



TANTA UNIVERSITY
FACULTY OF SCIENCE
DEPARTMENT OF MATHEMATICS
FINAL EXAM FOR FOURTH LEVEL (MATH STUDENTS)

COURSE TITLE: NUMERICAL ANALYSIS (2)

COURSE CODE: MA4109

DATE: 23/10/2017 TERM: FIRST TOTAL ASSESSMENT MARKS: 150 TIME ALLOWED: 2 HOURS

Answer the following questions:

- (I) (a) Find the general solution for the following linear difference equation: (20 marks)
$$\Delta f(x) + 4(1 - x^2)f(x) = 1 - 3x .$$

(b) Discuss the stability for the following numerical procedure with respect to its initial values:

$$y_n - y_{n-3} = \frac{3h}{8} [f(x_{n-3}, y_{n-3}) + 3f(x_{n-2}, y_{n-2}) + 3f(x_{n-1}, y_{n-1}) + f(x_n, y_n)], n \geq 3.$$

(20 marks)

- (II) (a) Apply the method of nets to compute the numerical solutions for the following mixed problem:

$$\frac{\partial u}{\partial t} - \frac{\partial^2 u}{\partial x^2} = \frac{x t}{2}, \quad u(x, 0) = \ln(2 - x) \quad (0 \leq x \leq 1);$$
$$u(0, t) = \ln 2, \quad u(1, t) = 0 \quad (t \geq 0),$$
$$h = 0.05, \quad \sigma = \frac{1}{2}.$$

(20 marks)

(b) Show how you can apply the method of finite differences to obtain the numerical solutions for the following boundary value problem:

$$y'' + (1 + x^3)y' - x^2 y = 0, \quad x \in [1, 1.8]; \quad y(1) = 0, \quad y(1.8) = 1.96, \quad h = 0.01. \quad (20 \text{ marks})$$

- (III) (a) Define: An interior nodal point - The collocation points - Degenerate kernel
- The Dirichlet problem. (15 marks)

(b) Find an approximate solution for the following Fredholm's integral equation:

$$x(t) = t^3 + 1 + \int_0^1 (s^2 - 1) e^{-ts} x(s) ds, \quad t \in [0, 1]. \quad (20 \text{ marks})$$

- (IV) (a) Define ill and well-conditioned problems and whence study the stability of the following initial value problem with respect to its initial condition:

$$y'(x) = -[y(x)]^2, \quad 0 \leq x \leq b; \quad y(0) = 1. \quad (15 \text{ marks})$$

(b) Making use the method of least squares, construct an analytical approximate solution for the following boundary value problem:

$$y'' + xy' - y = 0, \quad x \in [-1, 0]; \quad y(-1) - y'(-1) = 3, \quad y(0) + y'(0) = 0. \quad (20 \text{ marks})$$

EXAMINERS	PROF. DR. A. R. M. EL-NAMOURY	DR. A. A. HEMEDA
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With our best wishes

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Tanta University
Faculty of Science
Mathematics Department
Year: 4
Pages of questions: only one page



Date: 27/12/2017
Time allowed: 3 h
Full Degree: 150

Subject: Topology 2 (MA4111)

Answer the following questions

Question 1:

1. Prove that in every T_0 space X , $\{x\}'$ is closed for every $x \in X$.
2. Discuss the compactness on real line \mathbb{R} with topologies: Discrete space- Indiscrete space- co-finite topology- usual topology.

Question 2:

1. Prove that every compact Hausdörff space is normal. (Is the converse is true?)
2. For a continuous mapping $f: (X, \tau_1, T_1) \rightarrow (Y, \tau_2)$. Prove that the inverse image of points in Y is closed set in X .

Question 3:

1. State with proof Hein-Borel Theorem.
2. If $X = \{a, b, c\}$ with a topology $\tau = \{X, \emptyset, \{a\}, \{b, c\}\}$. Discuss the regularity, normality, T_3 and T_4 . (Draw the structure of space.)

Question 4:

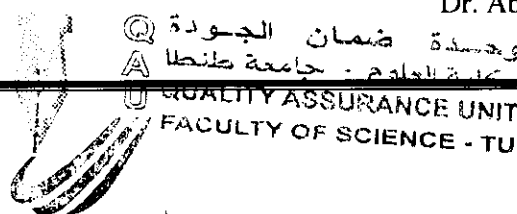
1. For every topological space (X, τ) and $A \subset X$, prove that A is compact with respect to τ iff A is compact with respect to τ_A .
2. Prove that the usual topology is Hausdörff.


Question 5:

1. Prove that a continuous one-to-one function from a compact space onto a Hausdörff space is homeomorphism.
2. Show that every subset from a co-finite topology is compact.

