



TECHNICAL UNIVERSITY OF MOMBASA

Faculty of Applied & Health Sciences

DEPARTMENT OF MATHEMATICS & PHYSICS
UNIVERSITY EXAMINATION FOR DEGREE OF:
BACHELOR OF SCIENCE IN MEDICAL LABORATORY

AMA 4320: BIOSTATISTICS

END OF SEMESTER EXAMINATION

SERIES: APRIL 2015

TIME ALLOWED: 2 HOURS

Instructions to Candidates:

You should have the following for this examination

- *Mathematical tables*
- *Scientific Calculator*

This paper consist of **FIVE** questions

Answer question **ONE (COMPULSORY)** and any other **TWO** questions

Maximum marks for each part of a question are as shown

This paper consists of **FIVE** printed pages

Question One (Compulsory)

- a) (i) Differentiate between Quantitative and Qualitative variables **(2 marks)**
(ii) Differentiate between a bar plot and a histogram **(2 marks)**
(iii) Differentiate between a sample and a population **(2 marks)**
- b) The data below shows the recording of the reverse-bias collector current (in micro-comperes) for a set of 20 transistors

0.20	0.6	0.20	0.48	0.92
0.33	0.10	0.53	0.42	0.50
0.19	0.22	0.18	0.17	0.20
0.14	0.09	0.13	0.26	0.66

- (i) Compute the sample range

(1 mark)

- (ii) Compare the sample mean (2 marks)
- (iii) Compute the sample median (2 marks)

c) In order to compare the distributions of sepal and petal lengths from irish data set, a box plot was drawn. Use the diagram below to answer the following questions:

8
7
6
5
4
3
2
1
0

- (i) What does the bottom of each box represent (1 mark)
- (ii) What does the top of each box represent (1 mark)
- (iii) What can you say about the distribution of the two variables (2 marks)

d) Suppose that the number of cars x that pass through a car wash between 4.00pm and 5.00pm on any sunny Friday has the following probability distribution:

x	4	5	6	7	8	9
$P(x =)$	1/12	1/12	1/4	1/4	1/6	1/6

Find:

- (i) $E(x)$ (3 marks)
 - (ii) $Var(x)$ (3 marks)
- e) Give and explain TWO measures of relative standing (3 marks)
- f) Benzene is a possible cancer-agent. It is suspected that the concentration of Benzene in the air from a chemical company is greater than 1ppm. The following sample was collected to test the claim:

0.21	1.44	2.54	2.97	0.00
3.91	2.24	2.41	4.50	0.15
0.30	0.36	4.50	5.03	0.00
2.89	4.71	0.85	2.60	1.26

- (i) State the null and alternative hypothesis (2 marks)
- (ii) Test the hypothesis at 5% level of significance if the sample standard deviation is 1.736 (3 marks)

(iii) What do you conclude
(1 mark)

(1)

Question Two

- a) On average, 3 traffic accidents per month occur at a certain intersection. What is the probability that in any given month at this intersection:
- (i) Exactly 5 accidents will occur (3 marks)
 - (ii) Fewer than 3 accidents will occur (3 marks)
 - (iii) At least TWO accidents will occur? (3 marks)
- b) Imperfections in computer circuit boards and computer chips lend themselves to statistical treatment. For a particular type of board the probability of a diode failure is 0.03 and the board contains 200 diodes:
- (i) What is the main number of failure among the diodes? (2 marks)
 - (ii) What is the variance (2 marks)
 - (iii) The board will work if there are no defective diodes. What is the probability that a board will work (3 marks)
- c) A certain area of the Eastern United States is on average hit by 6 hurricanes a year. Find the probability that in a given year that area will be hit by:
- (i) Fewer than 4 hurricanes (2 marks)
 - (ii) Exactly 6 hurricanes (2 marks)

