



Answer the following questions:

[Q1:] Choose the correct answer:- [30 marks]

- In MS Excel. The menu option that can be used to split windows into two is
A. Format - > Window B. View - > Window - > Split
C. Window - > Split D. View - > Split
- Which of the following is not a valid data type in Excel?
A. Number B. Character C. Currency D. Date/Time
- Concatenation of text can be done using
A. Apostrophe (') B. Exclamation (!)
C. Hash (#) D. Ampersand (&)
- The cell reference for cell range of G2 to M12 is
A. G2.M12 B. G2:M12 C. G2:M12 D. G2-M12
- Which of the following is correct?
A. =AVERAGE(4, 5, 6, 7) B. =AVERAGE(A1, B1, C1)
C. =AVERAGE(A1:A9, B1:B9) D. =All of the above
- In MS-EXCEL program, assume that the current worksheet is blank, and only the cells B4, C1, D1, E1 and F1 contain the values 1, 3, 7, 2 and 5, respectively. If the cell B5 contain the expression: B5= SUM(LARGE(B4:F4,1,2,3))+ROUNDUP(5.499;0) the the value of B5 after executions is then
A. 12 B. 20 C. 21 D. 22
- What is the advantage of using SPSS over calculating statistics by hand?
A. It equips you with a useful transferable skill.
B. It reduces the chance of making errors in your calculations.
C. Many researchers use SPSS as it is a recognized software package.
D. All of the above.
- While using SPSS software program, in the _____ tab rows represent variables and columns represent characteristics of variables.
A. Data view B. Variable view
C. Output viewer D. Data editor
- How is a variable name different from a variable label?
A. It is shorter and less detailed B. It is longer and more detailed
C. It is abstract and unspecific D. It refers to codes rather than variables
- To generate a Spearman's rho test, which set of instructions should you give SPSS?
A. Analyze; Crosstabs; Descriptive Statistics; Spearman; OK
B. Graphs; Frequencies; select variables; Spearman; OK
C. Analyze; Compare Means; Anova table; First layer; Spearman; OK
D. Analyze; Correlate; Bivariate; select variables; Spearman; OK

(Please turn the page for the rest of the questions) %

[Q2-a] State, only four MS Excel Error Values. [4 marks]

[Q2-b:] By using MS Excel, describe two different methods that can be used to calculate $\lim_{n \rightarrow \infty} x_n$ as the convergence point of the sequence $X_{r+1} = x_r - \frac{x_r^2 - 2}{2x_r}$, $r = 0, 1, 2, \dots$. Use $x_0 = 1$. [4 marks]

[Q2-c:] What does it mean by each of the following Microsoft Excel Vocabulary words:- Active Cell Formula Bar Workbook Worksheet. [2 marks]

[Q3-a:] It is assumed that the sample 12.5, 13, 15, 17, 16, 12, 13, 15, 16, 12.5, 19, 13, 16 was drawn from a normal distribution $N(\mu, \sigma^2)$, and there is a claim that the $\mu = 14$. From these data, and by using the following SPSS output tables. [6 marks]

T-Test

One-Sample Statistics				
	N	Mean	Std. Deviation	Std. Error Mean
X	14	14.5714	2.05555	.54937

One-Sample Test						
Test Value = 14						
	t	df	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of the Difference	
					Lower	Upper
X	1.040	13	.317	.5714	-.6154	1.7583

- At five percentage significance level, write a report about this claim.
- Construct a 95 % confidence interval for the measure of interocular pressure.
- Describe, in details, how this test statistics could be done by using SPSS programs.

[Q3-b:] The following table shows the relation between two variables X and Y. [4 marks]

X	4	3	6	9	4	10
Y	3	4	5	7	3	9

From these data, and by using the following SPSS output table, write the best regression line of Y on X.

Coefficients^a

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	.452	.862		.525	.628
	X	.786	.131	.948	5.975	.004

a. Dependent Variable: Y



أولاً: أجب عن السؤال التالي :- (١٤ درجة - كل فقرة ٧ درجات)

(١) (أ) أثبت أن مركز أي زمرة هو زمرة جزئية ناظمية.

(ب) إذا كانت $(H_2, *)$, $(H_1, *)$ زمرتان جزئيتان من الزمرة $(G, *)$ فأثبت أن $(H_1H_2, *)$ زمرة جزئية من $(G, *)$ إذا وفقط إذا كان $H_1H_2 = H_2H_1$.

