)z = \log(x + y)$
(ii) $(D_1^2 - a^2 D_2^2)z = x^2 + y^2$, ثابت مطلق a

(3) اوجد الحل العام لكل من المعادلتين التفاضليتين الجزئيتين الاتيتين :-
(i) $(D_1^2 D_2 + D_2^2 - 2)z = e^{2y} \sin 3x - e^x \cos 2y$
(ii) $(D_1^2 - D_2^2 - D_1 - 3D_2 - 2)z = e^{2x-3y} + x + y + 1$

(4) (i) احسب التكاملات الاتية :-
(a) $\int_0^{\infty} x^{-\frac{1}{3}}(1 + 2x)^{-3} dx$ (b) $\int_0^1 \sqrt{\log \frac{1}{x}} dx$

(ii) اثبت ان :-
(a) $\tan^{-1} x = x {}_2F_1(1, \frac{1}{2}; \frac{3}{2}; -x^2)$
(b) $(a - b) {}_2F_1(a, b; c; x) = a {}_2F_1(a + 1, b; c; x) - b {}_2F_1(a, b + 1; c; x)$

(5) اثبت ان دوال بسل من النوع الاول $J_n(x)$ تحقق الاتي :-
(i) $J_{-\frac{1}{2}}(x) = \sqrt{\frac{2}{\pi x}} \cos x$, (ii) $\int x^n J_{n-1}(x) dx = x^n J_n(x) + c$

(6) (i) اثبت ان كثيرات حدود لجندر $P_n(x)$ تحقق :-
(ii) احسب التكاملات الاتية :-
(a) $\int_{-1}^1 x P_n(x) P_{n+1}(x) dx$, (b) $\int_{-1}^1 x^2 P_n(x) P_{n+1}(x) dx$, (c) $\int_{-1}^1 x^2 P_n(x) dx$



Question 1: Put True or False for each of the following items (30 marks)

1. To enter a formula into a cell, begin by typing an equal sign.
2. Functions are pre-defined worksheet formulas.
3. Formulas in Excel must be written in a very specific format, referred to as syntax.
4. The second order of precedence is for exponentiation.
5. When the formula in cell **B7 =B4+B5+B6** is copied into cell **C7** the formula will be changed to **= C4+C5+C6**.
6. The error "#####" means Data being referenced is not available.
7. The range **B2:B7** is a range down a column.
8. To keep things clear and simple only add an absolute (\$) cell reference if absolutely necessary.
9. The formula **=ROUND(78.686788,-1)** results in the value 80 .
10. Placing an absolute sign in front of a ranged name (**\$budget**) is incorrect syntax.
11. The columns of the worksheet are named with Numbers.
12. Cells may contain only Labels and Values.
13. The cell address first lists the row name and then the column name.
14. This selected cell is referred to as the **active cell**.
15. The contents of the active cell will also be displayed on the **formula bar**.
16. A cell that is on sheet 3, in the second column third row would be referred to as **Sheet3@B3**.
17. Formatted Display is the number of decimal places that appear in a cell.
18. Formulas can be copied to perform different operations on a corresponding set of data.
19. The function **COUNT(value1,[value2],...)** counts non-blank cells.
20. The Average function ignore the blank cells.
21. TRUE and FALSE are called Boolean Values.
22. SPSS stands for Statistical Package for the Social Sciences.
23. SPSS is capable of handling large amounts of data.
24. SPSS has only two windows Data view and Output view.
25. **Transform** menu includes several options to change current variables.
26. In SPSS, Each column typically represents the data from 1 case.
27. In SPSS, The first column of variable view is Name.
28. In SPSS, you can sort data from **Transform** menu then **Sort Cases**.
29. Descriptive statistics are calculated using the **Analyze** menu.
30. Correlation is used to test the degree of association between variables.

Answer Sheet		
	True	False
1		
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Question 2: (10 marks)

	A	B	C	D	E	F	G
1		MT1	MT2	Final	Total	Honors	Passed
2	Possible points	100	100	200	400		320
3							
4	Blue	79	89	169	337	FALSE	TRUE
5	Jones	85	65	195	345	FALSE	TRUE
6	Grey	60	97	187	344	TRUE	TRUE
7	Mary	10	30	50	90	TRUE	FALSE
8							

Write the following Boolean functions

1. Blue's total and Jones' total are greater than Grey's:
2. Grey's total is not the maximum grade:
3. None of the students passed the course
4. Blue is not an Honors student
5. Blue didn't get a passing grade (320)

Question 3: (10 marks)

1. What are the difference between Data View, Variable View and Output View in SPSS?
2. Some significance tests are very restrictive about the form of data they can accept. What are the different types of measurement?
3. Describe how to test the degree of association between variables by SPSS.
4. Explain how to use SPSS to calculate the frequency and percent of females and males who did and did not have social problems.

Q2.

- a. Maintain two different Algorithm of crossover process with mention the probability of crossover (5 marks)
- b. Maintain two different Algorithm of mutation process with mention the probability of mutation. (5 marks)

Q3. a. Maintain tree type representation of solutions in genetic algorithm. (3 marks)

b. Using genetic algorithm to find the maximum value of the function $(15x - x^2)$ where parameter x varies between 0 and 15. For simplicity, we may assume that x takes only integer values. Using the genetic algorithm procedure in one step and begin with four solutions in initial solutions. (10 marks)

Q4. Discuss the internal structure of Taxi driver Robot. (7 marks)

Q5. Discuss the Tabu search method and maintain the type of memory using in this method and maintain the Tabu search algorithm. (10 marks)

==best wishes==

Dr. Alaa F. Mohamed



2017-2018
18-5-2018

Final Exam for Level 3
Subject: Artificial Intelligent
MC352
Time: 2 Hours

Mathematics Dept.
Faculty of Science
Assiut University

Q1. Choose the correct answer. (10 marks)

1.is the right action is the one that will cause the agent to be most successful
a) rationality b) Omniscience c) Perfection
2. Motors, files and body parts are considered as
a) effector b) sensor c) agents
3. Speaker, monitor and body part are considered as.....
a) effector b) sensor c) agents
4. The environment of part parking rebort is.....
a) Dynamics b) statistic c) semi
5. The environment of cross puzzle is considered as
a) squential b) eposidic c) mixed
6. The environment of backgammon game is considered as.....
a) Stochastic b) deterministic c) mixed
7. The accessibility of cross-word puzzle
a) partially b) fully c) statistic
8. Simulated annealing is considered as
a) informed search b) blind search c) agents
9. The is a metaheuristic begin with some of solution and make some operators
a) A* search b) Tabu search c) genetic algorithm
10. Theis a metaheuristic using memory that guides a local search procedure to explore the solution space.
a) A* search b) Tabu search c) genetic algorithm

Answer the following questions: (50 Marks)

Question 1: Answer the following points (10 Marks)

- 1- Explain the internet "nuts and bolts"?
- 2- Explain the sources of packet delay?
- 3- What are protocols?
- 4- Explain Access network: digital subscriber line (DSL)?

Question 2: Answer the following points (10 Marks)

- 1- What is the network core?
- 2- Explain Packet Switching: queueing delay, loss?
- 3- Define throughput?
- 4- Define and explain traffic intensity?

Question 3: Answer the following points (10 Marks)

- 1- Explain the Internet protocol stack?
- 2- Mention some network applications?
- 3- Explain the application client-server architecture?
- 4- Explain P2P architecture?

Question 4: Answer the following points (10 Marks)

- 1- HTTP is "stateless". What does that mean?
- 2- Compare between persistent HTTP and non-persistent HTTP?
- 3- Give examples of HTTP response status codes?
- 4- Explain the term (web caches) and how it is useful?

Question 5: Answer the following points (10 Marks)

- 1- Give a DNS name resolution example?
- 2- Compare between multiplexing and demultiplexing? Support your answer with a diagram?
- 3- Define and explain the use of ACKs and NAKs?
- 4- Define and explain HOL? Support your answer with a diagram?

جامعة أسيوط	مايو 2018	كود المقرر: 356 رك
كلية العلوم		المقرر : مقدمة فى الحسابات العلمية
قسم الرياضيات		الزمن : ساعتان

Answer the following questions by using MATLAB language: (50 marks)

1- Using Newton's forward difference formula, find $y(0.1)$ using the table below:

x	0.0	0.2	0.4	0.6	0.8
y	1.000	1.22140	1.49182	1.82212	2.22554

2- Solve the differential equation by Adams method (without using nested for loops) at $x=0.2$:

$$\frac{dy}{dt} = t^2 - y, \quad y(0) = 1, \quad h = 0.05.$$

and compare it with the analytic solution $y = -e^{-t} + t^2 - 2t + 2$.

3- Solve the following initial value problem:

$$\frac{d^2u}{dt^2} + 4\frac{du}{dt} + 3u = 0, \quad u(0) = 1, \quad \frac{du}{dt}(0) = 0.$$

4- Let $f(x) = \cos 2x$ and $x_0 = 0$. Determine

- The third Taylor polynomial for f about x_0 .
- Find error bound at $x = 0.2$ and compare it to the actual error.

5- For the well-known Chua's circuit equation in chaotic studies that

$$\dot{x} = \alpha[y - x - f(x)], \quad \dot{y} = x - y + z, \quad \dot{z} = -\beta y - \gamma z, \quad t \in (0, 10),$$

where the nonlinear function $f(x)$ is described by

$$f(x) = bx + 0.5(a-b)(|x+1| - |x-1|) \text{ and } a < b < 0.$$

Write an M-function to describe the equation, and draw the phase trajectory for the parameters $\alpha = 9$, $\beta = 100/7$, $\gamma = 0$, $a = -8/7$, $b = -5/7$, and initial conditions

$$x(0) = -2.121304, \quad y(0) = -0.066170, \quad z(0) = 2.881090.$$

Good Luck

Dr. Tarek Aboelenen



امتحان الفرقة الثالثة شعبة الرياضيات

الزمن : ثلاث ساعات

رقم المقرر ورمزه : ١٣٤٦

المقرر : عمليات عشوائية وتطبيقاتها

أجب عن خمسة أسئلة فقط مما يأتي :- درجة جزء كل سؤال (خمس درجات)

١- (أ) لمجموعة المتغيرات العشوائية المستقلة $X_1, X_2, X_3, \dots$ بفرض أن التوقع الرياضي $E(X_i) = m$ والتباين $V(X_i)$ لكل منها محدود عرف كل من التقارب عن طريق الإحتمال وقانون الأعداد الكبرى (الضعيف).
(ب) بفرض أن $f f s s f s f f s s s f f s f f s$ هي إحدى النتائج الممكنة في محاولات برنولي العشوائية المستقلة بحيث أن $P(s) = p, P(f) = q, p + q = 1$ عرف عملية عشوائية في الفراغ R^2 موضحا ذلك بيانيا .

٢- (أ) في عملية برنولي العشوائية $\{X_n; n > 0\}$ بالإحتمال $p = 0.6$ إذا كان $X = X_1 + X_2$ ، $Y = X_1 + X_3$ احسب الإحتمالات الآتية : $P(X < 2, Y \leq 1)$ ، $P(2X < 3Y)$ ، $P(Y = X)$.
(ب) في السؤال (٢-أ) أوجد العزم الارتباطي بين X ، Y موضحا العلاقة بينهما .

٣- (أ) وضح العلاقة بين عملية برنولي العشوائية $\{X_n; n > 0\}$ و العملية العشوائية $\{Y_n; n \geq 0\}$ حيث أن المتغير Y_n يخضع لتوزيع ذي الحدين واذكر صفات كل منهما ثم عبر مع الاستنتاج عن إحتمال الحادث $(Y_{n+1} = k)$ من خلال إحتمالات الحوادث : $(Y_n = k)$ ، $(Y_n = k - 1)$ لأي عدد صحيح $k > 0$.
(ب) في العملية العشوائية $\{Y_n; n \geq 0\}$ أوجد كل من $E(Y_5)$ ، $E(Y_4^2)$ ، $P(Y_5 = 3, Y_7 = 4, Y_{14} = 9)$.

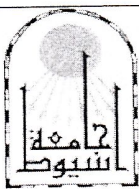
٤- (أ) عرف أزمنة النجاح T_k كعملية عشوائية موضحا العلاقة بينها وبين العملية العشوائية $\{Y_n; n \geq 0\}$ ثم اذكر فقط توزيع المتغير العشوائي T_k .
(ب) - في عملية بواسون العشوائية $\{N_t; t \geq 0\}$ بالمعدل $\lambda = 4$ احسب كل من الإحتمالات الآتية :
 $P(N_{1.5} = 2, N_4 = 5, N_{6.8} = 9)$ ، $P(N_3 = 5, N_7 = 9)$

٥- (أ) في عملية بواسون أو عملية الوصول المعودة $\{N_t; t \geq 0\}$ بالمعدل λ إثبت أن الإحتمال المشروط لعدد الوصول N_t بالنسبة إلى عدد الوصول N_{t+s} لكل $t > 0, s > 0$ يمثل توزيع ذي الحدين .
(ب) عرف العمليات العشوائية المستقلة ثم اثبت أن أي عمليتين مستقلتين لبواسون هو أيضا عملية بواسون .

٦- (أ) في عملية التجديد العشوائية $R = \{R_n; n \in N\}$ حيث N هي فئة الأعداد الصحيحة غير السالبة عرف دالة التجديد ثم عبر عنها من خلال توزيع المتغير R_n مع الاستنتاج .

(ب) في سلسلة ماركوف العشوائية المتقطعة $\{X_n; n \geq 0\}$ عرف مصفوفة الإحتمالات الإنتقالية بصفاتها المعروفة ثم احسب الإحتمال : $P(X_0 = 1, X_1 = 1, X_2 = 0, X_3 = 1, X_4 = 0, X_6 = 0)$ بفرض أن حالات الفراغ $(0, 1)$ والمصفوفة العشوائية

$$P = \begin{pmatrix} 1/2 & 1/2 \\ 1/3 & 2/3 \end{pmatrix} , \text{ ومنتجه الإحتمالات الابتدائية } \pi_0 = (2/5 \quad 3/5)$$

	المقرر: تحليل عددي (٣٢٣) الفرقة: المستوى الثالث الدرجة: ٥٠ درجة التاريخ: ٢٠١٨/٥/٢٩ الزمن: ثلاث ساعات	جامعة أسيوط كلية العلوم - قسم الرياضيات امتحان نهائي الفصل الدراسي الثاني للعام الجامعي ٢٠١٧/٢٠١٨
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Answer five questions only :- (10 marks for every question)

1-a) If the function $g \in C[a, b]$ and $g(x) \in [a, b] \forall x \in [a, b]$ and $g'(x)$ exist with $|g'(x)| \leq k < 1 \forall x \in [a, b]$ prove that the sequence defined by $P_n = g(P_{n-1}), n \geq 1$ will converge to the unique fixed point P and also $|P_{n+1} - P_n| \leq k^n |P_1 - P_0|$.

1-b) Verify that when Newton's method is used to compute $\sqrt{A}, A > 0$ (By solving the equation : $f(x) = x^2 - A$). The sequence of iterates is defined by : $x_{n+1} = (x_n + \frac{A}{x_n})/2$, and show that if the sequence $\{x_n\}$ is defined as the previous problem, then this method is quadratically convergence.

2-a) Derive Lagrange interpolation formula of degree n and write the error of the method.

2-b) For the given function $f(x) = \cos \pi x$ let $x_0 = -1, x_1 = 0, x_2 = 1$ construct the suitable interpolation polynomial and find the actual error.

3) Derive the formula of the Newton's interpolatory divided difference method and use this formula to obtain a polynomial of least degree that fits the values shown:

x	0	1	2	4	6
$f(x)$	1	9	23	93	259

من فضلك انظر خلف الورقة

السؤال الرابع :-

أ) يعرف الطي للدالتين $f(x)$, $g(x)$ كالآتي

$$f * g = \int_{-\infty}^{\infty} f(u) g(x-u) du$$

برهن علي أن تحويل فوريير للطرف الأيمن هو حاصل ضرب تحويلي فوريير للدالتين $f(x)$, $g(x)$

ب) أوجد تحويل فوريير للدالة $f(x) = \begin{cases} 1 & |x| < a \\ 0 & |x| > a \end{cases}$ وأرسم $f(x)$ كذلك تحويلها عند $a = 3$ وأوجد

$$\int_{-\infty}^{\infty} \frac{\sin u}{u} du \quad \text{كذلك} \quad \int_{-\infty}^{\infty} \frac{\sin \alpha a \cos \alpha x}{\alpha} d\alpha$$

ج) ترك خيط لانهائي من السكون وكانت أزاحته الابتدائية عن محور x هي $f(x)$ أوجد الإزاحه عند أي زمن .

انتهت الأسئلة مع تمنياتنا بالتوفيق ،،،،

لجنة الممتحنين :- أ.د/ نجاه عبد الرحمن حسين ، أ.د/ فاروق علي السيد



الامتحان النهائي للفصل الدراسي الثاني للعام الجامعي ٢٠١٧/٢٠١٨ م
 للفرقة : الثالثة
 الشعبة : الرياضيات
 التاريخ : ٢٠١٨/٥/٢٤ م

الزمن : ساعتان

الدرجة الكلية : ٥٠ درجة

درجة كل سؤال : ١٧ درجة

أسم المقرر : الطرق الرياضية
 رقم المقرر ورمزه : ٣٣٤ ر

أجب عن ثلاثة أسئلة فقط مما يأتي :-

السؤال الأول :-

أوجد تحويل لابلاس للمشتقة التفاضلية للدالة $F(t)$ عند نقط الاتصال والانفصال للدالة .

