TANTA UNIVERSITY
FACULTY OF SCIENCE
DEPARTMENT OF MATHEMATICS

EXAMINATION FOR PROSPECTIVE STUDENTS (4YEAR) STUDENTS OF STATISTICS

COURSE TITLE: RELIABILITY THEORY		COURSE CODE: ST4103	
DATE: 23-12 JANUARY 2018	TERM: 1	TOTAL ASSESSMENT MARKS: 150	TIME ALLOWED: 2 HOURS

Answer the following questions:

1- (a) Consider the failure rate is given by:

$$\lambda(t)=\frac{t}{t+1}\ ,\quad t\geq 0$$

(i) Find $R(t), F(t), f(t)$, and MTTF **(20 points)**

(ii) Find $R_X(t|t_0)$, and MRL at age t_0 **(20 points)**

(b) Consider a system of n independent units with lifetime follow the exp(λ_i), i=1,2,..,n. Find the probability that unit 2 fails before other units. (20 points)

2- (a) Consider a parallel system consisting of three subsystems, each subsystem consists of two units are connected in series, when the units in a system are i.i.d and follow the exp(λ) lifetime distribution, calculate the system reliability and MTTSF.
(25 points)

(b) 30 light bulbs were tested and the failures in 400 hours intervals are

Time intervals (hours)	$0\leq t\leq 400$	$400< t\leq 800$	$800< t\leq 1200$	$1200< t\leq 1600$	$t>1600$
Failure in the intervals	12	9	7	2	0

Find the computation of F(t), R(t), λ(t) and f(t) measures for the light bulb test data
(20 points)

3- (a) Discuss the test without replacement for determined the MLE and confidence interval of the MTTF θ, when system of n i.i.d units with exponential lifetime distribution placed on test. (25 points)

(b) Consider the lifetime of unit follow exponential distribution with λ and time repair follow exponential distribution with μ. Prove that the availability of unit is:

$$A(t)=\frac{1}{\lambda+\mu}\{\mu+\lambda\exp[-(\mu+\lambda)t]\}$$

(20 points)

EXAMINERS	PROF. DR./ MEDHAT EL-DAMSESY	DR./ NEAMA TEMRAZ

With my best wishes

QUALITY ASSURANCE UNIT
FACULTY OF SCIENCE - TU

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TANTA UNIVERSITY
FACULTY OF SCIENCE
DEPARTMENT OF MATHEMATICS

EXAMINATION FOR PROSPECTIVE STUDENTS (FOURTH YEAR) STUDENTS OF STATISTICS

COURSE TITLE: NONPARAMETRIC STATISTICS | COURSE CODE: ST4101

DATE: | TERM: FIRST | TOTAL ASSESSMENT MARKS: 150 | TIME ALLOWED: 2 HOURS

Answer the following questions:

(1) a- If X_1, X_2, X_3, X_4, X_5 is a random sample from the uniform distribution on $(0,1)$, then find probability density function (p.d.f.) of the sample median, the expectation and the variance of the sample median. (20 Marks)

b- Let Y_1, Y_2, Y_3, Y_4 denote the order statistics of a random sample of size 4 from the uniform distribution on $(0,1)$. Find the p.d.f. of Y_1 and $p(Y_1 > 0.5)$. (20 Marks)

c- Define: population, order statistics, parameter, statistic. Tolerance limits for a dist. (10 Marks)

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(2) a- If $Y_1, Y_2, \dots, Y_{10}$ denote the order statistics of a random sample of size 10, then calculate the Tolerance coefficient if take (Y_2, Y_9) as Tolerance limits of ratio 0.70 from the distribution. (20 Marks)

b- The following data represent the number of hours that a rechargeable hedge trimmer operates before a recharge is required: 1.5, 2.2, 0.9, 1.3, 2.0, 1.6, 1.8, 1.5, 2.0, 1.2, 1.7.
Use the sign test at $\alpha = 0.05$ to test the hypothesis that $\nu = 1.8$ against $H_1: \nu > 1.8$. (20 Marks)

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(3) a- It is claimed that a new diet will reduce a person's weight by 4.5 kilograms, on average, in a period of 2 weeks. The weights of 10 women who followed this diet were recorded before and after a 2-week period yielding the following data:

Weight Before:	58.5	60.3	61.7	69.0	64.0	62.6	56.7	63.6	68.2	59.4
Weight After:	60.0	54.9	58.1	62.1	58.5	59.9	54.4	60.2	62.3	58.7

Use the signed-rank test at the $\alpha = 0.05$ to test the hypothesis that $\nu_1 = \nu_2$ against $H_1: \nu_1 \neq \nu_2$. (20 Marks)

b- Estimate the quantile $X_{0.90}$ from a random sample with size 15. (20 Marks)

c- Find the confidence interval for the median if the sample size is 8 and $\alpha = 0.50$. (20 Marks)

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$Z_{0.05} = 1.645$, $Z_{0.025} = 1.96$

Examiners	Dr. Hamdy M. Abou-Gabal	Dr. Abd El-Moneim Anwer

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TANTA UNIVERSITY
FACULTY OF SCIENCE
DEPARTMENT OF MATHEMATICS
EXAMINATION FOR (FOURTH YEAR) STUDENTS OF SATISTICS

COURSE TITLE: STATISTICAL INFERENCE 2	COURSE CODE: ST4105

DATE: JANUARY, 2018	TERM: FIRST	TOTAL ASSESSMENT MARKS: 150	TIME ALLOWED: 2HOURS

Answer the following questions

First question:

1. State and prove Neyman and Pearson theorem.
2. Suppose that $(X_1, X_2, \dots, X_n)$ is random sample of size n from population with mean μ and variance σ^2. Show that $E(S^2) = \sigma^2$, where $S^2 = \frac{1}{n-1}\sum_{i=1}^{n}(x_i - \bar{x})^2$.

Second question:

1. Explain the sequential probability ratio test.
2. Let X be a random variable follows $N(\theta_1, \theta_2)$ where $\theta = \{(\theta_1, \theta_2): -\infty < \theta_1 < \infty,\ \theta_2 > 0\}$. Test by using likelihood ratio test $H_0: \theta_1 = 0, \theta_2 > 0$ against $H_1: \theta_1 \neq 0, \theta_2 > 0$.

Third question:

1. Let $(X_1, X_2, \dots, X_n)$ be a random sample of size n from population with probability density function:

$$f(x;\theta) = \begin{cases} \theta\, x^{\theta-1}, & 0 < x < 1 \\ 0, & otherwise \end{cases}, \qquad \theta > 0$$

Prove that $Y = \prod_{i=1}^{n} X_i$ is sufficient statistic for θ.

2. A random sample of 395 people was surveyed and each person was asked to report the highest education level they obtained. The data that resulted from the survey is summarized in the following table:

Gender \ Education	High School	Bachelors	Masters	Ph.d.
Female	60	54	46	41
Male	40	44	53	57

Are gender and education level dependent at 5% level of significance?
(where ${\chi^2}_{0.95,3} = 7.815$).

EXAMINERS	DR/ HALA ALI FERGANY	DR/ NEAMA SALAH YOUSSEF

With my best wishes

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) $S=\{x : x=(x_1,x_2) : x_1 \ge 2, \quad x_2 \le 4\}$.

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

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 $2x_1+x_2 \le 5$, $x_1,x_2 \ge 0$.

(Best wishes)

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