MURANG'A UNIVERSITY OF TECHNOLOGY

SCHOOL OF PURE AND APPLIED SCIENCES

DEPARTMENT OF APPLIED SCIENCES

UNIVERSITY ORDINARY EXAMINATION

2017/2018 ACADEMIC YEAR

FIRST YEAR **FIRST** SEMESTER EXAMINATION FOR THE DEGREE OF BACHELOR OF SCIENCE IN MATHEMATICS AND ECONOMICS

AMS 105 – INTRODUCTION TO BIOSTATISTICS

DURATION: 2 HOURS

DATE: 8TH DECEMBER, 2017

TIME: 2.00 – 4.00 P.M.

Instructions to Candidates:

1. Answer **Question 1** and **Any Other Two** questions.
2. Mobile phones are not allowed in the examination room.
3. You are not allowed to write on this examination question paper.

SECTION ONE - COMPULSORY

QUESTION ONE

(a) Differentiate the following terms as used in statistics

i) Descriptive and inferential statistics (2 marks)

ii) Estimator and estimate (2 marks)

(b) The following data shows the age distribution of cases of a certain disease reported during a year in a particular town

Age	5-14	15-24	25-34	35-44	45-54	55-64
No. of cases	5	10	120	22	13	5

Calculate the quartile deviation and its coefficient (4 marks)

(c) In a production process of Biostatistics laboratory equipments, it has been established that 5% of total output is defective. If six items are picked at random for inspection, evaluate the following probabilities

i) Exactly three defective (2 marks)

ii) More than a half are defective (3 marks)

(d) Suppose the arrival of patients at a clinic in a certain town is poisson process with rate 2.8 per hour. Calculate the probability that a doctor operating in this town for 2 hours

i) Receive no patients (2 marks)

ii) Will wait for at least 30 minutes before …..

The mean and standard deviation for the grade points of a random sample of 36 college students are calculated to be 2.61 and 0.32 respectively. Find the 95% confidence interval for the mean of the entire class.

(e) Height of fathers and sons are given in inches in the following table below

Height of fathers (x)	65	66	67	68	69	71	73
Height of sons (y)	67	68	64	68	72	70	69

Calculate the spearman rank correlation coefficient and comment on your answer (5 marks)

(f) Mr. Hassan has two gardeners; Obote and Kamuri. Obote comes on a ⅓ of the occasions and Kamuri ⅔ of the Occasions. There is a probability of $^{1}/_{10}$ that Obote will forget to water the flowers and probability of ½ that Kamuri will forget to water the flowers. One day Mr. Hassan had to leave the house before the gardener arrives. On his return he finds that the gardener has

come and gone, and also the flowers were not watered. What is the probability that Kamuri came that day (4 marks)

SECTION TWO – ANSWER ANY TWO QUESTIONS

QUESTION TWO

(a) State and explain any two properties of an estimator as used in estimation (4 marks)

(b) Let $x_1, x_2 \ldots x_n$ be a random sample from a Bernoulli population with parameter θ

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

Find the maximum likelihood estimator of θ (8 marks)

Let $x_1, x_2 \ldots x_n$ be a random sample from $f(x,\alpha) = \begin{cases} \frac{2}{\propto^2}(\propto - x, & 0<x<\propto, \; 0<\propto<\infty \\ 0 \; Otherwise \end{cases}$

Obtain by the method of moments the estimator for $\propto$ (8 marks)

QUESTION THREE

The table below shows Biostatistics examination marks for a class of one hundred students in Murang'a University of Technology

Marks out of 70	10-19	20-29	30-39	40-49	50-59	60-69
No. of students	4	8	r	22	48	k

The mean mark for the students is 46.5

i) Show that the values of r and k are 12 and 6 respectively (6 marks)

ii) Using 34.5 as the assumed mean, determine the variance and standard deviation of the above distribution (6 marks)

iii) Calculate the mode, median and second Pearson measure of skewness for the above data (8 marks)

QUESTION FOUR

(a) Given the general linear model $y_i = a + bx_i + \varepsilon_i$ where $i = 1,2 \ldots n$ where $E(\varepsilon_i) = 0, Var\ (\varepsilon_i) = \sigma^2, Cor(\varepsilon_i \varepsilon_j) = 0, i \neq j$

i) Obtain the normal equations (4 marks)

ii) Find the estimate of a and b (6 marks)

(b) Ten competitors in a beauty contest are arranged by three judges in the following order.

Judge 1	1	6	5	10	3	2	4	9	7	8
Judge 2	3	5	8	4	7	10	2	1	6	9
Judge 3	6	4	9	8	1	2	3	10	5	7

Use the range correlation coefficient to determine which pair of judges has the nearest approach to common test in beauty (10 marks)

QUESTION FIVE

(a) A marketing research firm wants to estimate the share that foreign companies have in the USA market for medical products. A random sample of 100 consumers in obtained and it is found that 34 people in the sample are users of domestic medical products. Curve a 95% confidence interval for the share of foreign medical products in this markets (5 marks)

(b) The data below shows the advertisement cost and sales revenue of a certain animal feeds company for ten days

Advert [Shs '000']x	39	65	62	90	65	75	75	98	36	78
Sales [Shs '000']y	47	53	58	86	53	68	68	60	90	51

Calculate the Pearson correlation coefficient (10 marks)

In 500 independent biology tests, a student made 25 errors. His instructor randomly checked seven tests of the student. Find the probability that the instructor detects

i) Exactly two errors (2 marks)

ii) At most two errors (3 marks)