أبرهن علي أن

$$\lim_{t \rightarrow 0} F(t) = \lim_{s \rightarrow \infty} s f(s)$$

$$\lim_{t \rightarrow \infty} F(t) = \lim_{s \rightarrow 0} s f(s)$$

$$\Gamma\left(\frac{1}{2}\right) = \sqrt{\pi}, \quad \int_0^{\infty} \delta(t) dt = 1, \quad L \sin \sqrt{t} = \frac{\sqrt{\pi}}{3} e^{-\frac{1}{4s}} s^{\frac{3}{2}}$$

السؤال الثاني :-

حل المعادلات الآتية :

$$t Y''(t) + Y'(t) + 4t Y(t) = 0, \quad y(0) = 3, y'(0) = 0$$

$$\frac{\partial U}{\partial x} = 2 \frac{\partial U}{\partial t} + U, \quad x > 0, t > 0 \quad U(x, 0) = 6 e^{-3x}$$

$$\int_0^t Y(u) Y(t-u) du = 16 \sin 4t$$

السؤال الثالث :-

(أ) فك الدالة $f(x) = x^2$, $0 < x < 2\pi$ بدلالة متسلسلة فوريير ثم أحسب المجموع

$$1 + \frac{1}{2^2} + \frac{1}{3^2} + \frac{1}{4^2} + \dots$$

(ب) صفيحة علي شكل دائري نصف قطرها الوحدة ووجهيها معزولين ونصف محيطها محفوظ عند درجة حرارة u_1

والآخر عند u_2 أوجد حالة الأتزان الحراري .

من فضلك أنظر بقية الأسئلة خلف الورقة ،،،،،



Answer the following questions (50 marks)

Q1.	Complete the following: (1)..... is a representation of a two-dimensional image as a finite set of digital values, called picture elements or pixels - Common image formats include.....(2).... ,(3)..... ,(4)..... (5)..... creates a Distance tool a draggable, resizable line that measures the distance between its endpoints. (6)..... These are the result of objects that are self-luminous, such as stars and light bulbs. (7).....the resulting output pixel is computed as a sum of products of the pixel values and mask coefficients in the pixel's neighborhood in the original image. - The Sobel operators used to compute edges are(8)..... ,(9)..... - Edge detector should have:(10)..... ,(11)..... - Types of noise are(12)..... ,(13)....	(13 marks)
Q2.	a) Compute Z from the following matlab script (6 marks) <pre> x = [150 10 90;80 50 60;121 160 20] y = [-1 0 1;-2 0 2;-1 0 1] z = imfilter(x,y,'corr') </pre> b) What is the Delta compression and compute the compressed data of the data (6 marks) 220 321 335 211 250 200 233 214 232 212	(12 marks)
Q3.	a) Write the MATLAB code used to: (4 marks) - Read any image then use affine transformation matrix for each of the operations below: - Flip the image right to left - Translation by [25, 15] pixels b) What are the main differences between: (8 marks) - Global thresholding and optimal thresholding. - Raster and vector image . - Interpixel redundancy and Psychovisual redundancy	(12 marks)

(Q5) (i) Assume that U, V are open intervals and let $f : U \rightarrow \mathbb{R}$ and $g : V \rightarrow \mathbb{R}$ be two differentiable functions such that $f(U) \subset V$. Prove that $g \circ f$ is differentiable on U and that $(g \circ f)' = (g' \circ f) \cdot f'$ [5 marks]

(ii) Prove that the function $f(x) := \frac{1}{x}$ is differentiable on $]0, \infty[$ but not uniformly continuous therein. [5 marks]

(Q6) (i) State and prove Rolle's theorem then use it to prove the mean value theorem. [6 marks]

(ii) Let I be an open interval. Apply the mean value theorem to prove that a function differentiable on I is

1. increasing if and only if $f' \geq 0$ on I ,

2. decreasing if and only if $f' \leq 0$ on I .

[4 marks]

With the best of luck,

Prof. Rashwan A. Rashwan,

Dr. Ahmed A. Abdelhakim



Time: 3 hours

Total mark: 50

Answer *only five* of the following questions:

(Q1) (i) Suppose that O_i , $i \geq 1$, are open subsets of $\mathbb{R}$. Prove that $\cup_{i \geq 1} O_i$ is also open in $\mathbb{R}$. [5 marks]

(ii) Let $S \subset \mathbb{R}$. Show that S is closed if and only if S contains the limit point of every convergent sequence of elements of S . [5 marks]

(Q2) (i) Prove that a sequence of real numbers converges if and only if it is a Cauchy sequence. [6 marks]

(ii) Show that if $(x_n)_{n \geq 1} \subset \mathbb{R}$ is a monotonically increasing sequence that is bounded above, then $x_n \rightarrow \sup_{n \geq 1} x_n$, as $n \rightarrow \infty$. [4 marks]

(Q3) (i) Show that $f : D \subset \mathbb{R} \rightarrow \mathbb{R}$ is continuous at $x_0 \in D$ if and only if the sequence $(f(x_n))_{n \geq 1}$ converges to $f(x_0)$ whenever $(x_n)_{n \geq 1}$ is a sequence in D that converges to x_0 . [6 marks]

(ii) Use the characterization given in (i) to prove the discontinuity at the origin of the function $f(x) = \begin{cases} \cos \frac{1}{x}, & x \neq 0; \\ 0, & x = 0. \end{cases}$ [4 marks]

(Q4) (i) Assume that D is a closed bounded subset of $\mathbb{R}$. Prove that if $f : D \rightarrow \mathbb{R}$ is continuous then f is bounded on D , and there exist $\alpha, \beta \in D$ such that $f(\alpha) = \max_{x \in D} f(x)$ and $f(\beta) = \min_{x \in D} f(x)$. [5 marks]

(ii) Argue by contradiction to demonstrate that if $f : [a, b] \rightarrow \mathbb{R}$ is continuous then it is uniformly continuous on $[a, b]$. [5 marks]

Please Turn over the page



أجب عن أسئلة الآتية :- (كل سؤال ١٠ درجات)

(١) (أ) أثبت قاعدة التضعيف لدالة جاما $\sqrt{\pi} \Gamma(2x) = 2^{2x-1} \Gamma(x) \Gamma\left(x + \frac{1}{2}\right), x > 0$

ثم استخدمها فى إثبات أن: $\Gamma\left(\frac{5}{6}\right) \left[\Gamma\left(\frac{1}{3}\right)\right]^2 = 2 \sqrt[3]{2} \sqrt{\frac{\pi^3}{3}}$

(ب) باستخدام دوال جاما و بيتا أوجد التكاملات الآتية: (i) $\int_0^{\frac{\pi}{2}} \sqrt{\tan \theta} d\theta$ (ii) $\int_0^{\infty} \frac{\sqrt{x}}{e^{x^3}} dx$

(٢) (أ) أثبت أن: $\Gamma(x) \Gamma(1-x) = \frac{\pi}{\sin \pi x}, 0 < x < 1$ ومن ثم أثبت أن

$\Gamma\left(x + \frac{1}{2}\right) \Gamma\left(\frac{1}{2} - x\right) = \frac{\pi}{\cos \pi x}$

(ب) أثبت أن:

(i) $\sqrt{1-x^2} T_n(x) = U_{n+1}(x) - x U_n(x),$

(ii) $(1-x^2) U'_n(x) = -n x U_n(x) + n U_{n-1}(x)$

(٣) أثبت أن:

(i) ${}_2F_1(\alpha, \beta; \gamma, x) = (1-x)^{-\beta} {}_2F_1\left(\gamma - \alpha, \beta; \gamma, \frac{x}{x-1}\right)$

(ii) ${}_1F_1\left(\frac{1}{2}; \frac{3}{2}, -x^2\right) = \frac{\sqrt{\pi}}{2x} \operatorname{erf}(x)$ حيث أن: $\operatorname{erf}(x) = \frac{2}{\sqrt{\pi}} \int_0^x e^{-t^2} dt$ هى دالة الخطأ

(iii) ${}_1F_1(\alpha + 1; \gamma, x) - {}_1F_1(\alpha; \gamma, x) - \frac{x}{\gamma} {}_1F_1(\alpha + 1; \gamma + 1, x) = 0$

(٤) (أ) أوجد مفكوك ليجندر للدالة: $f(x) = x^3$

(ب) أثبت أن: $H_n(x) = (-1)^n e^{x^2} \frac{d^n}{dx^n} (e^{-x^2})$ حيث $H_n(x)$ كثيرة حدود هيرميت.

(ج) أثبت أن: $J_{\frac{1}{2}}(x) = \sqrt{\frac{2}{\pi}} \frac{\sin x}{\sqrt{x}}$

(٥) (أ) باستخدام الصيغة التكاملية لدوال بسل أثبت أن: $\int_0^{\infty} e^{-3x} J_0(4x) dx = \frac{1}{5}$

(ب) أوجد الحل العام لمعادلة بسل التفاضلية:

$x^2 \frac{d^2 y}{dx^2} + x \frac{dy}{dx} + (x^2 - n^2)y = 0$

CS12	CS11	CS10	Description
0	0	0	No clock source (Timer/Counter stopped).
0	0	1	clk _{IO} /1 (No prescaling)
0	1	0	clk _{IO} /8 (From prescaler)
0	1	1	clk _{IO} /64 (From prescaler)
1	0	0	clk _{IO} /256 (From prescaler)
1	0	1	clk _{IO} /1024 (From prescaler)
1	1	0	External clock source on T1 pin. Clock on falling edge.
1	1	1	External clock source on T1 pin. Clock on rising edge.

Timer/Counter1 – TCNT1H and TCNT1L

Bit	7	6	5	4	3	2	1	0	
	TCNT1[15:8]								TCNT1H
	TCNT1[7:0]								TCNT1L
Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

Output Compare Register 1 B – OCR1BH and OCR1BL

Bit	7	6	5	4	3	2	1	0	
	OCR1B[15:8]								OCR1BH
	OCR1B[7:0]								OCR1BL
Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

Input Capture Register 1 – ICR1H and ICR1L

Bit	7	6	5	4	3	2	1	0	
	ICR1[15:8]								ICR1H
	ICR1[7:0]								ICR1L
Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

Timer/Counter Interrupt Mask Register – TIMSK⁽¹⁾

Bit	7	6	5	4	3	2	1	0	
	OCIE2	OCIE1	OCIE1A	OCIE1B	TOIE1	OCIE0	TOIE0		TIMSK
Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

- Bit 5 – TICIE1: Timer/Counter1, Input Capture Interrupt Enable
- Bit 4 – OCIE1A: Timer/Counter1, Output Compare A Match Interrupt Enable
- Bit 3 – OCIE1B: Timer/Counter1, Output Compare B Match Interrupt Enable
- Bit 2 – TOIE1: Timer/Counter1, Overflow Interrupt Enable

Timer/Counter Interrupt Flag Register – TIFR

Bit	7	6	5	4	3	2	1	0	
	OCF2	TOV2	ICF1	OCF1A	OCF1B	TOV1	OCF0	TOV0	TIFR
Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

- Bit 5 – ICF1: Timer/Counter1, Input Capture Flag
- Bit 4 – OCF1A: Timer/Counter1, Output Compare A Match Flag
- Bit 3 – OCF1B: Timer/Counter1, Output Compare B Match Flag
- Bit 2 – TOV1: Timer/Counter1, Overflow Flag

USART

Operating Mode	Equation for Calculating Baud Rate ⁽¹⁾	Equation for Calculating UBRR Value
Asynchronous Normal Mode (U2X = 0)	$BAUD = \frac{f_{osc}}{16(UBRR + 1)}$	$UBRR = \frac{f_{osc}}{16BAUD} - 1$
Asynchronous Double Speed Mode (U2X = 1)	$BAUD = \frac{f_{osc}}{8(UBRR + 1)}$	$UBRR = \frac{f_{osc}}{8BAUD} - 1$
Synchronous Master Mode	$BAUD = \frac{f_{osc}}{2(UBRR + 1)}$	$UBRR = \frac{f_{osc}}{2BAUD} - 1$

USART I/O Data Register – UDR

Bit	7	6	5	4	3	2	1	0	
	RXB[7:0]								UDR (Read)
	TXB[7:0]								UDR (Write)
Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

Timer/Counter
Interrupt Mask
Register – TIMSK

Bit	7	6	5	4	3	2	1	0	
	OCIE2	TOIE2	OCIE1	OCIE1A	OCIE1B	TOIE1	OCIE0	TOIE0	TIMSK
Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

Bit 1 – OCIE0: Timer/Counter0 Output Compare Match Interrupt Enable
Bit 0 – TOIE0: Timer/Counter0 Overflow Interrupt Enable

Timer/Counter
Interrupt Flag Register
– TIFR

Bit	7	6	5	4	3	2	1	0	
	OCF2	TOV2	ICF1	OCF1A	OCF1B	TOV1	OCF0	TOV0	TIFR
Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

Bit 1 – OCF0: Output Compare Flag 0
Bit 0 – TOV0: Timer/Counter0 Overflow Flag

Timer/Counter1
Control Register A –
TCCR1A

Bit	7	6	5	4	3	2	1	0	
	COM1A1	COM1A0	COM1B1	COM1B0	FOC1A	FOC1B	WGM11	WGM10	TCCR1A
Read/Write	R/W	R/W	R/W	R/W	W	W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

Bit 7:6 – COM1A1:0: Compare Output Mode for Compare unit A
Bit 5:4 – COM1B1:0: Compare Output Mode for Compare unit B
Bit 3 – FOC1A: Force Output Compare for Compare unit A
Bit 2 – FOC1B: Force Output Compare for Compare unit B
Bit 1:0 – WGM11:0: Waveform Generation Mode

CS02	CS01	CS00	Description
0	0	0	No clock source (Timer/Counter stopped).
0	0	1	clk_{ICP} (No prescaling)
0	1	0	$clk_{ICP}/2$ (From prescaler)
0	1	1	$clk_{ICP}/64$ (From prescaler)
1	0	0	$clk_{ICP}/256$ (From prescaler)
1	0	1	$clk_{ICP}/1024$ (From prescaler)
1	1	0	External clock source on T0 pin, Clock on falling edge.
1	1	1	External clock source on T0 pin, Clock on rising edge.

COM1A1/COM1B1	COM1A0/COM1B0	Description
0	0	Normal port operation, OC1A/OC1B disconnected.
0	1	Toggle OC1A/OC1B on compare match
1	0	Clear OC1A/OC1B on compare match (Set output to low level)
1	1	Set OC1A/OC1B on compare match (Set output to high level)

Mode	WGM13	WGM12 (CTC1)	WGM11 (PWM11)	WGM10 (PWM10)	Timer/Counter Mode of Operation	TOP	Update of OCR1x	TOV1 Flag Set on
0	0	0	0	0	Normal	0xFFFF	Immediate	MAX
1	0	0	0	1	PWM, Phase Correct, 8-bit	0x00FF	TOP	BOTTOM
2	0	0	1	0	PWM, Phase Correct, 9-bit	0x01FF	TOP	BOTTOM
3	0	0	1	1	PWM, Phase Correct, 10-bit	0x03FF	TOP	BOTTOM
4	0	1	0	0	CTC	OCR1A	Immediate	MAX
5	0	1	0	1	Fast PWM, 8-bit	0x00FF	BOTTOM	TOP
6	0	1	1	0	Fast PWM, 9-bit	0x01FF	BOTTOM	TOP
7	0	1	1	1	Fast PWM, 10-bit	0x03FF	BOTTOM	TOP
8	1	0	0	0	PWM, Phase and Frequency Correct	ICR1	BOTTOM	BOTTOM
9	1	0	0	1	PWM, Phase and Frequency Correct	OCR1A	BOTTOM	BOTTOM
10	1	0	1	0	PWM, Phase Correct	ICR1	TOP	BOTTOM
11	1	0	1	1	PWM, Phase Correct	OCR1A	TOP	BOTTOM
12	1	1	0	0	CTC	ICR1	Immediate	MAX
13	1	1	0	1	Reserved	–	–	–
14	1	1	1	0	Fast PWM	ICR1	BOTTOM	TOP
15	1	1	1	1	Fast PWM	OCR1A	BOTTOM	TOP

Timer/Counter1
Control Register B –
TCCR1B

Bit	7	6	5	4	3	2	1	0	
	ICNC1	ICES1	–	WGM13	WGM12	CS12	CS11	CS10	TCCR1B
Read/Write	R/W	R/W	R	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

Bit 7 – ICNC1: Input Capture Noise Canceler
Bit 6 – ICES1: Input Capture Edge Select
Bit 5 – Reserved Bit
Bit 4:3 – WGM13:2: Waveform Generation Mode
Bit 2:0 – CS12:0: Clock Select

CS12	CS11	CS10	Description
0	0	0	No clock source (Timer/Counter stopped).
0	0	1	$clk_{IO}/1$ (No prescaling)
0	1	0	$clk_{IO}/8$ (From prescaler)
0	1	1	$clk_{IO}/64$ (From prescaler)
1	0	0	$clk_{IO}/256$ (From prescaler)
1	0	1	$clk_{IO}/1024$ (From prescaler)
1	1	0	External clock source on T1 pin. Clock on falling edge.
1	1	1	External clock source on T1 pin. Clock on rising edge.

