1969

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

COURSE TITLE: NUMERICAL ANALYSIS (2) | COURSE CODE: MA4109

DATE: 23/12/2017 | 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:

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

(20 marks)

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

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

(20 marks)

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

$$y'' + (1 + x^3) y' - x^2\, y = 0\ ,\ \ x \in [1\,, 1.8];\ y(1) = 0,\ y(1.8) = 1.96\,, h = 0.01\ .$$ **(20 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:

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

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

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

$$y'' + xy' - y = 0\ ,\ \ x \in [-1\,, 0]\ ;\ \ y(-1) - y'(-1) = 3\ ,\ y(0) + y'(0) = 0\ .$$

(20 marks)

EXAMINERS	PROF. DR. A. R. M. EL-NAMOURY	DR. A. A. HEMEDA

With our best wishes

رياضة ٣

Tanta University **Faculty of Science** **Mathematics Department** **Year: 4** **Pages of questions: only one page**	**Subject: Topology 2 (MA4111)**	**Date: 27/12/2017** **Time allowed: 3 h** **Full Degree: 150**

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: $(X, \tau_1, T_1) \to (Y, \tau_2)$. 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 $\tau = \{X, \varphi, \{a\}, \{b, c\}\}$. 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) $A = \frac{1}{2}\int_0^a (xy^{\cdot} - yx^{\cdot})dt.$

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

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 $x_3^2 = 1 - x_1$, $x_2^2 = x_1$ *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) $k^{\cdot} > 0$ (b) $k^{\cdot} < 0$ (c) $k^{\cdot} = 0$

7-The parameterization of the curve $\frac{x^2}{2^2}+\frac{y^2}{3^2}=1$ *equal*
(a) $\alpha(t)$ =(3cos t, 2sin t) (b) $\alpha(t)$ =(2cos t, 3sin t) (c) $\alpha(t)$ =(Sec t , sinh)

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)

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

Answer fife questions:

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

$ds^2 = (\xi^2 + \eta^2)d\xi^2 + (\xi^2 + \eta^2)d\eta^2 + \eta\xi d\varphi^2$

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

(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 0btain 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 Khalifa

EXAMINERS	DR./MOHAMED ABDOU KHALIFA	PROF./OMEAR SHAKER
	PROF./ SLIM ALI MOHAMMADEIN	DR/

With my best wishes

جامعة طنطا

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**

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Answer all the following questions:

First question: (**40 Marks**)

(a) Discuss the convexity of the following sets:

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

(ii) $S=\{x : g_i(x) \leq 0, \quad i=1,2,\cdots,m\}$, 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: $x_1+2x_2=2, \quad x_1,x_2 \geq 0$

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

$\min f(x)=x_1^2+(x_2+1)^2+(x_3-1)^2$ 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:

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

(Best wishes)

Examiners:	**1- Prof. Dr. E.A. Youness**	**2- Dr. N. A. El-Kholy**

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 tablue

	-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 tablue

	-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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