ثانياً: أجب عن ثلاثة أسئلة فقط من الأسئلة التالية :- (١٢ درجة لكل سؤال - كل فقرة ٦ درجات)

(٢) (أ) إذا كانت $\varphi : (G, *) \rightarrow (H, \times)$ تماثل من الزمرة $(G, *)$ إلى الزمرة (H, \times) ، وأن $\psi : (H, \times) \rightarrow (K, \otimes)$ تماثل من الزمرة (H, \times) إلى الزمرة (K, \otimes) فأثبت أن: $(\psi \circ \varphi) : (G, *) \rightarrow (K, \otimes)$ هو أيضاً تماثل.

(ب) أثبت أن الزمرة $(G, *)$ إبدالية في كل حالة من الحالات الآتية:

$$(i) (a * b)^{-1} = a^{-1} * b^{-1}, \quad \forall a, b \in G \quad (ii) a^2 = e, \quad \forall a \in G$$

(٣) (أ) إذا كانت φ تشاكل من الزمرة $(G, *)$ إلى الزمرة (G', \circ) فأثبت أن:

$$(Ker \varphi, *) \text{ زمرة جزئية من الزمرة } (G, *).$$

(ب) أثبت أن تقاطع أي زمرتين جزئيتين من الزمرة $(G, *)$ هو زمرة جزئية.

(٤) (أ) كون جدول النظام (Z_5^*, \cdot_5) وبين أنه زمرة إبدالية ثم أوجد أصغر قيمة غير سالبة x في كل حالة من الحالات الآتية:

$$(i) [18] \cdot_5 [x] = [2] \quad (ii) [x]^{-1} \cdot_5 [13] = [16]$$

(ب) إذا كانت $(H, *)$ زمرة جزئية للزمرة $(G, *)$ فأثبت أن $(N(H), *)$ زمرة جزئية للزمرة $(G, *)$ حيث $N(H) = \{a \in G : a * H * a^{-1} = H\}$.

(٥) (أ) إذا كانت φ تشاكل من الزمرة $(G, *)$ إلى الزمرة (G', \circ) وكانت $(H, *)$ زمرة جزئية ناظمية من الزمرة $(G, *)$ ، وكان $\varphi(G) = G'$ فأثبت أن: $(\varphi(H), \circ)$ زمرة جزئية ناظمية من الزمرة (G', \circ) .

(ب) إذا كانت φ تشاكل من الزمرة $(G, *)$ إلى الزمرة (G', \circ) فأثبت أن:

$$\varphi(g^{-1}) = (\varphi(g))^{-1}, \quad \forall g \in G$$



Answer only five the following questions

1- a) If x is rational and y is irrational then prove that $x + y$ and $x \cdot y$ are irrational.

b) Find limit point of the sets:

(i) $A = \left\{ a + \frac{(-1)^n}{n}, n \in \mathbb{N} \right\}$ (ii) $B = \left\{ \frac{1}{n} + \frac{(-1)^n}{n}, n \in \mathbb{N} \right\}$ (iii) $C = \left\{ n(-1)^n, n \in \mathbb{N} \right\}$

(iv) $D = \left\{ \frac{1}{n} + (-1)^n, n \in \mathbb{N} \right\}$ (v) $E = \left\{ \sqrt{2} + \frac{1}{n}, n \in \mathbb{N} \right\}$

2- a) If M_1 and M_2 are neighbourhood of a point x . Show that $M_1 \cap M_2$ is also a neighbourhood of x .

b) Show that if A is a nonempty bounded set of real numbers then

$$\inf(A) \leq \sup(A)$$

What can be said about A if: $\inf(A) = \sup(A)$.

3- a) Find, if they exists, the supremum, infimum, maximum and minimum of the following sets of real number:

(i) $S = \{x \in \mathbb{Q} : 0 \leq x \leq \sqrt{2}\}$ (ii) $S = \{x : x^2 + x + 1 \geq 0\}$

(iii) $S = \left\{ \frac{1}{n} + (-1)^n, n \in \mathbb{Z} \right\}$ (iv) $S = \{x : x < 0, x^2 + x - 1 < 0\}$

b) Using $(\epsilon - N)$ prove that

$$\lim_{n \rightarrow \infty} (n)^{\frac{1}{n}} = 1$$

4- a) Find the $\overline{\text{Lim}}$ and $\underline{\text{Lim}}$ of the sequences:

(i) $\left\{ 4 + \cos \frac{n\pi}{2} \right\}$ (ii) $\left\{ \frac{1 + (-1)^n}{n} \right\}$ (iii) $\left\{ \sin \frac{n\pi}{3} \right\}$

b) Let $f(x)$ be defined by:

$$f(x) = \begin{cases} 0, & x = 0 \\ x \sin \frac{1}{x}, & x \neq 0 \end{cases}$$

Find: $D^+ f(0)$, $D_+ f(0)$, $D^- f(0)$, $D_- f(0)$.