Timer/Counter1 – TCNT1H and TCNT1L

Bit	7	6	5	4	3	2	1	0	
	TCNT1[15:8]								TCNT1H
	TCNT1[7:0]								TCNT1L
Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

Output Compare Register 1 B – OCR1BH and OCR1BL

Bit	7	6	5	4	3	2	1	0	
	OCR1B[15:8]								OCR1BH
	OCR1B[7:0]								OCR1BL
Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

Input Capture Register 1 – ICR1H and ICR1L

Bit	7	6	5	4	3	2	1	0	
	ICR1[15:8]								ICR1H
	ICR1[7:0]								ICR1L
Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

Timer/Counter Interrupt Mask Register – TIMSK⁽¹⁾

Bit	7	6	5	4	3	2	1	0	
	OCIE2	TOIE2	TICIE1	OCIE1A	OCIE1B	TOIE1	OCIE0	TOIE0	TIMSK
Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

- Bit 5 – TICIE1: Timer/Counter1, Input Capture Interrupt Enable
 Bit 4 – OCIE1A: Timer/Counter1, Output Compare A Match Interrupt Enable
 Bit 3 – OCIE1B: Timer/Counter1, Output Compare B Match Interrupt Enable
 Bit 2 – TOIE1: Timer/Counter1, Overflow Interrupt Enable

Timer/Counter Interrupt Flag Register – TIFR

Bit	7	6	5	4	3	2	1	0	
	OCF2	TOV2	ICF1	OCF1A	OCF1B	TOV1	OCF0	TOV0	TIFR
Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

- Bit 5 – ICF1: Timer/Counter1, Input Capture Flag
 Bit 4 – OCF1A: Timer/Counter1, Output Compare A Match Flag
 Bit 3 – OCF1B: Timer/Counter1, Output Compare B Match Flag
 Bit 2 – TOV1: Timer/Counter1, Overflow Flag

USART

Operating Mode	Equation for Calculating Baud Rate ⁽¹⁾	Equation for Calculating UBRR Value
Asynchronous Normal Mode (U2X = 0)	$BAUD = \frac{f_{osc}}{16(UBRR + 1)}$	$UBRR = \frac{f_{osc}}{16BAUD} - 1$
Asynchronous Double Speed Mode (U2X = 1)	$BAUD = \frac{f_{osc}}{8(UBRR + 1)}$	$UBRR = \frac{f_{osc}}{8BAUD} - 1$
Synchronous Master Mode	$BAUD = \frac{f_{osc}}{2(UBRR + 1)}$	$UBRR = \frac{f_{osc}}{2BAUD} - 1$

USART I/O Data Register – UDR

Bit	7	6	5	4	3	2	1	0	
	RXB[7:0]								UDR (Read)
	TXB[7:0]								UDR (Write)
Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

USART Control and Status Register A – UCSRA

Bit	7	6	5	4	3	2	1	0	
	RXC	TXC	UDRE	FE	DOR	PE	U2X	MPCM	UCSRA
Read/Write	R	R/W	R	R	R	R	R/W	R/W	
Initial Value	0	0	1	0	0	0	0	0	

- Bit 7 – RXC: USART Receive Complete
- Bit 6 – TXC: USART Transmit Complete
- Bit 5 – UDRE: USART Data Register Empty
- Bit 4 – FE: Frame Error
- Bit 3 – DOR: Data OverRun
- Bit 2 – PE: Parity Error
- Bit 1 – U2X: Double the USART Transmission Speed
- Bit 0 – MPCM: Multi-processor Communication Mode

USART Control and Status Register B – UCSRB

Bit	7	6	5	4	3	2	1	0	
	RXCIE	TXCIE	UDRIE	RXEN	TXEN	UCSZ2	RXB8	TXB8	UCSRB
Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R	R/W	
Initial Value	0	0	0	0	0	0	0	0	

- Bit 7 – RXCIE: RX Complete Interrupt Enable
- Bit 6 – TXCIE: TX Complete Interrupt Enable
- Bit 5 – UDRIE: USART Data Register Empty Interrupt Enable
- Bit 4 – RXEN: Receiver Enable
- Bit 3 – TXEN: Transmitter Enable
- Bit 2 – UCSZ2: Character Size
- Bit 1 – RXB8: Receive Data Bit 8
- Bit 0 – TXB8: Transmit Data Bit 8

USART Control and Status Register C – UCSRC

Bit	7	6	5	4	3	2	1	0	
	URSEL	UMSEL	UPM1	UPM0	USBS	UCSZ1	UCSZ0	UCPOL	UCSRC
Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	
Initial Value	1	0	0	0	0	1	1	0	

- Bit 7 – URSEL: Register Select
- Bit 6 – UMSEL: USART Mode Select
- Bit 5:4 – UPM1:0: Parity Mode
- Bit 3 – USBS: Stop Bit Select
- Bit 2:1 – UCSZ1:0: Character Size
- Bit 0 – UCPOL: Clock Polarity

UMSEL	Mode
0	Asynchronous Operation
1	Synchronous Operation

USBS	Stop Bit(s)
0	1-bit
1	2-bit

UPM1	UPM0	Parity Mode
0	0	Disabled
0	1	Reserved
1	0	Enabled, Even Parity
1	1	Enabled, Odd Parity

UCPOL	Transmitted Data Changed (Output of TxD Pin)	Received Data Sampled (Input on RxD Pin)
0	Rising XCK Edge	Falling XCK Edge
1	Falling XCK Edge	Rising XCK Edge

Table 66. UCSZ Bits Settings

UCSZ2	UCSZ1	UCSZ0	Character Size
0	0	0	5-bit
0	0	1	6-bit
0	1	0	7-bit
0	1	1	8-bit
1	0	0	Reserved
1	0	1	Reserved
1	1	0	Reserved
1	1	1	9-bit

USART Baud Rate Registers – UBRRL and UBRRH

Bit	15	14	13	12	11	10	9	8	
	URSEL	-	-	-	-	UBRR[11:9]	-	-	UBRRH
	-	-	-	-	-	UBRR[7:0]	-	-	UBRRL
Read/Write	R/W	R	R	R	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	



Operation Research326 R

11-5-2018

Third Level: Computer Science Section

Time: 3 hours

Total Degree (50 marks)

Science Faculty

Mathematical Department

Answer the following Questions:

1-Use the Simplex method to solve the following linear programming

Maximize $Z = 10x_1 + 11x_2$

Subject to $x_1 + 2x_2 \leq 150$, $3x_1 + 4x_2 \leq 200$, $6x_1 + x_2 \leq 175$

and $x_1, x_2 \geq 0$

(10 marks)

2) Use the graphical and the algebraic method to solve the problem

Max $f(\underline{x}) = 5x_1 + 7x_2$ Subject to $5x_1 + 8x_2 \leq 24$, $x_1 + x_2 \leq 4$,

$10x_1 + 7x_2 \leq 35$ and $x_1, x_2 \geq 0$

(12.5marks)

3) Use the Lagrange multiplier method to find the extreme points of the problem

Minimize $f(\underline{x}) = x_1^2 + x_2^2 - 3x_1x_2$

Subject to $g(\underline{x}) = x_1^2 + x_2^2 - 8 = 0$.

(12.5marks)

4) Use the Hessian Matrix to find the local points of the problem

$f(\underline{x}) = f(x_1, x_2) = x_1^3 + x_2^3 + 2x_1^2 + 4x_2^2 + 6$

(10marks)

5) Find the local Points

$f(x) = 3x^4 - 20x^3 + 36x^2 + 16$ (5marks)

Best Wishes

Dr. Alaa Fahim

Question No. 5 (10 marks, 2 ½ each part).

Read the following program codes carefully, and write the function of each program code in the blank space provided:

C Program # 1	Function
<pre>#include <avr/io.h> int main (void) { while (EECR & (1 << EEWE)); EEAR = 0x5F; EEDR = 'G'; EECR = (1 << EEMWE); EECR = (1 << EEWE); return 0; }</pre>	

C Program # 2	Function
<pre>#include <avr/io.h> #define LED 7 #define SENSOR 1 int main (void) { DDRB = DDRB & ~(1 << SENSOR); DDRC = DDRC (1 << LED); while (1) { if (PINB & (1 << SENSOR)) PORTC = PORTC (1 << LED); else PORTC = PORTC & ~(1 << LED); } return 0; }</pre>	

C Program # 3	Function
<pre> #include <avr/io.h> int main (void) { DDRB = 0xFF; while (1) { T0Delay (); PORTB = PORTB ^ 0x10; } } void T0Delay () { TCNT0 = 186; TCCR0 = 0x02; while ((TIFR & (1 << TOV0)) == 0); TCCR0 = 0; TIFR = 0x1; } </pre>	

C Program # 4	Function
<pre> #include <avr/io.h> #include <avr/interrupt.h> int main () { DDRC = 0x08; PORTD = 1 << 2; GICR = (1 << INT0); sei (); while (1) { ISR (INT0_vect) { PORTC = ~(1 << 3); } } } </pre>	

Question No. 6 (10 Marks).

It is required to design a sliding door controlled by Atmega32. The store also counts the number of people entered in its EEPROM (\$000) and display it on LCD (PORT A). When user press a push button (ETX INT2), it activate a DC motor to open the door in one direction and increment the number stored in EEPROM. When the door is fully opened, another switch is activated (EXT INT1) to stop the motor for 5 seconds (use TIMER0), then the motor rotate in the reverse direction to close. When the door is fully closed, it activate another switch (EXT INT0) to stop the motor. The motor works according to the below table:

	PORTC.0	PORTC.1
Stop	0	0
Opening the door	1	0
Closing the door	1	1

- a) Draw the general layout of the embedded system. (4 marks)

- b) Write an AVR C program to control the sliding door and, count the number of visitors and display it on LCD. (6 marks)

Best Wishes

----- End of Questions -----

Dr. Osama Haraz

(XCK/T0) PB0	1	40	PA0 (ADC0)
(T1) PB1	2	39	PA1 (ADC1)
(INT2/AIN0) PB2	3	38	PA2 (ADC2)
(OC0/AIN1) PB3	4	37	PA3 (ADC3)
(SS) PB4	5	36	PA4 (ADC4)
(MOSI) PB5	6	35	PA5 (ADC5)
(MISO) PB6	7	34	PA6 (ADC6)
(SCK) PB7	8	33	PA7 (ADC7)
RESET	9	32	AREF
VCC	10	31	GND
GND	11	30	AVCC
XTAL2	12	29	PC7 (TOSC2)
XTAL1	13	28	PC6 (TOSC1)
(RXD) PD0	14	27	PC5 (TDI)
(TXD) PD1	15	26	PC4 (TDO)
(INT0) PD2	16	25	PC3 (TMS)
(INT1) PD3	17	24	PC2 (TCK)
(OC1B) PD4	18	23	PC1 (SDA)
(OC1A) PD5	19	22	PC0 (SCL)
(ICP1) PD6	20	21	PD7 (OC2)

Status Register

Bit	7	6	5	4	3	2	1	0	
	I	T	H	S	V	N	Z	C	SREG
Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

Bit 7 – I: Global Interrupt Enable
 Bit 6 – T: Bit Copy Storage
 Bit 5 – H: Half Carry Flag
 Bit 4 – S: Sign Bit, $S = N \oplus V$

Bit 3 – V: Two's Complement Overflow Flag
 Bit 2 – N: Negative Flag
 Bit 1 – Z: Zero Flag

The EEPROM Address Register – EEARH and EEARL

Bit	15	14	13	12	11	10	9	8	
	–	–	–	–	–	–	EEAR9	EEAR8	EEARH
	EEAR7	EEAR6	EEAR5	EEAR4	EEAR3	EEAR2	EEAR1	EEAR0	EEARL
Read/Write	R	R	R	R	R	R	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	X	

The EEPROM Data Register – EEDR

Bit	7	6	5	4	3	2	1	0	
	MSB							LSB	EEDR
Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

The EEPROM Control Register – EECR

Bit	7	6	5	4	3	2	1	0	
	–	–	–	–	EERIE	EEMWE	EEWE	EERE	EECR
Read/Write	R	R	R	R	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	X	0	

Bit 3 – EERIE: EEPROM Ready Interrupt Enable
 Bit 2 – EEMWE: EEPROM Master Write Enable

Bit 1 – EEWE: EEPROM Write Enable
 Bit 0 – EERE: EEPROM Read Enable

Interrupts

MCU Control Register – MCUCR

The MCU Control Register contains control bits for interrupt sense control and general MCU functions.

Bit	7	6	5	4	3	2	1	0	
	SE	SM2	SM1	SM0	ISC11	ISC10	ISC01	ISC00	MCUCR
Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

Bit 3, 2 – ISC11, ISC10: Interrupt Sense Control 1 Bit 1 and Bit 0

Bit 1, 0 – ISC01, ISC00: Interrupt Sense Control 0 Bit 1 and Bit 0

ISC11	ISC10	Description
0	0	The low level of INT1 generates an interrupt request.
0	1	Any logical change on INT1 generates an interrupt request.
1	0	The falling edge of INT1 generates an interrupt request.
1	1	The rising edge of INT1 generates an interrupt request.

ISC01	ISC00	Description
0	0	The low level of INT0 generates an interrupt request.
0	1	Any logical change on INT0 generates an interrupt request.
1	0	The falling edge of INT0 generates an interrupt request.
1	1	The rising edge of INT0 generates an interrupt request.

MCU Control and Status Register – MCUCSR

Bit	7	6	5	4	3	2	1	0	
	JTD	ISC2	–	JTRF	WDRF	BORF	EXTRF	PORF	MCUCSR
Read/Write	R/W	R/W	R	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0						See Bit Description

Bit 6 – ISC2: Interrupt Sense Control 2

General Interrupt Control Register – GICR

Bit	7	6	5	4	3	2	1	0	
	INT1	INT0	INT2	–	–	–	IVSEL	IVCE	GICR
Read/Write	R/W	R/W	R/W	R	R	R	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

Bit 7 – INT1: External Interrupt Request 1 Enable
Bit 6 – INT0: External Interrupt Request 0 Enable

Bit 5 – INT2: External Interrupt Request 2 Enable

General Interrupt Flag Register – GIFR

Bit	7	6	5	4	3	2	1	0	
	INTF1	INTF0	INTF2	–	–	–	–	–	GIFR
Read/Write	R/W	R/W	R/W	R	R	R	R	R	
Initial Value	0	0	0	0	0	0	0	0	

Bit 7 – INTF1: External Interrupt Flag 1
Bit 6 – INTF0: External Interrupt Flag 0

Bit 5 – INTF2: External Interrupt Flag 2

Port A Data Register – PORTA

Bit	7	6	5	4	3	2	1	0	
	PORTA7	PORTA6	PORTA5	PORTA4	PORTA3	PORTA2	PORTA1	PORTA0	PORTA
Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

Port A Data Direction Register – DDRA

Bit	7	6	5	4	3	2	1	0	
	DDA7	DDA6	DDA5	DDA4	DDA3	DDA2	DDA1	DDA0	DDRA
Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

Port A Input Pins Address – PINA

Bit	7	6	5	4	3	2	1	0	
	PINA7	PINA6	PINA5	PINA4	PINA3	PINA2	PINA1	PINA0	PINA
Read/Write	R	R	R	R	R	R	R	R	
Initial Value	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	

Time/Counter Control Register – TCCR0

Bit	7	6	5	4	3	2	1	0	
	FOC0	WGM00	COM01	COM00	WGM01	CS02	CS01	CS00	TCCR0
Read/Write	W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

Bit 7 – FOC0: Force Output Compare

Bit 6, 3 – WGM01:0: Waveform Generation Mode

Bit 5:4 – COM01:0: Compare Match Output Mode
Bit 2:0 – CS02:0: Clock Select

Mode	WGM01 (CTC0)	WGM00 (PWM0)	Timer/Counter Mode of Operation	TOP	Update of OCR0	TOV0 Flag Set-on	COM01	COM00	Description
0	0	0	Normal	0xFF	Immediate	MAX	0	0	Normal port operation, OC0 disconnected.
1	0	1	PWM, Phase Correct	0xFF	TOP	BOTTOM	0	1	Toggle OC0 on compare match
2	1	0	CTC	OCR0	Immediate	MAX	1	0	Clear OC0 on compare match
3	1	1	Fast PWM	0xFF	BOTTOM	MAX	1	1	Set OC0 on compare match

Timer/Counter Register – TCNT0

Bit	7	6	5	4	3	2	1	0	
	TCNT0[7:0]								TCNT0
Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

Output Compare Register – OCR0

Bit	7	6	5	4	3	2	1	0	
	OCR0[7:0]								OCR0
Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

Timer/Counter
Interrupt Mask
Register – TIMSK

Bit	7	6	5	4	3	2	1	0	
	OCIE2	TOIE2	OCIE1	OCIE1A	OCIE1B	TOIE1	OCIE0	TOIE0	TIMSK
Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

Bit 1 – OCIE0: Timer/Counter0 Output Compare Match Interrupt Enable
Bit 0 – TOIE0: Timer/Counter0 Overflow Interrupt Enable

Timer/Counter
Interrupt Flag Register
– TIFR

Bit	7	6	5	4	3	2	1	0	
	OCF2	TOV2	ICF1	OCF1A	OCF1B	TOV1	OCF0	TOV0	TIFR
Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

Bit 1 – OCF0: Output Compare Flag 0
Bit 0 – TOV0: Timer/Counter0 Overflow Flag

Timer/Counter1
Control Register A –
TCCR1A

Bit	7	6	5	4	3	2	1	0	
	COM1A1	COM1A0	COM1B1	COM1B0	FOC1A	FOC1B	WGM11	WGM10	TCCR1A
Read/Write	R/W	R/W	R/W	R/W	W	W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

Bit 7:6 – COM1A1:0: Compare Output Mode for Compare unit A
Bit 5:4 – COM1B1:0: Compare Output Mode for Compare unit B
Bit 3 – FOC1A: Force Output Compare for Compare unit A
Bit 2 – FOC1B: Force Output Compare for Compare unit B
Bit 1:0 – WGM11:0: Waveform Generation Mode

CS02	CS01	CS00	Description
0	0	0	No clock source (Timer/Counter stopped).
0	0	1	clk_{RCY} (No prescaling)
0	1	0	$clk_{RCY}/8$ (From prescaler)
0	1	1	$clk_{RCY}/64$ (From prescaler)
1	0	0	$clk_{RCY}/256$ (From prescaler)
1	0	1	$clk_{RCY}/1024$ (From prescaler)
1	1	0	External clock source on T0 pin. Clock on falling edge.
1	1	1	External clock source on T0 pin. Clock on rising edge.