With best wishes

Dr. Abd El-Fattah El-Atik



 1969	Tanta University Faculty of Science Department of Mathematics		
	Final Exam for the First Semester 2017-2018		
	Course title:	Differential geometry(1)	Course Code: MA4107
	Date: 30 /12 /2017	Total mark: 150 Marks	Time allowed: 2 Hours

Answer all the following questions:

First question: Choose the correct answer (30 Marks):

1-If $\alpha(t) = (x(t), y(t))$ is a positively – oriented simple closed curve in R^2

With period a , then A equal

(a) $A = \frac{1}{2} \int_0^a (xy' - yx') dt.$

(b) $A = \frac{1}{2} \int_0^a (xy' - yx') dt.$

(c) $A = \frac{1}{2} \int_0^a (xy' + yx') dt.$

2-If $\alpha(s)$ is a unit speed curve of R^2 , then

(a) $\alpha'(s) = \alpha''(s)$

(b) $\alpha'(s) = -\alpha''(s)$

(c) $\alpha'(s)$ is orthogonal to $\alpha''(s)$

3-Let α be a simple closed curve, let ℓ be its length and let A be the area. Then

(a) $A > \frac{\ell^2}{4\pi}$

(b) $A < \frac{\ell^2}{4\pi}$

(c) $A \leq \frac{\ell^2}{4\pi}$

4-Every convex simple closed curve in R^2 has at least

(a) Four vertices

(b) Two vertices

(c) Three vertices

5-The parameterization of the curve $x_3^2 = 1 - x_1^2$, $x_2^2 = x_1^2$ equal

(a) $\alpha(t) = (\cos t, \sin t)$ (b) $\alpha(t) = (\cos^2 t, \cos t, \sin t)$ (c) $\alpha(t) = (\sec t, \sinh t)$

6- A vertex of a curve $\alpha(s)$ in R^2 is a point where

(a) $k' > 0$

(b) $k' < 0$

(c) $k' = 0$

7-The parameterization of the curve $\frac{x^2}{2^2} + \frac{y^2}{3^2} = 1$ equal

(a) $\alpha(t) = (3\cos t, 2\sin t)$ (b) $\alpha(t) = (2\cos t, 3\sin t)$ (c) $\alpha(t) = (\sec t, \sinh t)$

8-Which one of the following statements is true

(a) A circle is convex. (b) A circle is not convex.

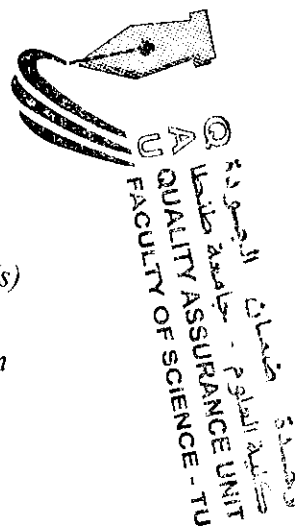
(c) A circle is open.

9-The equation of tangent line of the curve $\alpha(s)$ equal

(a) $\vec{r} = \alpha(s_0) + \lambda T$


(b) $\vec{r} = \alpha(s_0) + \lambda N$

(c) $\vec{r} = \alpha(s_0) + \lambda B$



(Please Turn the Paper)

2

	TANTA UNIVERSITY FACULTY OF SCIENCE DEPARTMENT OF MATHEMATICS		
	EXAMINATION FOR PROSPECTIVE STUDENTS (4 TH YEAR) STUDENTS OF MATHEMATICS		
	COURSE TITLE: GENERAL RELATIVITY		COURSE CODE: MA4113
DATE: 3/1/2017	TERM: FIRST	TOTAL ASSESSMENT MARKS:	TIME ALLOWED: 2 HOURS

Answer five questions:

[1] (a) Prove that $ds^2 = dx^2 + dy^2 + dz^2$ in parabolic coordinates (ξ, η, ϕ) given as
 $ds^2 = (\xi^2 + \eta^2)d\xi^2 + (\xi^2 + \eta^2)d\eta^2 + \eta\xi d\phi^2$

where $x = \xi\eta\cos\phi$, $y = \xi\eta\sin\phi$, $z = (\xi^2 - \eta^2)/2$.

(b) Prove that the Christoffel's symbol of second kind is not tensor.

[2] (a) The equation $K(ij)A_{jk} = B_{ik}$ holds for all the coordinates systems. If A and B are second-rank tensors, show that K is a second tensor also.

(b) Use the question [3] (b) and obtain the equations of the geodesic for the same metric

(c) derive the Euler equations.

[3] (a) Prove that $B_{i,j}$ is tensor of rank two and find Riemann-Christoffel's tensor $B^{\rho}_{\mu\nu\sigma}$.

