



**MASINDE MULIRO UNIVERSITY OF
SCIENCE AND TECHNOLOGY
(MMUST)**

**UNIVERSITY EXAMINATIONS
2022/2023 ACADEMIC YEAR**

SECOND YEAR FIRST SEMESTER EXAMINATIONS

**FOR THE DEGREE
OF
BACHELOR OF SCIENCE**

COURSE CODE: STA 126

COURSE TITLE: PROBABILITY AND STATISTICS

DATE: 24/04/2023

TIME: 3:00 – 5:00 PM

INSTRUCTIONS

- Answer Question One and ANY other Two Questions

QUESTION ONE (30 MARKS)

a) Define the following terms as used in tests of hypothesis

- i) Type I error (1 mark)
- ii) Type II error (1 mark)
- iii) Degrees of freedom (1 mark)
- iv) Null hypothesis (1 mark)
- v) Significance level α (1 mark)

b) For the given sample data below, determine at 5% level of significance that the wages per hour for semi-skilled workers are the same in two cities. The sample data:

$$\bar{x}_1 = \$6, \quad S_1^2 = \$2, \quad n_1 = 40, \quad (5\text{marks})$$

$$\bar{x}_2 = \$5.4, \quad S_2^2 = \$1.8, \quad n_2 = 54$$

c) Two samples of 100 electric bulbs each has a means 1500 and 1550, standard deviation 50 and 60. Can it be concluded that two brands differ significantly at 1% significance in equality. (4marks)

d) For the following set of values of X and Y

X	2.0	3.3	3.7	2.0	2.3	2.7	4.0	3.7	3.0	2.3
Y	1.3	3.3	3.3	2.0	1.7	3.0	4.0	3.0	2.7	3.0

Find the regression equation $y = a + bx$ (10marks)

e) An aptitude test was conducted for selecting computer scientists in an organization from 1000 students. The average score is 42 and the standard deviation is 24. Assuming normal distribution for the scores, find:

- i) The number of candidates whose scores exceeded 58 (3marks)
- ii) The number of students whose scores lied between 30 and 66 (3marks)

QUESTION TWO (20 MARKS)

- a) State three properties of a good estimator (3 marks)
- b) The mean height obtained from a random sample of 36 children is 30 inches. The standard deviation of the distribution of height of the population is known to be 1.5 inches. Test the statement that the mean height of the population is 33 inches at 5% level of significance. Also, set up 99% confidence limits of the mean height of the population. (9 marks)
- c) Investigating the success of its interviews, a firm finds that 176 out of 225 interviews attempted by trained interviewers are successfully completed. 310 interviews attempted by untrained interviewers, only 188 are successfully completed. Determine whether these data provide sufficient evidence at the 5% level of significance to indicate a relationship between the training status of interviewers and the outcome of interview attempted.

(8 marks)

QUESTION THREE (20 MARKS)

- a) A car dealer has collected the data shown in the table below on the number of foreign and domestic cars purchased by customers under 30 years old and 30 years above. To test at the 1% level of significance if the type of car bought (foreign and domestic) is independent of the age of the buyers.

Age	Type of car		Total
	Foreign	Domestic	
< 30	30	40	70
≥ 30	20	80	100
Total	50	120	170

Test at the 1% if the type of car bought is dependent of the age.

(10 marks)

- b) The following data relate to the yield of 4 varieties of rice each shown on 5 plots. Find whether there is significant difference between the mean yield of these varieties. (10 marks)

Plot Name/Treatment	1	2	3	4
P	99	103	109	104
Q	101	102	103	100
R	103	100	107	103
S	99	105	97	107
T	98	95	99	106

QUESTION FOUR (20 MARKS)

- a) Given below are the gains in speed in Mbps on two servers, X and Y

X	15	22	20	22	18	14	22			
Y	14	24	12	20	32	21	30	20	22	25

Test at 5% level, whether the two servers differ significantly with regard to increase in speed. (10 marks)

- b) 10 persons were appointed in an electrical position in an office. Their performance was noted by giving a test and the marks recorded out of 50. They were given 6 months training and again they were given a test and marks were recorded out of 50.

Employees	A	B	C	D	E	F	G	H	I	J
Before training	25	20	35	15	42	28	26	44	35	48
After training	26	20	34	13	43	40	29	41	36	46

Can it be concluded that the employees have benefited by the training ($\alpha = 5\%$) (10marks)

QUESTION FIVE (20 MARKS)

- a) A sample of 600 accounts was taken to test the accuracy of posting and balancing of accounts wherein 45 mistakes were found. Find out the population proportion. Use 99% level of confidence. (4marks)
- b) In a random sample from of 1000 persons from town A, 400 are found to be consumers of wheat. In a sample of 800 from town B, 400 are found to be consumers of wheat. Do these data reveal a significant difference between town A and town B as far as the proportion of wheat is concerned? (4marks)
- c) An old film is treated with a chemical in order to improve the contrast. Preliminary nine samples drawn from a segment of the film produced the following results

X	1.0	1.5	2.0	2.5	3.0	3.5	4.0	4.5	5.0
Y	49	60	66	62	72	64	89	90	96

- Calculate the product moment correlation coefficient (4marks)
- Do the data provide sufficient evidence to indicate that the nine samples drawn from segment of the film produced are independent (3marks)
- Find the regression equation of y on x (5marks)