COM1A1/COM1B1	COM1A0/COM1B0	Description
0	0	Normal port operation, OC1A/OC1B disconnected.
0	1	Toggle OC1A/OC1B on compare match
1	0	Clear OC1A/OC1B on compare match (Set output to low level)
1	1	Set OC1A/OC1B on compare match (Set output to high level)

Mode	WGM13	WGM12 (CTC1)	WGM11 (PWM11)	WGM10 (PWM10)	Timer/Counter Mode of Operation	TOP	Update of OCR1x	TOV1 Flag Set on
0	0	0	0	0	Normal	0xFFFF	Immediate	MAX
1	0	0	0	1	PWM, Phase Correct, 8-bit	0x00FF	TOP	BOTTOM
2	0	0	1	0	PWM, Phase Correct, 9-bit	0x01FF	TOP	BOTTOM
3	0	0	1	1	PWM, Phase Correct, 10-bit	0x03FF	TOP	BOTTOM
4	0	1	0	0	CTC	OCR1A	Immediate	MAX
5	0	1	0	1	Fast PWM, 8-bit	0x00FF	BOTTOM	TOP
6	0	1	1	0	Fast PWM, 9-bit	0x01FF	BOTTOM	TOP
7	0	1	1	1	Fast PWM, 10-bit	0x03FF	BOTTOM	TOP
8	1	0	0	0	PWM, Phase and Frequency Correct	ICR1	BOTTOM	BOTTOM
9	1	0	0	1	PWM, Phase and Frequency Correct	OCR1A	BOTTOM	BOTTOM
10	1	0	1	0	PWM, Phase Correct	ICR1	TOP	BOTTOM
11	1	0	1	1	PWM, Phase Correct	OCR1A	TOP	BOTTOM
12	1	1	0	0	CTC	ICR1	Immediate	MAX
13	1	1	0	1	Reserved	–	–	–
14	1	1	1	0	Fast PWM	ICR1	BOTTOM	TOP
15	1	1	1	1	Fast PWM	OCR1A	BOTTOM	TOP

Timer/Counter1
Control Register B –
TCCR1B

Bit	7	6	5	4	3	2	1	0	
	ICNC1	ICES1	–	WGM13	WGM12	CS12	CS11	CS10	TCCR1B
Read/Write	R/W	R/W	R	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

Bit 7 – ICNC1: Input Capture Noise Canceler
Bit 6 – ICES1: Input Capture Edge Select
Bit 5 – Reserved Bit
Bit 4:3 – WGM13:2: Waveform Generation Mode
Bit 2:0 – CS12:0: Clock Select



Operation Research326 R

11-5-2018

Third Level: Computer Science Section

Time: 3 hours

Total Degree (50 marks)

Science Faculty

Mathematical Department

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Subject to $x_1 + 2x_2 \leq 150$, $3x_1 + 4x_2 \leq 200$, $6x_1 + x_2 \leq 175$

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(12.5marks)

3) Use the Lagrange multiplier method to find the extreme points of the problem

Minimize $f(\underline{x}) = x_1^2 + x_2^2 - 3x_1x_2$

Subject to $g(\underline{x}) = x_1^2 + x_2^2 - 8 = 0$.

(12.5marks)

4) Use the Hessian Matrix to find the local points of the problem

$f(\underline{x}) = f(x_1, x_2) = x_1^3 + x_2^3 + 2x_1^2 + 4x_2^2 + 6$

(10marks)

5) Find the local Points

$f(x) = 3x^4 - 20x^3 + 36x^2 + 16$ (5marks)

Best Wishes

Dr. Alaa Fahim

اجب عن خمسة فقط من الاسئلة الاتية :- (10 درجات لكل سؤال : بواقع 5 درجات لكل فقرة)

(1) (i) اوجد الحل العام للمعادلة : $p_1 + 3p_2 + 2p_3(1 + \sqrt{x_1 + x_2 + x_3 - u}) = 6$
(ii) اوجد الحل الخاص للمعادلة : $(y - z)[2xyp + (x^2 - y^2)q] + z(x^2 - y^2) = 0$
الذي يمر خلال المنحنى $y = 0, x^3 = z^2$

(2) اوجد الحل العام لكل من المعادلتين التفاضليتين الجزئيتين الاتيتين :-
(i) $(D_1^3 - D_1^2 D_2 - D_1 D_2^2 + D_2^3)z = \log(x + y)$
(ii) $(D_1^2 - a^2 D_2^2)z = x^2 + y^2$, ثابت مطلق a

(3) اوجد الحل العام لكل من المعادلتين التفاضليتين الجزئيتين الاتيتين :-
(i) $(D_1^2 D_2 + D_2^2 - 2)z = e^{2y} \sin 3x - e^x \cos 2y$
(ii) $(D_1^2 - D_2^2 - D_1 - 3D_2 - 2)z = e^{2x-3y} + x + y + 1$

(4) (i) احسب التكاملات الاتية :-
(a) $\int_0^{\infty} x^{-\frac{1}{3}}(1 + 2x)^{-3} dx$ (b) $\int_0^1 \sqrt{\log \frac{1}{x}} dx$

(ii) اثبت ان :-
(a) $\tan^{-1} x = x {}_2F_1(1, \frac{1}{2}; \frac{3}{2}; -x^2)$
(b) $(a - b) {}_2F_1(a, b; c; x) = a {}_2F_1(a + 1, b; c; x) - b {}_2F_1(a, b + 1; c; x)$

(5) اثبت ان دوال بسل من النوع الاول $J_n(x)$ تحقق الاتي :-
(i) $J_{-\frac{1}{2}}(x) = \sqrt{\frac{2}{\pi x}} \cos x$, (ii) $\int x^n J_{n-1}(x) dx = x^n J_n(x) + c$

(6) (i) اثبت ان كثيرات حدود لجندر $P_n(x)$ تحقق :-
(ii) احسب التكاملات الاتية :-
(a) $\int_{-1}^1 x P_n(x) P_{n+1}(x) dx$, (b) $\int_{-1}^1 x^2 P_n(x) P_{n+1}(x) dx$, (c) $\int_{-1}^1 x^2 P_n(x) dx$



Question 1: Put *True* or *False* for each of the following items (30 marks)

1. To enter a formula into a cell, begin by typing an equal sign.
2. Functions are pre-defined worksheet formulas.
3. Formulas in Excel must be written in a very specific format, referred to as syntax.
4. The second order of precedence is for exponentiation.
5. When the formula in cell **B7 =B4+B5+B6** is copied into cell **C7** the formula will be changed to **= C4+C5+C6**.
6. The error "#####" means Data being referenced is not available.
7. The range **B2:B7** is a range down a column.
8. To keep things clear and simple only add an absolute (\$) cell reference if absolutely necessary.
9. The formula **=ROUND(78.686788,-1)** results in the value 80 .
10. Placing an absolute sign in front of a ranged name (**\$budget**) is incorrect syntax.
11. The columns of the worksheet are named with Numbers.
12. Cells may contain only Labels and Values.
13. The cell address first lists the row name and then the column name.
14. This selected cell is referred to as the **active cell**.
15. The contents of the active cell will also be displayed on the **formula bar**.
16. A cell that is on sheet 3, in the second column third row would be referred to as **Sheet3@B3**.
17. Formatted Display is the number of decimal places that appear in a cell.
18. Formulas can be copied to perform different operations on a corresponding set of data.
19. The function **COUNT(value1,[value2],...)** counts non-blank cells.
20. The Average function ignore the blank cells.
21. TRUE and FALSE are called Boolean Values.
22. SPSS stands for Statistical Package for the Social Sciences.
23. SPSS is capable of handling large amounts of data.
24. SPSS has only two windows Data view and Output view.
25. **Transform** menu includes several options to change current variables.
26. In SPSS, Each column typically represents the data from 1 case.
27. In SPSS, The first column of variable view is Name.
28. In SPSS, you can sort data from **Transform** menu then **Sort Cases**.
29. Descriptive statistics are calculated using the **Analyze** menu.
30. Correlation is used to test the degree of association between variables.

Answer Sheet		
	True	False
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Question 2: (10 marks)

	A	B	C	D	E	F	G
1		MT1	MT2	Final	Total	Honors	Passed
2	Possible points	100	100	200	400		320
3							
4	Blue	79	89	169	337	FALSE	TRUE
5	Jones	85	65	195	345	FALSE	TRUE
6	Grey	60	97	187	344	TRUE	TRUE
7	Mary	10	30	50	90	TRUE	FALSE
8							

Write the following Boolean functions

1. Blue's total and Jones' total are greater than Grey's:
2. Grey's total is not the maximum grade:
3. None of the students passed the course
4. Blue is not an Honors student
5. Blue didn't get a passing grade (320)

Question 3: (10 marks)

1. What are the difference between Data View, Variable View and Output View in SPSS?
2. Some significance tests are very restrictive about the form of data they can accept. What are the different types of measurement?
3. Describe how to test the degree of association between variables by SPSS.
4. Explain how to use SPSS to calculate the frequency and percent of females and males who did and did not have social problems.

Q2.

- a. Maintain two different Algorithm of crossover process with mention the probability of crossover (5 marks)
- b. Maintain two different Algorithm of mutation process with mention the probability of mutation. (5 marks)

Q3. a. Maintain tree type representation of solutions in genetic algorithm. (3 marks)

b. Using genetic algorithm to find the maximum value of the function $(15x - x^2)$ where parameter x varies between 0 and 15. For simplicity, we may assume that x takes only integer values. Using the genetic algorithm procedure in one step and begin with four solutions in initial solutions. (10 marks)

Q4. Discuss the internal structure of Taxi driver Robot. (7 marks)

Q5. Discuss the Tabu search method and maintain the type of memory using in this method and maintain the Tabu search algorithm. (10 marks)

==best wishes==

Dr. Alaa F. Mohamed

Answer the following questions: (50 Marks)

Question 1: Answer the following points (10 Marks)

- 1- Explain the internet "nuts and bolts"?
- 2- Explain the sources of packet delay?
- 3- What are protocols?
- 4- Explain Access network: digital subscriber line (DSL)?

Question 2: Answer the following points (10 Marks)

- 1- What is the network core?
- 2- Explain Packet Switching: queueing delay, loss?
- 3- Define throughput?
- 4- Define and explain traffic intensity?

Question 3: Answer the following points (10 Marks)

- 1- Explain the Internet protocol stack?
- 2- Mention some network applications?
- 3- Explain the application client-server architecture?
- 4- Explain P2P architecture?

Question 4: Answer the following points (10 Marks)

- 1- HTTP is "stateless". What does that mean?
- 2- Compare between persistent HTTP and non-persistent HTTP?
- 3- Give examples of HTTP response status codes?
- 4- Explain the term (web caches) and how it is useful?

Question 5: Answer the following points (10 Marks)

- 1- Give a DNS name resolution example?
- 2- Compare between multiplexing and demultiplexing? Support your answer with a diagram?
- 3- Define and explain the use of ACKs and NAKs?
- 4- Define and explain HOL? Support your answer with a diagram?

جامعة أسيوط	مايو 2018	كود المقرر: 356 رك
كلية العلوم		المقرر : مقدمة فى الحسابات العلمية
قسم الرياضيات		الزمن : ساعتان

Answer the following questions by using MATLAB language: (50 marks)

1- Using Newton's forward difference formula, find $y(0.1)$ using the table below:

x	0.0	0.2	0.4	0.6	0.8
y	1.000	1.22140	1.49182	1.82212	2.22554

2- Solve the differential equation by Adams method (without using nested for loops) at $x=0.2$:

$$\frac{dy}{dt} = t^2 - y, \quad y(0) = 1, \quad h = 0.05.$$

and compare it with the analytic solution $y = -e^{-t} + t^2 - 2t + 2$.

3- Solve the following initial value problem:

$$\frac{d^2u}{dt^2} + 4\frac{du}{dt} + 3u = 0, \quad u(0) = 1, \quad \frac{du}{dt}(0) = 0.$$

4- Let $f(x) = \cos 2x$ and $x_0 = 0$. Determine

- The third Taylor polynomial for f about x_0 .
- Find error bound at $x = 0.2$ and compare it to the actual error.

5- For the well-known Chua's circuit equation in chaotic studies that

$$\dot{x} = \alpha[y - x - f(x)], \quad \dot{y} = x - y + z, \quad \dot{z} = -\beta y - \gamma z, \quad t \in (0, 10),$$

where the nonlinear function $f(x)$ is described by

$$f(x) = bx + 0.5(a-b)(|x+1| - |x-1|) \text{ and } a < b < 0.$$

Write an M-function to describe the equation, and draw the phase trajectory for the parameters $\alpha = 9$, $\beta = 100/7$, $\gamma = 0$, $a = -8/7$, $b = -5/7$, and initial conditions

$$x(0) = -2.121304, \quad y(0) = -0.066170, \quad z(0) = 2.881090.$$

Good Luck

Dr. Tarek Aboelenen



امتحان الفرقة الثالثة شعبة الرياضيات

الزمن : ثلاث ساعات

رقم المقرر ورمزه : ١٣٤٦

المقرر : عمليات عشوائية وتطبيقاتها

أجب عن خمسة أسئلة فقط مما يأتي :- درجة جزء كل سؤال (خمس درجات)

١- (أ) لمجموعة المتغيرات العشوائية المستقلة $X_1, X_2, X_3, \dots$ بفرض أن التوقع الرياضي $E(X_i) = m$ والتباين $V(X_i)$ لكل منها محدود عرف كل من التقارب عن طريق الإحتمال وقانون الأعداد الكبرى (الضعيف).
(ب) - بفرض أن $f f s s f s f f s s s f f s f f s$ هي إحدى النتائج الممكنة في محاولات برنولي العشوائية المستقلة بحيث أن $P(s) = p, P(f) = q, p + q = 1$ عرف عملية عشوائية في الفراغ R^2 موضحا ذلك بيانيا .

٢- (أ) في عملية برنولي العشوائية $\{X_n; n > 0\}$ بالإحتمال $p = 0.6$ إذا كان $X = X_1 + X_2$ ، $Y = X_1 + X_3$ احسب الإحتمالات الآتية : $P(X < 2, Y \leq 1)$ ، $P(2X < 3Y)$ ، $P(Y = X)$.
(ب) في السؤال (٢-أ) أوجد العزم الارتباطي بين X ، Y موضحا العلاقة بينهما .

٣- (أ) وضح العلاقة بين عملية برنولي العشوائية $\{X_n; n > 0\}$ و العملية العشوائية $\{Y_n; n \geq 0\}$ حيث أن المتغير Y_n يخضع لتوزيع ذي الحدين واذكر صفات كل منهما ثم عبر مع الاستنتاج عن إحتمال الحادث $(Y_{n+1} = k)$ من خلال إحتمالات الحوادث : $(Y_n = k)$ ، $(Y_n = k - 1)$ لأي عدد صحيح $k > 0$.
(ب) - في العملية العشوائية $\{Y_n; n \geq 0\}$ أوجد كل من $E(Y_5)$ ، $E(Y_4^2)$ ، $P(Y_5 = 3, Y_7 = 4, Y_{14} = 9)$.

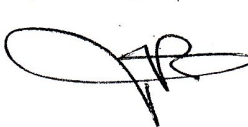
٤- (أ) عرف أزمنة النجاح T_k كعملية عشوائية موضحا العلاقة بينها وبين العملية العشوائية $\{Y_n; n \geq 0\}$ ثم اذكر فقط توزيع المتغير العشوائي T_k .
(ب) - في عملية بواسون العشوائية $\{N_t; t \geq 0\}$ بالمعدل $\lambda = 4$ احسب كل من الإحتمالات الآتية :
 $P(N_{1.5} = 2, N_4 = 5, N_{6.8} = 9)$ ، $P(N_3 = 5, N_7 = 9)$

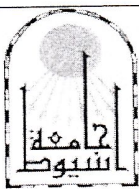
٥- (أ) في عملية بواسون أو عملية الوصول المعودة $\{N_t; t \geq 0\}$ بالمعدل λ إثبت أن الإحتمال المشروط لعدد الوصول N_t بالنسبة إلى عدد الوصول N_{t+s} لكل $t > 0, s > 0$ يمثل توزيع ذي الحدين.
(ب) - عرف العمليات العشوائية المستقلة ثم اثبت أن أي عمليتين مستقلتين لبواسون هو أيضا عملية بواسون .

٦- (أ) في عملية التجديد العشوائية $R = \{R_n; n \in N\}$ حيث N هي فئة الأعداد الصحيحة غير السالبة عرف دالة التجديد ثم عبر عنها من خلال توزيع المتغير R_n مع الاستنتاج .

(ب) في سلسلة ماركوف العشوائية المتقطعة $\{X_n; n \geq 0\}$ عرف مصفوفة الإحتمالات الإنتقالية بصفاتها المعروفة ثم احسب الإحتمال : $P(X_0 = 1, X_1 = 1, X_2 = 0, X_3 = 1, X_4 = 0, X_6 = 0)$ بفرض أن حالات الفراغ $(0, 1)$ والمصفوفة العشوائية

$$P = \begin{pmatrix} 1/2 & 1/2 \\ 1/3 & 2/3 \end{pmatrix} , \text{ ومنتجه الإحتمالات الابتدائية } \pi_0 = (2/5 \quad 3/5)$$

	المقرر: تحليل عددي (٣٢٣) الفرقة: المستوى الثالث الدرجة: ٥٠ درجة التاريخ: ٢٠١٨/٥/٢٩ الزمن: ثلاث ساعات	جامعة أسيوط كلية العلوم - قسم الرياضيات امتحان نهائي الفصل الدراسي الثاني للعام الجامعي ٢٠١٧/٢٠١٨
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Answer five questions only :- (10 marks for every question)

1-a) If the function $g \in C[a, b]$ and $g(x) \in [a, b] \forall x \in [a, b]$ and $g'(x)$ exist with $|g'(x)| \leq k < 1 \forall x \in [a, b]$ prove that the sequence defined by $P_n = g(P_{n-1}), n \geq 1$ will converge to the unique fixed point P and also $|P_{n+1} - P_n| \leq k^n |P_1 - P_0|$.

1-b) Verify that when Newton's method is used to compute $\sqrt{A}, A > 0$ (By solving the equation : $f(x) = x^2 - A$). The sequence of iterates is defined by : $x_{n+1} = (x_n + \frac{A}{x_n})/2$, and show that if the sequence $\{x_n\}$ is defined as the previous problem, then this method is quadratically convergence.

2-a) Derive Lagrange interpolation formula of degree n and write the error of the method.

2-b) For the given function $f(x) = \cos \pi x$ let $x_0 = -1, x_1 = 0, x_2 = 1$ construct the suitable interpolation polynomial and find the actual error.