Question Three

- a) A random sample of 12 graduates of a certain secretarial school typed on average of 79.3 words per minute with a standard deviation of 7.8 words per minute. Assuming a normal distribution for the number of words typed per minute, find a 95 confidence interval for the average number of words typed by all graduates of this school (5 marks)
- b) A taxi company is trying to decide whether to purchase brand A or brand B tires for its fleet of taxis. To estimate the difference in the two brands, an experiment is conducted using 12 of each brand. The tires are run until they wear out. The results are:

Brand A: $\bar{x}_1 = 36,300$ kilometers
 $S_1 = 5000$ kilometers

Brand B: $\bar{x}_2 = 38,100$ kilometers
 $S_2 = 6100$ kilometers

- (i) Compute a 95% confidence interval for $N_A - N_B$ assuming the populations to be approximately normal distributed. Assume the variances are equal (5 marks)
- (ii) Initially the company thought there was no difference between Brand A and Brand B. Do you agree with the company (3 marks)

c) The data below shows distribution of marks of students in a particular course:

Class	30-39	40-49	50-59	60-69	70-79	80-89	90-99
Frequency	8	87	190	304	211	85	20

Find:

- (i) The mean score of the students (3 marks)
- (ii) The standard deviation of the scores (4 marks)

Question Four

a) A study of the amount of rainfall and the quantity of air pollution removed produced the following data:

Daily Rainfall 0.01cm) x(Particulate Removed $\mu\text{g} / \text{m}^3$) y(
4.3	126
4.5	121
5.9	116
5.6	118
6.1	114
5.2	118
3.8	132
2.1	141
7.5	108

- (i) Find the equation of the regression line to predict the particulate removed from the amount of daily rainfall (10 mark)
- (ii) Estimate the amount of particulate removed when the daily rainfall is $x = 4.8$ units (3 marks)
- (iii) What kind of association exist between daily rainfall and particulate removed (2 marks)

b) An actuary wanted to develop O model to predict how long individuals will live. After consulting a number of Physicians, she collected the age at death (y). The average number of hours of exercise per week (x_1), the cholesterol level (x_2), and the number of points that the individual's blood pressure exceeded recommended, value (x_3). A random sample of 40 individuals was selected. The computer output of the multiple regression model is shown below:

Predictor	Parameter Estimate	Std deviation	t
Intercept	55.8	11.8	4.729
X_1	1.79	0.44	4.068
X_2	-0.021	0.011	-1.909
X_3	-0.061	0.014	-1.143

$$S = 9.47 \quad R - sq = 22.5\%$$

Analysis of variance

Source of variation	df	ss	ms	F
Sources of variation	3	936	312	3.477
Error	36	3230	89.722	
Total	39	4166		

- (i) Interpret the coefficient (parameter estimate) associated with X_1 , X_2 and X_3 **(3 marks)**
(ii) Interpret the R^2 **(2 marks)**

Question Five

- a) Scientist have linked a catastrophic decline in the number of frogs inhabiting the world to ultraviolet radiation from Earth's tattered ozone layer (Tampa Tribune March 1, 1994). The pacific tree frog, however, is not believed to be in decline because it produces an enzyme that appears to protect its eggs from ultra violet radiation. Researchers at Oregon state University compared the hatching rate of two groups of pacific tree frog eggs. One group of eggs was shielded with ultraviolet blocking sun shades, whereas the second group was not. The number of eggs successfully hatched in each group is provided in the table:

	Sun-shaded Eggs	Unshaded Eggs
Total number	70	80
Number hatched	34	31

- I. What is the hatching proposition for sun-shaded eggs **(1 mark)**
- II. What is the hatching proportion for unshaded eggs **(1 mark)**
- III. What is the hatching difference **(2 marks)**
- IV. Find the confidence interval (95%) if:
 - (i) The standard deviation for hatching in (i) **(3 marks)**
 - (ii) The standard deviation for hatching proportion in (ii) above is 0.0545 **(3 marks)**
- V. Compare the hatching rates of the two groups of pacific tree frog eggs with a test of hypothesis. The standard error of risk difference is 0.0808 **(7 marks)**
 - (i) Differentiate between type I and type II error **(2 marks)**
 - (ii) What is power of a test **(1 mark)**