(b) Find the fundamental metric and Christoffel's symbols to the metric


$$ds^2 = dt^2 - e^{2kt}(dx^2 + dy^2 + dz^2)$$

Dr. Mohamed Khataifa

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	PROF./ SLIM ALI MOHAMMADEIN	DR/

With my best wishes



 1969	Tanta University		
	Faculty of Science		
	Department of Mathematics		
	Final term exam for the first semester 2017-2018		
Course title:	Operarions Research (2)	Course code: MA4105	
Date: 6 /1 /2018	Total Marks: 150	Time allowed: Hours	

Answer all the following questions:

First question: (40 Marks)

(a) Discuss the convexity of the following sets:

(i) $S = \{x : x = (x_1, x_2) : x_1 \geq 2, x_2 \leq 4\}$.

(ii) $S = \{x : g_i(x) \leq 0, i = 1, 2, \dots, m\}$, where $g_i(x)$ are convex functions .

(b) Find whether the $f(x) = 25x_1^2 + 34x_2^2 + 41x_3^2 - 24x_2x_3$ is a positive definite or not.

(c) Prove that if $f(x)$ and $g(x)$ be convex functions defined over a convex set S then the sum $f(x) + g(x)$ is a convex function?.

Second question: (40 Marks)

(a) Find the local extrema $f(x_1, x_2, x_3) = x_1^2 + (x_1 + x_2)^2 + (x_1 + x_3)^2$.

(b) Using Lagrangian multipliers to find the extreme points for the function

$$z = f(x_1, x_2) = 4x_1 + 6x_2 - 2x_1^2 - 2x_1x_2 - 2x_2^2$$

Subject to the constraint: $x_1 + 2x_2 = 2, x_1, x_2 \geq 0$

Determine whether the etreme points are maximum or minimum.

Third question: (30 Marks) ok

(a) Minimize $f(x) = x_1^2 + x_2^2 + 2x_1 + 4x_2 + 5$ using the steepest descent method starting at the point $x_1 = 0$ and $x_2 = 0$.

(b) By direct substitution method solve the following NLPP

$$\min f(x) = x_1^2 + (x_2 + 1)^2 + (x_3 - 1)^2 \text{ subject to constraint } x_1 + 5x_2 - 3x_3 = 6.$$

Fourth question: (40 Marks)

(a) Show that the following function is convex


$$f(x_1, x_2, x_3) = 3x_1^2 + 2x_2^2 + x_3^2 - 2x_1x_2 - 2x_1x_3 + 2x_2x_3 - 6x_1 - 4x_2 - 2x_3$$

(b) Use the Kuhn–Tucker conditions to solve the NLPP:

$$\text{maximize } z = 10x_1 + 4x_2 - 2x_1^2 - x_2^2 \text{ subject to } 2x_1 + x_2 \leq 5, x_1, x_2 \geq 0.$$

(Best wishes)

Examiners:	1- Prof. Dr. E.A. Youness	2- Dr. N. A. El-Kholy
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	TANTA UNIVERSITY FACULTY OF SCIENCE			
	DEPARTMENT OF MATHEMATICS			
FINAL EXAM FOR FRESHMEN (LEVEL 4) STUDENTS OF COMPUTER SCIENCES.				
COURSE TITLE:	OPERATIONS RESEARCH			COURSE CODE: MA4105
DATE:	JAN. 6, 2018	TERM: FIRST	TOTAL ASSESSMENT MARKS: 150	TIME ALLOWED: TWO HOURS

Answer on the following questions :

Question 1 : (30 marks)

Discuss the feasibility of the problem which has the following simplex tableue

	-z	x	y	U ₁	U ₂	d
-z	1	0	-2	0	0	5
-w	0	2	-3	1	1	5
U ₁	0	-1	1	1	0	3
U ₂	0	-1	2	0	1	2

Question 2 : (40 marks)

Determine the optimal solution from the following simplex tableue

	-z	x	y	S ₁	S ₂	d
-z	1	0	-2	0	0	5
x	0	2	1	1	1	3
S ₂	0	0	2	0	1	2

Question 3: (40 marks)

Find the solution of dual without making duality for the following program

$$\max Z = X_1 + 2X_2$$

Subject to

$$X_1 + X_2 \leq 20,$$

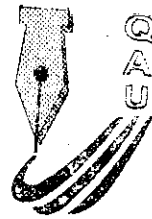
$$2X_1 + 3X_2 \leq 60,$$

$$X_1, X_2 \geq 0$$

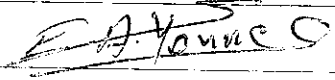
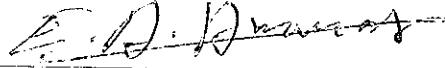
Question 4 : (40 marks)

Put the following system in its canonical form

$$x + y + z = 5, \quad 2x - y - z = 3$$



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