3) Derive the formula of the Newton's interpolatory divided difference method and use this formula to obtain a polynomial of least degree that fits the values shown:

x	0	1	2	4	6
$f(x)$	1	9	23	93	259

من فضلك انظر خلف الورقة

السؤال الرابع :-

أ) يعرف الطي للدالتين $f(x)$, $g(x)$ كالآتي

$$f * g = \int_{-\infty}^{\infty} f(u) g(x-u) du$$

برهن علي أن تحويل فوريير للطرف الأيمن هو حاصل ضرب تحويلي فوريير للدالتين $f(x)$, $g(x)$

ب) أوجد تحويل فوريير للدالة $f(x) = \begin{cases} 1 & |x| < a \\ 0 & |x| > a \end{cases}$ وأرسم $f(x)$ كذلك تحويلها عند $a = 3$ وأوجد

$$\int_{-\infty}^{\infty} \frac{\sin u}{u} du \quad \text{كذلك} \quad \int_{-\infty}^{\infty} \frac{\sin \alpha a \cos \alpha x}{\alpha} d\alpha$$

ج) ترك خيط لانهائي من السكون وكانت أزاحته الابتدائية عن محور x هي $f(x)$ أوجد الإزاحه عند أي زمن .

انتهت الأسئلة مع تمنياتنا بالتوفيق ،،،،

لجنة الممتحنين :- أ. د/ نجاه عبد الرحمن حسين ، أ. د/ فاروق علي السيد



الامتحان النهائي للفصل الدراسي الثاني للعام الجامعي ٢٠١٧/٢٠١٨ م
 للفرقة : الثالثة
 الشعبة : الرياضيات
 التاريخ : ٢٠١٨/٥/٢٤ م

الزمن : ساعتان

الدرجة الكلية : ٥٠ درجة

درجة كل سؤال : ١٧ درجة

أسم المقرر : الطرق الرياضية
 رقم المقرر ورمزه : ٣٣٤ ر

أجب عن ثلاثة أسئلة فقط مما يأتي :-

السؤال الأول :-

أوجد تحويل لابلاس للمشتقة التفاضلية للدالة $F(t)$ عند نقط الاتصال والانفصال للدالة .

أبرهن علي أن

$$\lim_{t \rightarrow 0} F(t) = \lim_{s \rightarrow \infty} s f(s)$$

$$\lim_{t \rightarrow \infty} F(t) = \lim_{s \rightarrow 0} s f(s)$$

$$\Gamma\left(\frac{1}{2}\right) = \sqrt{\pi}, \quad \int_0^{\infty} \delta(t) dt = 1, \quad L \sin \sqrt{t} = \frac{\sqrt{\pi}}{3} e^{-\frac{1}{4s}} s^{\frac{3}{2}}$$

السؤال الثاني :-

حل المعادلات الآتية :

$$t Y''(t) + Y'(t) + 4t Y(t) = 0, \quad y(0) = 3, y'(0) = 0$$

$$\frac{\partial U}{\partial x} = 2 \frac{\partial U}{\partial t} + U, \quad x > 0, t > 0 \quad U(x, 0) = 6 e^{-3x}$$

$$\int_0^t Y(u) Y(t-u) du = 16 \sin 4t$$

السؤال الثالث :-

أ) فك الدالة $f(x) = x^2$, $0 < x < 2\pi$ بدلالة متسلسلة فوريير ثم أحسب المجموع

$$1 + \frac{1}{2^2} + \frac{1}{3^2} + \frac{1}{4^2} + \dots$$

ب) صفيحة علي شكل دائري نصف قطرها الوحدة ووجهيها معزولين ونصف محيطها محفوظ عند درجة حرارة u_1

والآخر عند u_2 أوجد حالة الأتزان الحراري .

من فضلك أنظر بقية الأسئلة خلف الورقة ،،،،،



Answer the following questions (50 marks)

Q1.	Complete the following: (1)..... is a representation of a two-dimensional image as a finite set of digital values, called picture elements or pixels - Common image formats include.....(2).... ,(3)..... ,(4)..... (5)..... creates a Distance tool a draggable, resizable line that measures the distance between its endpoints. (6)..... These are the result of objects that are self-luminous, such as stars and light bulbs. (7).....the resulting output pixel is computed as a sum of products of the pixel values and mask coefficients in the pixel's neighborhood in the original image. - The Sobel operators used to compute edges are(8)..... ,(9)..... - Edge detector should have:(10)..... ,(11)..... - Types of noise are(12)..... ,(13)....	(13 marks)
Q2.	a) Compute Z from the following matlab script (6 marks) <pre> x = [150 10 90;80 50 60;121 160 20] y = [-1 0 1;-2 0 2;-1 0 1] z = imfilter(x,y,'corr') </pre> b) What is the Delta compression and compute the compressed data of the data (6 marks) 220 321 335 211 250 200 233 214 232 212	(12 marks)
Q3.	a) Write the MATLAB code used to: (4 marks) - Read any image then use affine transformation matrix for each of the operations below: - Flip the image right to left - Translation by [25, 15] pixels b) What are the main differences between: (8 marks) - Global thresholding and optimal thresholding. - Raster and vector image . - Interpixel redundancy and Psychovisual redundancy	(12 marks)

(Q5) (i) Assume that U, V are open intervals and let $f : U \rightarrow \mathbb{R}$ and $g : V \rightarrow \mathbb{R}$ be two differentiable functions such that $f(U) \subset V$. Prove that $g \circ f$ is differentiable on U and that $(g \circ f)' = (g' \circ f) \cdot f'$ [5 marks]

(ii) Prove that the function $f(x) := \frac{1}{x}$ is differentiable on $]0, \infty[$ but not uniformly continuous therein. [5 marks]

(Q6) (i) State and prove Rolle's theorem then use it to prove the mean value theorem. [6 marks]

(ii) Let I be an open interval. Apply the mean value theorem to prove that a function differentiable on I is

1. increasing if and only if $f' \geq 0$ on I ,

2. decreasing if and only if $f' \leq 0$ on I .

[4 marks]

With the best of luck,

Prof. Rashwan A. Rashwan,

Dr. Ahmed A. Abdelhakim



Time: 3 hours

Total mark: 50

Answer *only five* of the following questions:

(Q1) (i) Suppose that O_i , $i \geq 1$, are open subsets of $\mathbb{R}$. Prove that $\cup_{i \geq 1} O_i$ is also open in $\mathbb{R}$. [5 marks]

(ii) Let $S \subset \mathbb{R}$. Show that S is closed if and only if S contains the limit point of every convergent sequence of elements of S . [5 marks]

(Q2) (i) Prove that a sequence of real numbers converges if and only if it is a Cauchy sequence. [6 marks]

(ii) Show that if $(x_n)_{n \geq 1} \subset \mathbb{R}$ is a monotonically increasing sequence that is bounded above, then $x_n \rightarrow \sup_{n \geq 1} x_n$, as $n \rightarrow \infty$. [4 marks]

(Q3) (i) Show that $f : D \subset \mathbb{R} \rightarrow \mathbb{R}$ is continuous at $x_0 \in D$ if and only if the sequence $(f(x_n))_{n \geq 1}$ converges to $f(x_0)$ whenever $(x_n)_{n \geq 1}$ is a sequence in D that converges to x_0 . [6 marks]

(ii) Use the characterization given in (i) to prove the discontinuity at the origin of the function $f(x) = \begin{cases} \cos \frac{1}{x}, & x \neq 0; \\ 0, & x = 0. \end{cases}$ [4 marks]

(Q4) (i) Assume that D is a closed bounded subset of $\mathbb{R}$. Prove that if $f : D \rightarrow \mathbb{R}$ is continuous then f is bounded on D , and there exist $\alpha, \beta \in D$ such that $f(\alpha) = \max_{x \in D} f(x)$ and $f(\beta) = \min_{x \in D} f(x)$. [5 marks]

(ii) Argue by contradiction to demonstrate that if $f : [a, b] \rightarrow \mathbb{R}$ is continuous then it is uniformly continuous on $[a, b]$. [5 marks]

Please Turn over the page



أجب عن أسئلة الآتية :- (كل سؤال ١٠ درجات)

(١) (أ) أثبت قاعدة التضعيف لدالة جاما $\sqrt{\pi} \Gamma(2x) = 2^{2x-1} \Gamma(x) \Gamma\left(x + \frac{1}{2}\right), x > 0$

ثم استخدمها فى إثبات أن: $\Gamma\left(\frac{5}{6}\right) \left[\Gamma\left(\frac{1}{3}\right)\right]^2 = 2 \sqrt[3]{2} \sqrt{\frac{\pi^3}{3}}$

(ب) باستخدام دوال جاما و بيتا أوجد التكاملات الآتية: (i) $\int_0^{\frac{\pi}{2}} \sqrt{\tan \theta} d\theta$ (ii) $\int_0^{\infty} \frac{\sqrt{x}}{e^{x^3}} dx$

(٢) (أ) أثبت أن: $\Gamma(x) \Gamma(1-x) = \frac{\pi}{\sin \pi x}, 0 < x < 1$ ومن ثم أثبت أن

$\Gamma\left(x + \frac{1}{2}\right) \Gamma\left(\frac{1}{2} - x\right) = \frac{\pi}{\cos \pi x}$

(ب) أثبت أن:

(i) $\sqrt{1-x^2} T_n(x) = U_{n+1}(x) - x U_n(x),$

(ii) $(1-x^2) U'_n(x) = -n x U_n(x) + n U_{n-1}(x)$

(٣) أثبت أن:

(i) ${}_2F_1(\alpha, \beta; \gamma, x) = (1-x)^{-\beta} {}_2F_1\left(\gamma - \alpha, \beta; \gamma, \frac{x}{x-1}\right)$

(ii) ${}_1F_1\left(\frac{1}{2}; \frac{3}{2}, -x^2\right) = \frac{\sqrt{\pi}}{2x} \operatorname{erf}(x)$ حيث أن: $\operatorname{erf}(x) = \frac{2}{\sqrt{\pi}} \int_0^x e^{-t^2} dt$ هى دالة الخطأ

(iii) ${}_1F_1(\alpha + 1; \gamma, x) - {}_1F_1(\alpha; \gamma, x) - \frac{x}{\gamma} {}_1F_1(\alpha + 1; \gamma + 1, x) = 0$

(٤) (أ) أوجد مفكوك ليجندر للدالة: $f(x) = x^3$

(ب) أثبت أن: $H_n(x) = (-1)^n e^{x^2} \frac{d^n}{dx^n} (e^{-x^2})$ حيث $H_n(x)$ كثيرة حدود هيرميت.

(ج) أثبت أن: $J_{\frac{1}{2}}(x) = \sqrt{\frac{2}{\pi}} \frac{\sin x}{\sqrt{x}}$

(٥) (أ) باستخدام الصيغة التكاملية لدوال بسل أثبت أن: $\int_0^{\infty} e^{-3x} J_0(4x) dx = \frac{1}{5}$

(ب) أوجد الحل العام لمعادلة بسل التفاضلية:

$x^2 \frac{d^2 y}{dx^2} + x \frac{dy}{dx} + (x^2 - n^2)y = 0$

CS12	CS11	CS10	Description
0	0	0	No clock source (Timer/Counter stopped).
0	0	1	clk _{IO} /1 (No prescaling)
0	1	0	clk _{IO} /8 (From prescaler)
0	1	1	clk _{IO} /64 (From prescaler)
1	0	0	clk _{IO} /256 (From prescaler)
1	0	1	clk _{IO} /1024 (From prescaler)
1	1	0	External clock source on T1 pin. Clock on falling edge.
1	1	1	External clock source on T1 pin. Clock on rising edge.

Timer/Counter1 – TCNT1H and TCNT1L

Bit	7	6	5	4	3	2	1	0	
	TCNT1[15:8]								TCNT1H
	TCNT1[7:0]								TCNT1L
Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

Output Compare Register 1 B – OCR1BH and OCR1BL

Bit	7	6	5	4	3	2	1	0	
	OCR1B[15:8]								OCR1BH
	OCR1B[7:0]								OCR1BL
Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

Input Capture Register 1 – ICR1H and ICR1L

Bit	7	6	5	4	3	2	1	0	
	ICR1[15:8]								ICR1H
	ICR1[7:0]								ICR1L
Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

Timer/Counter Interrupt Mask Register – TIMSK⁽¹⁾

Bit	7	6	5	4	3	2	1	0	
	OCIE2	OCIE1	OCIE1A	OCIE1B	TOIE1	OCIE0	TOIE0		TIMSK
Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

- Bit 5 – OCIE1: Timer/Counter1, Input Capture Interrupt Enable
 Bit 4 – OCIE1A: Timer/Counter1, Output Compare A Match Interrupt Enable
 Bit 3 – OCIE1B: Timer/Counter1, Output Compare B Match Interrupt Enable
 Bit 2 – TOIE1: Timer/Counter1, Overflow Interrupt Enable

Timer/Counter Interrupt Flag Register – TIFR

Bit	7	6	5	4	3	2	1	0	
	OCF2	TOV2	ICF1	OCF1A	OCF1B	TOV1	OCF0	TOV0	TIFR
Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

- Bit 5 – ICF1: Timer/Counter1, Input Capture Flag
 Bit 4 – OCF1A: Timer/Counter1, Output Compare A Match Flag
 Bit 3 – OCF1B: Timer/Counter1, Output Compare B Match Flag
 Bit 2 – TOV1: Timer/Counter1, Overflow Flag

USART

Operating Mode	Equation for Calculating Baud Rate ⁽¹⁾	Equation for Calculating UBRR Value
Asynchronous Normal Mode (U2X = 0)	$BAUD = \frac{f_{osc}}{16(UBRR + 1)}$	$UBRR = \frac{f_{osc}}{16BAUD} - 1$
Asynchronous Double Speed Mode (U2X = 1)	$BAUD = \frac{f_{osc}}{8(UBRR + 1)}$	$UBRR = \frac{f_{osc}}{8BAUD} - 1$
Synchronous Master Mode	$BAUD = \frac{f_{osc}}{2(UBRR + 1)}$	$UBRR = \frac{f_{osc}}{2BAUD} - 1$

USART I/O Data Register – UDR

Bit	7	6	5	4	3	2	1	0	
	RXB[7:0]								UDR (Read)
	TXB[7:0]								UDR (Write)
Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

Timer/Counter
Interrupt Mask
Register – TIMSK

Bit	7	6	5	4	3	2	1	0	
	OCIE2	TOIE2	OCIE1	OCIE1A	OCIE1B	TOIE1	OCIE0	TOIE0	TIMSK
Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

Bit 1 – OCIE0: Timer/Counter0 Output Compare Match Interrupt Enable
Bit 0 – TOIE0: Timer/Counter0 Overflow Interrupt Enable

Timer/Counter
Interrupt Flag Register
– TIFR

Bit	7	6	5	4	3	2	1	0	
	OCF2	TOV2	OCF1	OCF1A	OCF1B	TOV1	OCF0	TOV0	TIFR
Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

Bit 1 – OCF0: Output Compare Flag 0
Bit 0 – TOV0: Timer/Counter0 Overflow Flag

Timer/Counter1
Control Register A –
TCCR1A

Bit	7	6	5	4	3	2	1	0	
	COM1A1	COM1A0	COM1B1	COM1B0	FOC1A	FOC1B	WGM11	WGM10	TCCR1A
Read/Write	R/W	R/W	R/W	R/W	W	W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

Bit 7:6 – COM1A1:0: Compare Output Mode for Compare unit A
Bit 5:4 – COM1B1:0: Compare Output Mode for Compare unit B
Bit 3 – FOC1A: Force Output Compare for Compare unit A
Bit 2 – FOC1B: Force Output Compare for Compare unit B
Bit 1:0 – WGM11:0: Waveform Generation Mode

CS02	CS01	CS00	Description
0	0	0	No clock source (Timer/Counter stopped).
0	0	1	$clk_{IO}/1$ (No prescaling)
0	1	0	$clk_{IO}/8$ (From prescaler)
0	1	1	$clk_{IO}/64$ (From prescaler)
1	0	0	$clk_{IO}/256$ (From prescaler)
1	0	1	$clk_{IO}/1024$ (From prescaler)
1	1	0	External clock source on T0 pin, Clock on falling edge.
1	1	1	External clock source on T0 pin, Clock on rising edge.

COM1A1/COM1B1	COM1A0/COM1B0	Description
0	0	Normal port operation, OC1A/OC1B disconnected.
0	1	Toggle OC1A/OC1B on compare match
1	0	Clear OC1A/OC1B on compare match (Set output to low level)
1	1	Set OC1A/OC1B on compare match (Set output to high level)

Mode	WGM13	WGM12 (CTC1)	WGM11 (PWM11)	WGM10 (PWM10)	Timer/Counter Mode of Operation	TOP	Update of OCR1x	TOV1 Flag Set on
0	0	0	0	0	Normal	0xFFFF	Immediate	MAX
1	0	0	0	1	PWM, Phase Correct, 8-bit	0x00FF	TOP	BOTTOM
2	0	0	1	0	PWM, Phase Correct, 9-bit	0x01FF	TOP	BOTTOM
3	0	0	1	1	PWM, Phase Correct, 10-bit	0x03FF	TOP	BOTTOM
4	0	1	0	0	CTC	OCR1A	Immediate	MAX
5	0	1	0	1	Fast PWM, 8-bit	0x00FF	BOTTOM	TOP
6	0	1	1	0	Fast PWM, 9-bit	0x01FF	BOTTOM	TOP
7	0	1	1	1	Fast PWM, 10-bit	0x03FF	BOTTOM	TOP
8	1	0	0	0	PWM, Phase and Frequency Correct	ICR1	BOTTOM	BOTTOM
9	1	0	0	1	PWM, Phase and Frequency Correct	OCR1A	BOTTOM	BOTTOM
10	1	0	1	0	PWM, Phase Correct	ICR1	TOP	BOTTOM
11	1	0	1	1	PWM, Phase Correct	OCR1A	TOP	BOTTOM
12	1	1	0	0	CTC	ICR1	Immediate	MAX
13	1	1	0	1	Reserved	–	–	–
14	1	1	1	0	Fast PWM	ICR1	BOTTOM	TOP
15	1	1	1	1	Fast PWM	OCR1A	BOTTOM	TOP

Timer/Counter1
Control Register B –
TCCR1B

Bit	7	6	5	4	3	2	1	0	
	ICNC1	ICES1	–	WGM13	WGM12	CS12	CS11	CS10	TCCR1B
Read/Write	R/W	R/W	R	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

Bit 7 – ICNC1: Input Capture Noise Canceler
Bit 6 – ICES1: Input Capture Edge Select
Bit 5 – Reserved Bit
Bit 4:3 – WGM13:2: Waveform Generation Mode
Bit 2:0 – CS12:0: Clock Select

CS12	CS11	CS10	Description
0	0	0	No clock source (Timer/Counter stopped).
0	0	1	$clk_{IO}/1$ (No prescaling)
0	1	0	$clk_{IO}/8$ (From prescaler)
0	1	1	$clk_{IO}/64$ (From prescaler)
1	0	0	$clk_{IO}/256$ (From prescaler)
1	0	1	$clk_{IO}/1024$ (From prescaler)
1	1	0	External clock source on T1 pin. Clock on falling edge.
1	1	1	External clock source on T1 pin. Clock on rising edge.