5- a) Discuss the convergence of the following series:

$$(i) \sum_{n=1}^{\infty} \frac{4n-3}{n+1} \quad (ii) \sum_{n=1}^{\infty} \cos\left(\pi + \frac{1}{2n}\right) \quad (iii) \sum_{n=1}^{\infty} \frac{n^n}{(n+1)^{n+1}}$$

b) Test the convergence of the following series:

$$(i) \sum_{n=1}^{\infty} \frac{1}{n \ln n} \quad (ii) \sum_{n=1}^{\infty} \frac{1.3.5 \dots (2n-1)}{2.4.6 \dots (2n)} x^{2n}$$

6- a) Define $f: \mathbb{R} \rightarrow \mathbb{R}$ by $f(x) = \sin(x^2)$.

Show that f is continuous but not uniformly continuous.

b) Suppose $f: [0, 1] \rightarrow \mathbb{R}$ is defined by:

$$f(x) = \begin{cases} -\frac{1}{2}x^2, & x \text{ irrational} \\ \frac{1}{2}x^2, & x \text{ rational} \end{cases}$$

Prove that f is not integrable in the sense of Riemann.

----- WITH MY BEST WISHES -----

DR. ATEF M. ABOELKHER



University: Assiut
Faculty: Science
Dept.: Math.

Algorithms
Final Exam Summer 18/19
MC353

Time: 2 Hours
4/9/2019
Level 3



Answer Only five questions:

Question 1:

1. Define the following terms:
computational problem – algorithm
2. Explain in details the Euclid's Algorithm
3. Explain how to make analysis of algorithms (how good is the algorithm)

Question 2:

1. What is the Big-Oh Notation
2. What are the Big-Oh of the following
 - $7n-2$
 - $3n^3 + 20n^2 + 5$
 - $3 \log n + 5$

Question 3:

1. What are the difference between big-Oh, big-Omega and big-Theta
2. Explain the Growth Rates in algorithms.

Question 4:

1. Explain the merge sort method and give an example
2. If we let $T(n)$ denote the running time of merge-sort:

$$T(n) = \begin{cases} b & \text{if } n < 2 \\ 2T(n/2) + bn & \text{if } n \geq 2 \end{cases}$$

analyze the running time of merge-sort by finding a closed form solution to the above equation.

Question 5:

1. Write the sorting categories with an example for each.
2. Write the selection-sort algorithm, then apply it to the following list (5,2,4,6,1,3)

Question 6:

1. Write the insertion-sort algorithm, then apply it to the following list (5,2,4,6,1,3)
2. Write the analysis of insertion sort, the give the best case analysis and the worst case analysis

BEST WISHES
DR. RASHA MAHMOUD



Faculty of Science
Math. Dept.

Final Exam
Subject: Introduction to Scientific Computing
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Assiut University

Answer the following questions, where each has 12.5 points.

Q1

What is the mathematical model?

Use Mathematica to solve these problems:

- 1- $\int_{1.4}^{2.0} \int_{1.0}^{1.5} \ln(x + 2y) dx dy$
- 2- $\frac{\partial}{\partial x} (e^{2x} \sin(y))$
- 3- $\sqrt{2}$ with 50 digits precision

Q2 –

- a) Write an algorithm that describes the Newton Raphson method to find the root for the function $f(x) = 0$.
- b) Write a Matlab code for this previous method.
- c) Can we use Newton Raphson method to find roots for any function?

Q3 –

- a) Write an algorithm that describes Runge-Kutta method to solve the initial value problem.
- b) Write a Matlab code for this algorithm.
- c) Solve **manually (two steps)** Runge-kutta method this initial value problem:

$$y' = y - t^2, \quad 0 \leq t \leq 2, y(0) = 0.5, \text{ where } h = 0.1$$

Q4 –

- a) Write a Matlab code for composite Simpson's Rule.
- b) Use Mathematica to solve these problems:

$$y'' = 2y^3, \quad 1 \leq x \leq 2, \text{ where } y(1) = 0.25 \text{ and } y(2) = 0.5, h=0.1$$

End of the Questions

Best Wishes,

Dr. Ibrahim Elsemman