Timer/Counter1 – TCNT1H and TCNT1L

Bit	7	6	5	4	3	2	1	0	
	TCNT1[15:8]								TCNT1H
	TCNT1[7:0]								TCNT1L
Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

Output Compare Register 1 B – OCR1BH and OCR1BL

Bit	7	6	5	4	3	2	1	0	
	OCR1B[15:8]								OCR1BH
	OCR1B[7:0]								OCR1BL
Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

Input Capture Register 1 – ICR1H and ICR1L

Bit	7	6	5	4	3	2	1	0	
	ICR1[15:8]								ICR1H
	ICR1[7:0]								ICR1L
Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

Timer/Counter Interrupt Mask Register – TIMSK⁽¹⁾

Bit	7	6	5	4	3	2	1	0	
	OCIE2	TOIE2	TICIE1	OCIE1A	OCIE1B	TOIE1	OCIE0	TOIE0	TIMSK
Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

- Bit 5 – TICIE1: Timer/Counter1, Input Capture Interrupt Enable
 Bit 4 – OCIE1A: Timer/Counter1, Output Compare A Match Interrupt Enable
 Bit 3 – OCIE1B: Timer/Counter1, Output Compare B Match Interrupt Enable
 Bit 2 – TOIE1: Timer/Counter1, Overflow Interrupt Enable

Timer/Counter Interrupt Flag Register – TIFR

Bit	7	6	5	4	3	2	1	0	
	OCF2	TOV2	ICF1	OCF1A	OCF1B	TOV1	OCF0	TOV0	TIFR
Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

- Bit 5 – ICF1: Timer/Counter1, Input Capture Flag
 Bit 4 – OCF1A: Timer/Counter1, Output Compare A Match Flag
 Bit 3 – OCF1B: Timer/Counter1, Output Compare B Match Flag
 Bit 2 – TOV1: Timer/Counter1, Overflow Flag

USART

Operating Mode	Equation for Calculating Baud Rate ⁽¹⁾	Equation for Calculating UBRR Value
Asynchronous Normal Mode (U2X = 0)	$BAUD = \frac{f_{osc}}{16(UBRR + 1)}$	$UBRR = \frac{f_{osc}}{16BAUD} - 1$
Asynchronous Double Speed Mode (U2X = 1)	$BAUD = \frac{f_{osc}}{8(UBRR + 1)}$	$UBRR = \frac{f_{osc}}{8BAUD} - 1$
Synchronous Master Mode	$BAUD = \frac{f_{osc}}{2(UBRR + 1)}$	$UBRR = \frac{f_{osc}}{2BAUD} - 1$

USART I/O Data Register – UDR

Bit	7	6	5	4	3	2	1	0	
	RXB[7:0]								UDR (Read)
	TXB[7:0]								UDR (Write)
Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

USART Control and Status Register A – UCSRA

Bit	7	6	5	4	3	2	1	0	
	RXC	TXC	UDRE	FE	DOR	PE	U2X	MPCM	UCSRA
Read/Write	R	R/W	R	R	R	R	R/W	R/W	
Initial Value	0	0	1	0	0	0	0	0	

- Bit 7 – RXC: USART Receive Complete
- Bit 6 – TXC: USART Transmit Complete
- Bit 5 – UDRE: USART Data Register Empty
- Bit 4 – FE: Frame Error
- Bit 3 – DOR: Data OverRun
- Bit 2 – PE: Parity Error
- Bit 1 – U2X: Double the USART Transmission Speed
- Bit 0 – MPCM: Multi-processor Communication Mode

USART Control and Status Register B – UCSRB

Bit	7	6	5	4	3	2	1	0	
	RXCIE	TXCIE	UDRIE	RXEN	TXEN	UCSZ2	RXB8	TXB8	UCSRB
Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R	R/W	
Initial Value	0	0	0	0	0	0	0	0	

- Bit 7 – RXCIE: RX Complete Interrupt Enable
- Bit 6 – TXCIE: TX Complete Interrupt Enable
- Bit 5 – UDRIE: USART Data Register Empty Interrupt Enable
- Bit 4 – RXEN: Receiver Enable
- Bit 3 – TXEN: Transmitter Enable
- Bit 2 – UCSZ2: Character Size
- Bit 1 – RXB8: Receive Data Bit 8
- Bit 0 – TXB8: Transmit Data Bit 8

USART Control and Status Register C – UCSRC

Bit	7	6	5	4	3	2	1	0	
	URSEL	UMSEL	UPM1	UPM0	USBS	UCSZ1	UCSZ0	UCPOL	UCSRC
Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	
Initial Value	1	0	0	0	0	1	1	0	

- Bit 7 – URSEL: Register Select
- Bit 6 – UMSEL: USART Mode Select
- Bit 5:4 – UPM1:0: Parity Mode
- Bit 3 – USBS: Stop Bit Select
- Bit 2:1 – UCSZ1:0: Character Size
- Bit 0 – UCPOL: Clock Polarity

UMSEL	Mode
0	Asynchronous Operation
1	Synchronous Operation

USBS	Stop Bit(s)
0	1-bit
1	2-bit

UPM1	UPM0	Parity Mode
0	0	Disabled
0	1	Reserved
1	0	Enabled, Even Parity
1	1	Enabled, Odd Parity

UCPOL	Transmitted Data Changed (Output of Tx D Pin)	Received Data Sampled (Input on Rx D Pin)
0	Rising XCK Edge	Falling XCK Edge
1	Falling XCK Edge	Rising XCK Edge

Table 66. UCSZ Bits Settings

UCSZ2	UCSZ1	UCSZ0	Character Size
0	0	0	5-bit
0	0	1	6-bit
0	1	0	7-bit
0	1	1	8-bit
1	0	0	Reserved
1	0	1	Reserved
1	1	0	Reserved
1	1	1	9-bit

USART Baud Rate Registers – UBRRL and UBRRH

Bit	15	14	13	12	11	10	9	8	
	URSEL	-	-	-	-	UBRR[11:9]	-	-	UBRRH
	-	-	-	-	-	UBRR[7:0]	-	-	UBRRH
	-	-	-	-	-	-	-	-	UBRRH
Read/Write	R/W	R	R	R	R/W	R/W	R/W	R/W	
	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	



Operation Research326 R

11-5-2018

Third Level: Computer Science Section

Time: 3 hours

Total Degree (50 marks)

Science Faculty

Mathematical Department

Answer the following Questions:

1-Use the Simplex method to solve the following linear programming

Maximize $Z = 10x_1 + 11x_2$

Subject to $x_1 + 2x_2 \leq 150$, $3x_1 + 4x_2 \leq 200$, $6x_1 + x_2 \leq 175$

and $x_1, x_2 \geq 0$

(10 marks)

2) Use the graphical and the algebraic method to solve the problem

Max $f(\underline{x}) = 5x_1 + 7x_2$ Subject to $5x_1 + 8x_2 \leq 24$, $x_1 + x_2 \leq 4$,

$10x_1 + 7x_2 \leq 35$ and $x_1, x_2 \geq 0$

(12.5marks)

3) Use the Lagrange multiplier method to find the extreme points of the problem

Minimize $f(\underline{x}) = x_1^2 + x_2^2 - 3x_1x_2$

Subject to $g(\underline{x}) = x_1^2 + x_2^2 - 8 = 0$.

(12.5marks)

4) Use the Hessian Matrix to find the local points of the problem

$f(\underline{x}) = f(x_1, x_2) = x_1^3 + x_2^3 + 2x_1^2 + 4x_2^2 + 6$

(10marks)

5) Find the local Points

$f(x) = 3x^4 - 20x^3 + 36x^2 + 16$ (5marks)

Best Wishes

Dr. Alaa Fahim



ASSIUT UNIVERSITY

Faculty of Engineering
Electrical Engineering Department

H325 – Microprocessors

Third Year, Mathematics Department
Bylaw: 2014

Academic year 2017/2018 – Final Exam

Time Allowed: 3 Hours

Total Marks: 50

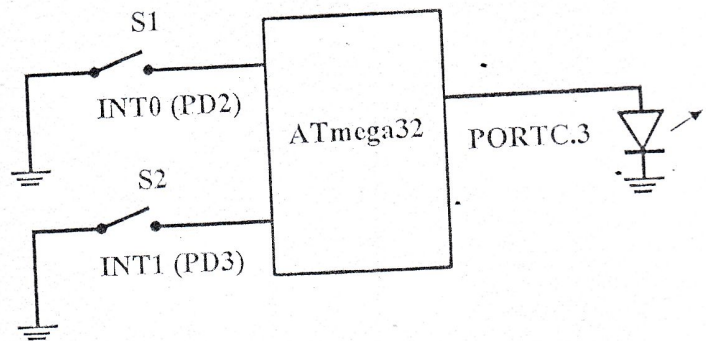
This exam consists of 6 problems. The total number of pages is 9, including the cover page. You have 3 hours to solve the problems. Put your final answer in the specified space for that.

Please note:

- This is a **CLOSED** book exam; however, students may bring their own ATmega32 Microcontroller datasheet.
- Consider ATmega32 Microcontroller running from 8 MHz crystal frequency.
- Use the free space after each assignment for your answer.

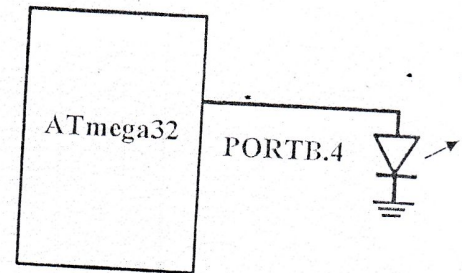
Question No. 2 (5 marks).

Assume that the INT0 and INT1 are connected to two SWITCHES named S1 and S2. Write a program in which, whenever S1 goes low, the content of EEPROM memory location 0x005F increases by one; and when S2 goes low, the content of EEPROM decreases by one. When the value stored in the EEPROM memory is bigger than 100, turn on the LED connected to PC3; otherwise, it is turned off. Use the external interrupt in level-triggered mode.



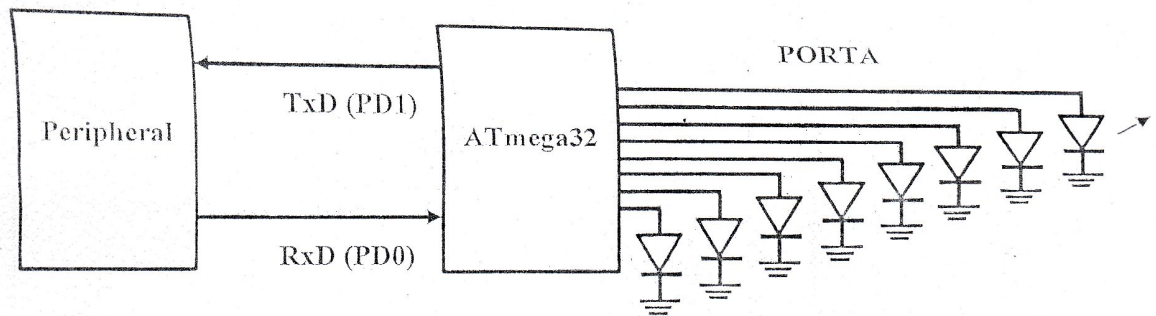
Question No. 3 (5 Marks).

Write a C program to toggle the LED connected to only the PORTB.4 bit continuously every second. Use TIMER1, Normal mode, and 1:256 prescaler to create the delay. Assume $XTAL = 8\text{ MHz}$.



Question No. 4 (5 marks).

Use the UART communication tool to transfer the letter 'Z' serially at 9600 baud, continuously and receive bytes of data serially and put them on Port A. Set the frame format to be 8-bit data, 1 stop bit, no parity bits. Assume XTAL = 8 MHz.



Question No. 5 (10 marks, 2 ½ each part).

Read the following program codes carefully, and write the function of each program code in the blank space provided:

C Program # 1	Function
<pre>#include <avr/io.h> int main (void) { while (EECR & (1 << EEWE)); EEAR = 0x5F; EEDR = 'G'; EECR = (1 << EEMWE); EECR = (1 << EEWE); return 0; }</pre>	

C Program # 2	Function
<pre>#include <avr/io.h> #define LED 7 #define SENSOR 1 int main (void) { DDRB = DDRB & ~(1 << SENSOR); DDRC = DDRC (1 << LED); while (1) { if (PINB & (1 << SENSOR)) PORTC = PORTC (1 << LED); else PORTC = PORTC & ~(1 << LED); } return 0; }</pre>	

C Program # 3	Function
<pre> #include <avr/io.h> int main (void) { DDRB = 0xFF; while (1) { T0Delay (); PORTB = PORTB ^ 0x10; } } void T0Delay () { TCNT0 = 186; TCCR0 = 0x02; while ((TIFR & (1 << TOV0)) == 0); TCCR0 = 0; TIFR = 0x1; } </pre>	

C Program # 4	Function
<pre> #include <avr/io.h> #include <avr/interrupt.h> int main () { DDRC = 0x08; PORTD = 1 << 2; GICR = (1 << INT0); sei (); while (1) { ISR (INT0_vect) { PORTC = ~(1 << 3); } } } </pre>	

Question No. 6 (10 Marks).

It is required to design a sliding door controlled by Atmega32. The store also counts the number of people entered in its EEPROM (\$000) and display it on LCD (PORT A). When user press a push button (ETX INT2), it activate a DC motor to open the door in one direction and increment the number stored in EEPROM. When the door is fully opened, another switch is activated (EXT INT1) to stop the motor for 5 seconds (use TIMER0), then the motor rotate in the reverse direction to close. When the door is fully closed, it activate another switch (EXT INT0) to stop the motor. The motor works according to the below table:

	PORTC.0	PORTC.1
Stop	0	0
Opening the door	1	0
Closing the door	1	1

- a) Draw the general layout of the embedded system. (4 marks)

- b) Write an AVR C program to control the sliding door and, count the number of visitors and display it on LCD. (6 marks)

Best Wishes

----- End of Questions -----

Dr. Osama Haraz

(XCK/T0) PB0	1	40	PA0 (ADC0)
(T1) PB1	2	39	PA1 (ADC1)
(INT2/AIN0) PB2	3	38	PA2 (ADC2)
(OC0/AIN1) PB3	4	37	PA3 (ADC3)
(SS) PB4	5	36	PA4 (ADC4)
(MOSI) PB5	6	35	PA5 (ADC5)
(MISO) PB6	7	34	PA6 (ADC6)
(SCK) PB7	8	33	PA7 (ADC7)
RESET	9	32	AREF
VCC	10	31	GND
GND	11	30	AVCC
XTAL2	12	29	PC7 (TOSC2)
XTAL1	13	28	PC6 (TOSC1)
(RXD) PD0	14	27	PC5 (TDI)
(TXD) PD1	15	26	PC4 (TDO)
(INT0) PD2	16	25	PC3 (TMS)
(INT1) PD3	17	24	PC2 (TCK)
(OC1B) PD4	18	23	PC1 (SDA)
(OC1A) PD5	19	22	PC0 (SCL)
(ICP1) PD6	20	21	PD7 (OC2)

Status Register

Bit	7	6	5	4	3	2	1	0	
	I	T	H	S	V	N	Z	C	SREG
Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

Bit 7 – I: Global Interrupt Enable
 Bit 6 – T: Bit Copy Storage
 Bit 5 – H: Half Carry Flag
 Bit 4 – S: Sign Bit, $S = N \oplus V$

Bit 3 – V: Two's Complement Overflow Flag
 Bit 2 – N: Negative Flag
 Bit 1 – Z: Zero Flag

The EEPROM Address Register – EEARH and EEARL

Bit	15	14	13	12	11	10	9	8	
	–	–	–	–	–	–	EEAR9	EEAR8	EEARH
	EEAR7	EEAR6	EEAR5	EEAR4	EEAR3	EEAR2	EEAR1	EEAR0	EEARL
Read/Write	R	R	R	R	R	R	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	X	

The EEPROM Data Register – EEDR

Bit	7	6	5	4	3	2	1	0	
	MSB							LSB	EEDR
Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

The EEPROM Control Register – EECR

Bit	7	6	5	4	3	2	1	0	
	–	–	–	–	EERIE	EEMWE	EEWE	EERE	EECR
Read/Write	R	R	R	R	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	X	0	

Bit 3 – EERIE: EEPROM Ready Interrupt Enable
 Bit 2 – EEMWE: EEPROM Master Write Enable

Bit 1 – EEWE: EEPROM Write Enable
 Bit 0 – EERE: EEPROM Read Enable

Interrupts

MCU Control Register – MCUCR

The MCU Control Register contains control bits for interrupt sense control and general MCU functions.

Bit	7	6	5	4	3	2	1	0	
	SE	SM2	SM1	SM0	ISC11	ISC10	ISC01	ISC00	MCUCR
Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

Bit 3, 2 – ISC11, ISC10: Interrupt Sense Control 1 Bit 1 and Bit 0

Bit 1, 0 – ISC01, ISC00: Interrupt Sense Control 0 Bit 1 and Bit 0

ISC11	ISC10	Description
0	0	The low level of INT1 generates an interrupt request.
0	1	Any logical change on INT1 generates an interrupt request.
1	0	The falling edge of INT1 generates an interrupt request.
1	1	The rising edge of INT1 generates an interrupt request.

ISC01	ISC00	Description
0	0	The low level of INT0 generates an interrupt request.
0	1	Any logical change on INT0 generates an interrupt request.
1	0	The falling edge of INT0 generates an interrupt request.
1	1	The rising edge of INT0 generates an interrupt request.

MCU Control and Status Register – MCUCSR

Bit	7	6	5	4	3	2	1	0	
	JTD	ISC2	–	JTRF	WDRF	BORF	EXTRF	PORF	MCUCSR
Read/Write	R/W	R/W	R	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0						See Bit Description

Bit 6 – ISC2: Interrupt Sense Control 2

General Interrupt Control Register – GICR

Bit	7	6	5	4	3	2	1	0	
	INT1	INT0	INT2	–	–	–	IVSEL	IVCE	GICR
Read/Write	R/W	R/W	R/W	R	R	R	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

Bit 7 – INT1: External Interrupt Request 1 Enable

Bit 5 – INT2: External Interrupt Request 2 Enable

Bit 6 – INT0: External Interrupt Request 0 Enable

General Interrupt Flag Register – GIFR

Bit	7	6	5	4	3	2	1	0	
	INTF1	INTF0	INTF2	–	–	–	–	–	GIFR
Read/Write	R/W	R/W	R/W	R	R	R	R	R	
Initial Value	0	0	0	0	0	0	0	0	

Bit 7 – INTF1: External Interrupt Flag 1

Bit 5 – INTF2: External Interrupt Flag 2

Bit 6 – INTF0: External Interrupt Flag 0

Port A Data Register – PORTA

Bit	7	6	5	4	3	2	1	0	
	PORTA7	PORTA6	PORTA5	PORTA4	PORTA3	PORTA2	PORTA1	PORTA0	PORTA
Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

Port A Data Direction Register – DDRA

Bit	7	6	5	4	3	2	1	0	
	DDA7	DDA6	DDA5	DDA4	DDA3	DDA2	DDA1	DDA0	DDRA
Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

Port A Input Pins Address – PINA

Bit	7	6	5	4	3	2	1	0	
	PINA7	PINA6	PINA5	PINA4	PINA3	PINA2	PINA1	PINA0	PINA
Read/Write	R	R	R	R	R	R	R	R	
Initial Value	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	

Time/Counter Control Register – TCCR0

Bit	7	6	5	4	3	2	1	0	
	FOC0	WGM00	COM01	COM00	WGM01	CS02	CS01	CS00	TCCR0
Read/Write	W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

Bit 7 – FOC0: Force Output Compare

Bit 5:4 – COM01:0: Compare Match Output Mode

Bit 6, 3 – WGM01:0: Waveform Generation Mode

Bit 2:0 – CS02:0: Clock Select

Mode	WGM01 (CTC0)	WGM00 (PWM0)	Timer/Counter Mode of Operation	TOP	Update of OCR0	TOV0 Flag Set-on	COM01	COM00	Description
0	0	0	Normal	0xFF	Immediate	MAX	0	0	Normal port operation, OC0 disconnected.
1	0	1	PWM, Phase Correct	0xFF	TOP	BOTTOM	0	1	Toggle OC0 on compare match
2	1	0	CTC	OCR0	Immediate	MAX	1	0	Clear OC0 on compare match
3	1	1	Fast PWM	0xFF	BOTTOM	MAX	1	1	Set OC0 on compare match

Timer/Counter Register – TCNT0

Bit	7	6	5	4	3	2	1	0	
	TCNT0[7:0]								TCNT0
Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

Output Compare Register – OCR0

Bit	7	6	5	4	3	2	1	0	
	OCR0[7:0]								OCR0
Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

Timer/Counter
Interrupt Mask
Register – TIMSK

Bit	7	6	5	4	3	2	1	0	
	OCIE2	TOIE2	OCIE1	OCIE1A	OCIE1B	TOIE1	OCIE0	TOIE0	TIMSK
Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

Bit 1 – OCIE0: Timer/Counter0 Output Compare Match Interrupt Enable
Bit 0 – TOIE0: Timer/Counter0 Overflow Interrupt Enable

Timer/Counter
Interrupt Flag Register
– TIFR

Bit	7	6	5	4	3	2	1	0	
	OCF2	TOV2	ICF1	OCF1A	OCF1B	TOV1	OCF0	TOV0	TIFR
Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

Bit 1 – OCF0: Output Compare Flag 0
Bit 0 – TOV0: Timer/Counter0 Overflow Flag

Timer/Counter1
Control Register A –
TCCR1A

Bit	7	6	5	4	3	2	1	0	
	COM1A1	COM1A0	COM1B1	COM1B0	FOC1A	FOC1B	WGM11	WGM10	TCCR1A
Read/Write	R/W	R/W	R/W	R/W	W	W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

Bit 7:6 – COM1A1:0: Compare Output Mode for Compare unit A
Bit 5:4 – COM1B1:0: Compare Output Mode for Compare unit B
Bit 3 – FOC1A: Force Output Compare for Compare unit A
Bit 2 – FOC1B: Force Output Compare for Compare unit B
Bit 1:0 – WGM11:0: Waveform Generation Mode

CS02	CS01	CS00	Description
0	0	0	No clock source (Timer/Counter stopped).
0	0	1	clk_{RCY} (No prescaling)
0	1	0	$clk_{RCY}/8$ (From prescaler)
0	1	1	$clk_{RCY}/64$ (From prescaler)
1	0	0	$clk_{RCY}/256$ (From prescaler)
1	0	1	$clk_{RCY}/1024$ (From prescaler)
1	1	0	External clock source on T0 pin. Clock on falling edge.
1	1	1	External clock source on T0 pin. Clock on rising edge.

COM1A1/COM1B1	COM1A0/COM1B0	Description
0	0	Normal port operation, OC1A/OC1B disconnected.
0	1	Toggle OC1A/OC1B on compare match
1	0	Clear OC1A/OC1B on compare match (Set output to low level)
1	1	Set OC1A/OC1B on compare match (Set output to high level)

Mode	WGM13	WGM12 (CTC1)	WGM11 (PWM11)	WGM10 (PWM10)	Timer/Counter Mode of Operation	TOP	Update of OCR1x	TOV1 Flag Set on
0	0	0	0	0	Normal	0xFFFF	Immediate	MAX
1	0	0	0	1	PWM, Phase Correct, 8-bit	0x00FF	TOP	BOTTOM
2	0	0	1	0	PWM, Phase Correct, 9-bit	0x01FF	TOP	BOTTOM
3	0	0	1	1	PWM, Phase Correct, 10-bit	0x03FF	TOP	BOTTOM
4	0	1	0	0	CTC	OCR1A	Immediate	MAX
5	0	1	0	1	Fast PWM, 8-bit	0x00FF	BOTTOM	TOP
6	0	1	1	0	Fast PWM, 9-bit	0x01FF	BOTTOM	TOP
7	0	1	1	1	Fast PWM, 10-bit	0x03FF	BOTTOM	TOP
8	1	0	0	0	PWM, Phase and Frequency Correct	ICR1	BOTTOM	BOTTOM
9	1	0	0	1	PWM, Phase and Frequency Correct	OCR1A	BOTTOM	BOTTOM
10	1	0	1	0	PWM, Phase Correct	ICR1	TOP	BOTTOM
11	1	0	1	1	PWM, Phase Correct	OCR1A	TOP	BOTTOM
12	1	1	0	0	CTC	ICR1	Immediate	MAX
13	1	1	0	1	Reserved	–	–	–
14	1	1	1	0	Fast PWM	ICR1	BOTTOM	TOP
15	1	1	1	1	Fast PWM	OCR1A	BOTTOM	TOP

Timer/Counter1
Control Register B –
TCCR1B

Bit	7	6	5	4	3	2	1	0	
	ICNC1	ICES1	–	WGM13	WGM12	CS12	CS11	CS10	TCCR1B
Read/Write	R/W	R/W	R	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

Bit 7 – ICNC1: Input Capture Noise Canceler
Bit 6 – ICES1: Input Capture Edge Select
Bit 5 – Reserved Bit
Bit 4:3 – WGM13:2: Waveform Generation Mode
Bit 2:0 – CS12:0: Clock Select



Operation Research326 R

11-5-2018

Third Level: Computer Science Section

Time: 3 hours

Total Degree (50 marks)

Science Faculty

Mathematical Department

Answer the following Questions:

1-Use the Simplex method to solve the following linear programming

Maximize $Z = 10x_1 + 11x_2$

Subject to $x_1 + 2x_2 \leq 150$, $3x_1 + 4x_2 \leq 200$, $6x_1 + x_2 \leq 175$

and $x_1, x_2 \geq 0$

(10 marks)

2) Use the graphical and the algebraic method to solve the problem

Max $f(\underline{x}) = 5x_1 + 7x_2$ Subject to $5x_1 + 8x_2 \leq 24$, $x_1 + x_2 \leq 4$,

$10x_1 + 7x_2 \leq 35$ and $x_1, x_2 \geq 0$

(12.5marks)

3) Use the Lagrange multiplier method to find the extreme points of the problem

Minimize $f(\underline{x}) = x_1^2 + x_2^2 - 3x_1x_2$

Subject to $g(\underline{x}) = x_1^2 + x_2^2 - 8 = 0$.

(12.5marks)

4) Use the Hessian Matrix to find the local points of the problem

$f(\underline{x}) = f(x_1, x_2) = x_1^3 + x_2^3 + 2x_1^2 + 4x_2^2 + 6$

(10marks)

5) Find the local Points

$f(x) = 3x^4 - 20x^3 + 36x^2 + 16$ (5marks)

Best Wishes

Dr. Alaa Fahim

اجب عن خمسة فقط من الاسئلة الاتية :- (10 درجات لكل سؤال : بواقع 5 درجات لكل فقرة)

(1) (i) اوجد الحل العام للمعادلة : $p_1 + 3p_2 + 2p_3(1 + \sqrt{x_1 + x_2 + x_3 - u}) = 6$
(ii) اوجد الحل الخاص للمعادلة : $(y - z)[2xyp + (x^2 - y^2)q] + z(x^2 - y^2) = 0$
الذي يمر خلال المنحنى $y = 0, x^3 = z^2$

(2) اوجد الحل العام لكل من المعادلتين التفاضليتين الجزئيتين الاتيتين :-
(i) $(D_1^3 - D_1^2 D_2 - D_1 D_2^2 + D_2^3)z = \log(x + y)$
(ii) $(D_1^2 - a^2 D_2^2)z = x^2 + y^2$, ثابت مطلق a

(3) اوجد الحل العام لكل من المعادلتين التفاضليتين الجزئيتين الاتيتين :-
(i) $(D_1^2 D_2 + D_2^2 - 2)z = e^{2y} \sin 3x - e^x \cos 2y$
(ii) $(D_1^2 - D_2^2 - D_1 - 3D_2 - 2)z = e^{2x-3y} + x + y + 1$

(4) (i) احسب التكاملات الاتية :-
(a) $\int_0^{\infty} x^{-\frac{1}{3}}(1 + 2x)^{-3} dx$ (b) $\int_0^1 \sqrt{\log \frac{1}{x}} dx$

(ii) اثبت ان :-
(a) $\tan^{-1} x = x {}_2F_1(1, \frac{1}{2}; \frac{3}{2}; -x^2)$
(b) $(a - b) {}_2F_1(a, b; c; x) = a {}_2F_1(a + 1, b; c; x) - b {}_2F_1(a, b + 1; c; x)$

(5) اثبت ان دوال بسل من النوع الاول $J_n(x)$ تحقق الاتي :-
(i) $J_{-\frac{1}{2}}(x) = \sqrt{\frac{2}{\pi x}} \cos x$, (ii) $\int x^n J_{n-1}(x) dx = x^n J_n(x) + c$

(6) (i) اثبت ان كثيرات حدود لجندر $P_n(x)$ تحقق :-
(ii) احسب التكاملات الاتية :-
(a) $\int_{-1}^1 x P_n(x) P_{n+1}(x) dx$, (b) $\int_{-1}^1 x^2 P_n(x) P_{n+1}(x) dx$, (c) $\int_{-1}^1 x^2 P_n(x) dx$



Question 1: Put True or False for each of the following items (30 marks)

1. To enter a formula into a cell, begin by typing an equal sign.
2. Functions are pre-defined worksheet formulas.
3. Formulas in Excel must be written in a very specific format, referred to as syntax.
4. The second order of precedence is for exponentiation.
5. When the formula in cell **B7 =B4+B5+B6** is copied into cell **C7** the formula will be changed to **= C4+C5+C6**.
6. The error "#####" means Data being referenced is not available.
7. The range **B2:B7** is a range down a column.
8. To keep things clear and simple only add an absolute (\$) cell reference if absolutely necessary.
9. The formula **=ROUND(78.686788,-1)** results in the value 80 .
10. Placing an absolute sign in front of a ranged name (**\$budget**) is incorrect syntax.
11. The columns of the worksheet are named with Numbers.
12. Cells may contain only Labels and Values.
13. The cell address first lists the row name and then the column name.
14. This selected cell is referred to as the **active cell**.
15. The contents of the active cell will also be displayed on the **formula bar**.
16. A cell that is on sheet 3, in the second column third row would be referred to as **Sheet3@B3**.
17. Formatted Display is the number of decimal places that appear in a cell.
18. Formulas can be copied to perform different operations on a corresponding set of data.
19. The function **COUNT(value1,[value2],...)** counts non-blank cells.
20. The Average function ignore the blank cells.
21. TRUE and FALSE are called Boolean Values.
22. SPSS stands for Statistical Package for the Social Sciences.
23. SPSS is capable of handling large amounts of data.
24. SPSS has only two windows Data view and Output view.
25. **Transform** menu includes several options to change current variables.
26. In SPSS, Each column typically represents the data from 1 case.
27. In SPSS, The first column of variable view is Name.
28. In SPSS, you can sort data from **Transform** menu then **Sort Cases**.
29. Descriptive statistics are calculated using the **Analyze** menu.
30. Correlation is used to test the degree of association between variables.

Answer Sheet		
	True	False
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Question 2: (10 marks)

	A	B	C	D	E	F	G
1		MT1	MT2	Final	Total	Honors	Passed
2	Possible points	100	100	200	400		320
3							
4	Blue	79	89	169	337	FALSE	TRUE
5	Jones	85	65	195	345	FALSE	TRUE
6	Grey	60	97	187	344	TRUE	TRUE
7	Mary	10	30	50	90	TRUE	FALSE
8							

Write the following Boolean functions

1. Blue's total and Jones' total are greater than Grey's:
2. Grey's total is not the maximum grade:
3. None of the students passed the course
4. Blue is not an Honors student
5. Blue didn't get a passing grade (320)

Question 3: (10 marks)

1. What are the difference between Data View, Variable View and Output View in SPSS?
2. Some significance tests are very restrictive about the form of data they can accept. What are the different types of measurement?
3. Describe how to test the degree of association between variables by SPSS.
4. Explain how to use SPSS to calculate the frequency and percent of females and males who did and did not have social problems.

Q2.

- a. Maintain two different Algorithm of crossover process with mention the probability of crossover (5 marks)
- b. Maintain two different Algorithm of mutation process with mention the probability of mutation. (5 marks)

Q3. a. Maintain tree type representation of solutions in genetic algorithm. (3 marks)

b. Using genetic algorithm to find the maximum value of the function $(15x - x^2)$ where parameter x varies between 0 and 15. For simplicity, we may assume that x takes only integer values. Using the genetic algorithm procedure in one step and begin with four solutions in initial solutions. (10 marks)

Q4. Discuss the internal structure of Taxi driver Robot. (7 marks)

Q5. Discuss the Tabu search method and maintain the type of memory using in this method and maintain the Tabu search algorithm. (10 marks)

==best wishes==

Dr. Alaa F. Mohamed

Answer the following questions: (50 Marks)

Question 1: Answer the following points (10 Marks)

- 1- Explain the internet "nuts and bolts"?
- 2- Explain the sources of packet delay?
- 3- What are protocols?
- 4- Explain Access network: digital subscriber line (DSL)?

Question 2: Answer the following points (10 Marks)

- 1- What is the network core?
- 2- Explain Packet Switching: queueing delay, loss?
- 3- Define throughput?
- 4- Define and explain traffic intensity?

Question 3: Answer the following points (10 Marks)

- 1- Explain the Internet protocol stack?
- 2- Mention some network applications?
- 3- Explain the application client-server architecture?
- 4- Explain P2P architecture?

Question 4: Answer the following points (10 Marks)

- 1- HTTP is "stateless". What does that mean?
- 2- Compare between persistent HTTP and non-persistent HTTP?
- 3- Give examples of HTTP response status codes?
- 4- Explain the term (web caches) and how it is useful?

Question 5: Answer the following points (10 Marks)

- 1- Give a DNS name resolution example?
- 2- Compare between multiplexing and demultiplexing? Support your answer with a diagram?
- 3- Define and explain the use of ACKs and NAKs?
- 4- Define and explain HOL? Support your answer with a diagram?

جامعة أسيوط	مايو 2018	كود المقرر: 356 رك
كلية العلوم		المقرر : مقدمة فى الحسابات العلمية
قسم الرياضيات		الزمن : ساعتان

Answer the following questions by using MATLAB language: (50 marks)

1- Using Newton's forward difference formula, find $y(0.1)$ using the table below:

x	0.0	0.2	0.4	0.6	0.8
y	1.000	1.22140	1.49182	1.82212	2.22554

2- Solve the differential equation by Adams method (without using nested for loops) at $x=0.2$:

$$\frac{dy}{dt} = t^2 - y, \quad y(0) = 1, \quad h = 0.05.$$

and compare it with the analytic solution $y = -e^{-t} + t^2 - 2t + 2$.

3- Solve the following initial value problem:

$$\frac{d^2u}{dt^2} + 4\frac{du}{dt} + 3u = 0, \quad u(0) = 1, \quad \frac{du}{dt}(0) = 0.$$

4- Let $f(x) = \cos 2x$ and $x_0 = 0$. Determine

- The third Taylor polynomial for f about x_0 .
- Find error bound at $x = 0.2$ and compare it to the actual error.

5- For the well-known Chua's circuit equation in chaotic studies that

$$\dot{x} = \alpha[y - x - f(x)], \quad \dot{y} = x - y + z, \quad \dot{z} = -\beta y - \gamma z, \quad t \in (0, 10),$$

where the nonlinear function $f(x)$ is described by

$$f(x) = bx + 0.5(a-b)(|x+1| - |x-1|) \text{ and } a < b < 0.$$

Write an M-function to describe the equation, and draw the phase trajectory for the parameters $\alpha = 9$, $\beta = 100/7$, $\gamma = 0$, $a = -8/7$, $b = -5/7$, and initial conditions

$$x(0) = -2.121304, \quad y(0) = -0.066170, \quad z(0) = 2.881090.$$

Good Luck

Dr. Tarek Aboelenen



امتحان الفرقة الثالثة شعبة الرياضيات

الزمن : ثلاث ساعات

رقم المقرر ورمزه : ١٣٤٦

المقرر : عمليات عشوائية وتطبيقاتها

أجب عن خمسة أسئلة فقط مما يأتي :- درجة جزء كل سؤال (خمس درجات)

١- (أ) لمجموعة المتغيرات العشوائية المستقلة $X_1, X_2, X_3, \dots$ بفرض أن التوقع الرياضي $E(X_i) = m$ والتباين $V(X_i)$ لكل منها محدود عرف كل من التقارب عن طريق الإحتمال وقانون الأعداد الكبرى (الضعيف).
(ب) بفرض أن $f f s s f s f f s s s f f s f f s$ هي إحدى النتائج الممكنة في محاولات برنولي العشوائية المستقلة بحيث أن $P(s) = p, P(f) = q, p + q = 1$ عرف عملية عشوائية في الفراغ R^2 موضحا ذلك بيانيا .

٢- (أ) في عملية برنولي العشوائية $\{X_n; n > 0\}$ بالإحتمال $p = 0.6$ إذا كان $X = X_1 + X_2$ ، $Y = X_1 + X_3$ احسب الإحتمالات الآتية : $P(X < 2, Y \leq 1)$ ، $P(2X < 3Y)$ ، $P(Y = X)$.
(ب) في السؤال (٢-أ) أوجد العزم الارتباطي بين X ، Y موضحا العلاقة بينهما .

٣- (أ) وضح العلاقة بين عملية برنولي العشوائية $\{X_n; n > 0\}$ و العملية العشوائية $\{Y_n; n \geq 0\}$ حيث أن المتغير Y_n يخضع لتوزيع ذي الحدين واذكر صفات كل منهما ثم عبر مع الإستنتاج عن إحتمال الحادث $(Y_{n+1} = k)$ من خلال إحتمالات الحوادث : $(Y_n = k)$ ، $(Y_n = k - 1)$ لأي عدد صحيح $k > 0$.
(ب) في العملية العشوائية $\{Y_n; n \geq 0\}$ أوجد كل من $E(Y_5)$ ، $E(Y_4^2)$ ، $P(Y_5 = 3, Y_7 = 4, Y_{14} = 9)$.

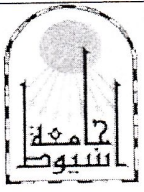
٤- (أ) عرف أزمنة النجاح T_k كعملية عشوائية موضحا العلاقة بينها وبين العملية العشوائية $\{Y_n; n \geq 0\}$ ثم اذكر فقط توزيع المتغير العشوائي T_k .
(ب) - في عملية بواسون العشوائية $\{N_t; t \geq 0\}$ بالمعدل $\lambda = 4$ احسب كل من الإحتمالات الآتية :
 $P(N_{1.5} = 2, N_4 = 5, N_{6.8} = 9)$ ، $P(N_3 = 5, N_7 = 9)$

٥- (أ) في عملية بواسون أو عملية الوصول المعودة $\{N_t; t \geq 0\}$ بالمعدل λ إثبت أن الإحتمال المشروط لعدد الوصول N_t بالنسبة إلى عدد الوصول N_{t+s} لكل $t > 0, s > 0$ يمثل توزيع ذي الحدين.
(ب) عرف العمليات العشوائية المستقلة ثم اثبت أن أي عمليتين مستقلتين لبواسون هو أيضا عملية بواسون .

٦- (أ) في عملية التجديد العشوائية $R = \{R_n; n \in N\}$ حيث N هي فئة الأعداد الصحيحة غير السالبة عرف دالة التجديد ثم عبر عنها من خلال توزيع المتغير R_n مع الإستنتاج .

(ب) في سلسلة ماركوف العشوائية المتقطعة $\{X_n; n \geq 0\}$ عرف مصفوفة الإحتمالات الإنتقالية بصفاتها المعروفة ثم احسب الإحتمال : $P(X_0 = 1, X_1 = 1, X_2 = 0, X_3 = 1, X_4 = 0, X_6 = 0)$ بفرض أن حالات الفراغ $(0, 1)$ والمصفوفة العشوائية

$$P = \begin{pmatrix} 1/2 & 1/2 \\ 1/3 & 2/3 \end{pmatrix} , \text{ ومنتجه الإحتمالات الابتدائية } \pi_0 = (2/5 \quad 3/5)$$

	المقرر: تحليل عددي (٣٢٣) الفرقة: المستوى الثالث الدرجة: ٥٠ درجة التاريخ: ٢٠١٨/٥/٢٩ الزمن: ثلاث ساعات	جامعة أسيوط كلية العلوم - قسم الرياضيات امتحان نهائي الفصل الدراسي الثاني للعام الجامعي ٢٠١٧/٢٠١٨
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Answer five questions only :- (10 marks for every question)

1-a) If the function $g \in C[a, b]$ and $g(x) \in [a, b] \forall x \in [a, b]$ and $g'(x)$ exist with $|g'(x)| \leq k < 1 \forall x \in [a, b]$ prove that the sequence defined by $P_n = g(P_{n-1}), n \geq 1$ will converge to the unique fixed point P and also $|P_{n+1} - P_n| \leq k^n |P_1 - P_0|$.

1-b) Verify that when Newton's method is used to compute $\sqrt{A}, A > 0$ (By solving the equation : $f(x) = x^2 - A$). The sequence of iterates is defined by : $x_{n+1} = (x_n + \frac{A}{x_n})/2$, and show that if the sequence $\{x_n\}$ is defined as the previous problem, then this method is quadratically convergence.

2-a) Derive Lagrange interpolation formula of degree n and write the error of the method.

2-b) For the given function $f(x) = \cos \pi x$ let $x_0 = -1, x_1 = 0, x_2 = 1$ construct the suitable interpolation polynomial and find the actual error.

3) Derive the formula of the Newton's interpolatory divided difference method and use this formula to obtain a polynomial of least degree that fits the values shown:

x	0	1	2	4	6
$f(x)$	1	9	23	93	259

من فضلك انظر خلف الورقة

السؤال الرابع :-

أ) يعرف الطي للدالتين $f(x)$, $g(x)$ كالآتي

$$f * g = \int_{-\infty}^{\infty} f(u) g(x-u) du$$

برهن علي أن تحويل فوريير للطرف الأيمن هو حاصل ضرب تحويلي فوريير للدالتين $f(x)$, $g(x)$

ب) أوجد تحويل فوريير للدالة $f(x) = \begin{cases} 1 & |x| < a \\ 0 & |x| > a \end{cases}$ وأرسم $f(x)$ كذلك تحويلها عند $a = 3$ وأوجد

$$\int_{-\infty}^{\infty} \frac{\sin u}{u} du \quad \text{كذلك} \quad \int_{-\infty}^{\infty} \frac{\sin \alpha a \cos \alpha x}{\alpha} d\alpha$$

ج) ترك خيط لانهائي من السكون وكانت أزاحته الابتدائية عن محور x هي $f(x)$ أوجد الإزاحه عند أي زمن .

انتهت الأسئلة مع تمنياتنا بالتوفيق ،،،،

لجنة الممتحنين :- أ. د/ نجاه عبد الرحمن حسين ، أ. د/ فاروق علي السيد



الامتحان النهائي للفصل الدراسي الثاني للعام الجامعي ٢٠١٧/٢٠١٨ م
 للفرقة : الثالثة
 الشعبة : الرياضيات
 التاريخ : ٢٠١٨/٥/٢٤ م

الزمن : ساعتان

الدرجة الكلية : ٥٠ درجة
 درجة كل سؤال : ١٧ درجة

أسم المقرر : الطرق الرياضية
 رقم المقرر ورمزه : ٣٣٤ ر

أجب عن ثلاثة أسئلة فقط مما يأتي :-
 السؤال الأول :-

أوجد تحويل لابلاس للمشتقة التفاضلية للدالة $F(t)$ عند نقط الاتصال والانفصال للدالة .

$$\lim_{t \rightarrow 0} F(t) = \lim_{s \rightarrow \infty} s f(s)$$

أبرهن علي أن

$$\lim_{s \rightarrow \infty} F(t) = \lim_{s \rightarrow 0} s f(s)$$

$$\Gamma\left(\frac{1}{2}\right) = \sqrt{\pi}, \quad \int_0^{\infty} \delta(t) dt = 1, \quad L \sin \sqrt{t} = \frac{\sqrt{\pi}}{3} e^{-\frac{1}{4s}} s^{\frac{3}{2}}$$

السؤال الثاني :-

حل المعادلات الآتية :

$$t Y''(t) + Y'(t) + 4t Y(t) = 0, \quad y(0) = 3, y'(0) = 0$$

$$\frac{\partial U}{\partial x} = 2 \frac{\partial U}{\partial t} + U, \quad x > 0, t > 0 \quad U(x, 0) = 6 e^{-3x}$$

$$\int_0^t Y(u) Y(t-u) du = 16 \sin 4t$$

السؤال الثالث :-

أ) فك الدالة $f(x) = x^2$, $0 < x < 2\pi$ بدلالة متسلسلة فوريير ثم أحسب المجموع

$$1 + \frac{1}{2^2} + \frac{1}{3^2} + \frac{1}{4^2} + \dots$$

ب) صفيحة علي شكل دائري نصف قطرها الوحدة ووجهيها معزولين ونصف محيطها محفوظ عند درجة حرارة u_1

والآخر عند u_2 أوجد حالة الأتزان الحراري .

من فضلك أنظر بقية الأسئلة خلف الورقة ،،،،،



Answer the following questions (50 marks)

Q1.	Complete the following: (1)..... is a representation of a two-dimensional image as a finite set of digital values, called picture elements or pixels - Common image formats include.....(2).... ,(3)..... ,(4)..... (5)..... creates a Distance tool a draggable, resizable line that measures the distance between its endpoints. (6)..... These are the result of objects that are self-luminous, such as stars and light bulbs. (7).....the resulting output pixel is computed as a sum of products of the pixel values and mask coefficients in the pixel's neighborhood in the original image. - The Sobel operators used to compute edges are(8)..... ,(9)..... - Edge detector should have:(10)..... ,(11)..... - Types of noise are(12)..... ,(13)....	(13 marks)
Q2.	a) Compute Z from the following matlab script (6 marks) <pre> x = [150 10 90;80 50 60;121 160 20] y = [-1 0 1;-2 0 2;-1 0 1] z = imfilter(x,y,'corr') </pre> b) What is the Delta compression and compute the compressed data of the data (6 marks) 220 321 335 211 250 200 233 214 232 212	(12 marks)
Q3.	a) Write the MATLAB code used to: (4 marks) - Read any image then use affine transformation matrix for each of the operations below: - Flip the image right to left - Translation by [25, 15] pixels b) What are the main differences between: (8 marks) - Global thresholding and optimal thresholding. - Raster and vector image . - Interpixel redundancy and Psychovisual redundancy	(12 marks)

(Q5) (i) Assume that U, V are open intervals and let $f : U \rightarrow \mathbb{R}$ and $g : V \rightarrow \mathbb{R}$ be two differentiable functions such that $f(U) \subset V$. Prove that $g \circ f$ is differentiable on U and that $(g \circ f)' = (g' \circ f) \cdot f'$ [5 marks]

(ii) Prove that the function $f(x) := \frac{1}{x}$ is differentiable on $]0, \infty[$ but not uniformly continuous therein. [5 marks]

(Q6) (i) State and prove Rolle's theorem then use it to prove the mean value theorem. [6 marks]

(ii) Let I be an open interval. Apply the mean value theorem to prove that a function differentiable on I is

1. increasing if and only if $f' \geq 0$ on I ,

2. decreasing if and only if $f' \leq 0$ on I .

[4 marks]

With the best of luck,

Prof. Rashwan A. Rashwan,

Dr. Ahmed A. Abdelhakim



Time: 3 hours

Total mark: 50

Answer *only five* of the following questions:

(Q1) (i) Suppose that O_i , $i \geq 1$, are open subsets of $\mathbb{R}$. Prove that $\cup_{i \geq 1} O_i$ is also open in $\mathbb{R}$. [5 marks]

(ii) Let $S \subset \mathbb{R}$. Show that S is closed if and only if S contains the limit point of every convergent sequence of elements of S . [5 marks]

(Q2) (i) Prove that a sequence of real numbers converges if and only if it is a Cauchy sequence. [6 marks]

(ii) Show that if $(x_n)_{n \geq 1} \subset \mathbb{R}$ is a monotonically increasing sequence that is bounded above, then $x_n \rightarrow \sup_{n \geq 1} x_n$, as $n \rightarrow \infty$. [4 marks]

(Q3) (i) Show that $f : D \subset \mathbb{R} \rightarrow \mathbb{R}$ is continuous at $x_0 \in D$ if and only if the sequence $(f(x_n))_{n \geq 1}$ converges to $f(x_0)$ whenever $(x_n)_{n \geq 1}$ is a sequence in D that converges to x_0 . [6 marks]

(ii) Use the characterization given in (i) to prove the discontinuity at the origin of the function $f(x) = \begin{cases} \cos \frac{1}{x}, & x \neq 0; \\ 0, & x = 0. \end{cases}$ [4 marks]

(Q4) (i) Assume that D is a closed bounded subset of $\mathbb{R}$. Prove that if $f : D \rightarrow \mathbb{R}$ is continuous then f is bounded on D , and there exist $\alpha, \beta \in D$ such that $f(\alpha) = \max_{x \in D} f(x)$ and $f(\beta) = \min_{x \in D} f(x)$. [5 marks]

(ii) Argue by contradiction to demonstrate that if $f : [a, b] \rightarrow \mathbb{R}$ is continuous then it is uniformly continuous on $[a, b]$. [5 marks]

Please Turn over the page

Assiut University
Faculty of Science
Math. Dep.

4th Mathematics
Complex Analysis 412M
Instructor: Professor Dr. Mohamed Abd El-Rahman Ahmed

Time: 3 hours
Jun : 2013

Answer only five of the following questions:

1- a) **Mention with details** five properties that are satisfied for real functions and not satisfied for corresponding complex functions. (5 degrees)

b) **Show that** $z\bar{z} = |z|^2 \quad \forall z \in C$ and deduce that

$$||z_1| - |z_2|| \leq |z_1 - z_2| \quad \forall z_1, z_2 \in C. \quad (5 \text{ degrees})$$

2- a) **State and prove** Cauchy Integral Formula. (3 degrees)

b) **Solve** the equations $e^{2z-1} = 1$, $\cos(z) = 2$, $\ln(z) = \frac{\pi}{2}i$, $\sinh(z) = i$. (7 degrees)

3- a) **Give and prove** the characterization of the continuity of complex-valued functions. (5 degrees)

b) **Write** Cauchy-Riemann equations at a point. Use these equations to exhibit that the function $f(z) = |z|^2$ hasn't derivative at any point $z \neq 0$. (5 degrees)

4- a) **State and prove** Residue Theorem. (3 degrees)

b) **Show that** $x \cos(x) \cosh(y) + y \sin(x) \sinh(y) - 3e^{-x} \cos(y)$ is a harmonic function.

Also, determine the corresponding analytic function f where the given

function is an imaginary component of f with $f(0) = -3$. Finally, verify that

$$f(z) - f(-z) + 6 \cosh(z) = 0. \quad (7 \text{ degrees})$$

5- a) **Verify that:**

$$\frac{z_1}{z_2} = \frac{z_1 \bar{z}_2}{|z_2|^2}; \quad z_2 \neq 0, \quad \ln(z) = \ln|z| + i(\arg(z) + 2n\pi); \quad n = 0, \pm 1, \quad (6 \text{ degrees})$$

$$\cosh(z) = \cosh(\operatorname{Re}(z)) \cos(\operatorname{Im}(z)) + i \sinh(\operatorname{Re}(z)) \sin(\operatorname{Im}(z))$$

b) **Using Cauchy Integral Formula for Derivatives of Analytic Functions, find:**

$$\int_C \frac{5z-2}{z^3(z-3)} dz \text{ where } C \text{ is the circle } |z|=2, \text{ described counterclockwise. (4 degrees)}$$

6- a) **State and deduce** the characterization of the limit of complex sequences. (3 degrees)

b) (I) **Using Residue Theorem, evaluate** $\int_C \frac{3z^2+2}{(z-1)(z^2+9)} dz$ taken

counterclockwise around the circle $|z-2|=2$.

(II) **Write** Laurent series of the function $\frac{z-1}{z^2}$ for the domain $|z-1|>1$. (7 degrees)

The End

GOOD LUCK