



MAASAI MARA UNIVERSITY

**REGULAR UNIVERSITY EXAMINATIONS
2023/2024 ACADEMIC YEAR
THIRD YEAR SECOND SEMESTER**

**SCHOOL OF PURE, APPLIED AND HEALTH
SCIENCES
BACHELOR OF SCIENCE APPLIED STATISTICS
WITH COMPUTING**

**COURSE CODE: STA 4249-1
COURSE TITLE: NON PARAMETRIC METHODS**

DATE: 23/4/2024

TIME: 1430-1630 HRS

INSTRUCTIONS TO CANDIDATES

1. Answer **Question ONE** and any other **Two** questions.
2. Show all the workings clearly
3. Do not write on the question paper
4. All Examination Rules Apply.

QUESTION ONE-20 MARKS

a) State two cases when non parametric tests can be used

(2 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 to test the hypothesis that this particular trimmer operates with a median of 1.8 hours before requiring a recharge.

(5 marks)

c) The nicotine contents of two brands of cigarettes, measured in milligrams, was found to be as follows:

Brand A	2.1	4.0	6.3	5.4	4.8	3.7	6.1	3.3		
Brand B	4.1	0.6	3.1	2.5	4.0	6.2	1.6	2.2	1.9	5.4

Test the hypothesis, at 5% level of significance, that the median nicotine contents of the two brands are equal

(5 marks)

d) In an experiment to determine which of the different missile systems is preferable, the propellant burning rate is measured. The data, after coding, are given the table below.

Use Kruskal-Wallis test and 5% level of significance to test the hypothesis that the propellant burning rates are the same for the three missiles systems.

Missile system											
1				2				3			
24.0	16.7	22.8	19.8	23.2	19.8	18.1	17.6	18.4	19.1	17.3	17.3
18.9				20.2	17.8			19.7	18.9	18.8	19.3

(8 marks)

QUESTION TWO-15 MARKS

a) Describe chi-square as a non-parametric test

(5 marks)

- b) The table below shows the data obtained during the outbreak of smallpox;

	Attacked	Not Attacked
Vaccinated	31	469
Non-Vaccinated	185	1315

Test the effectiveness of vaccination in preventing the attack from smallpox using chi-square at level of significance.

(10 marks)

QUESTION THREE- 15 MARKS

- a) The figures listed in the table below, released by the federal trade commission; show the milligrams of tar and nicotine in 10 brands of cigarettes. Calculate the rank correlation coefficient to measure the degree of relationship between tar and nicotine contents in cigarettes.

Interpret your results.

Cigarette brand	Tar content	Nicotine content
Viceroy	14	0.9
Marlboro	17	1.1
Chesterfield	28	1.6
Kool	17	1.3
Kent	16	1.0
Raleigh	13	0.8
Old gold	24	1.5
Phillip Morris	25	1.4
Oasis	18	1.2
players	31	2.0

(8 marks)

- b) Students are randomly assigned to groups which are taught German by 3 different methods; class instruction and language laboratory, only class room instructions and only self-study in language laboratory. The following are the final exam results of samples of students from the three groups.

Method1	94	88	91	74	86	97	
Method2	85	82	79	84	61	72	80
Method 3	89	67	72	76	69		

Use the H-test at 5% level of significant to test whether the three population samples are identical.

(7 marks)

QUESTION FOUR-15 MARKS

- a) The production rate of spindles produced in a machine follows non-normal distribution. The production manager feels that the production rate of the machine is not different from 75 spindles per hour. To test his intuition, the quality assistant of the shop has selected a random sample of 36 different hourly production at the shop as given below:

67 70 76 85 60 66 80 71 87 80 78 78
89 71 75 82 89 74 74 83 73 82 82 89
98 89 88 82 86 85 72 77 81 79 85 89

Check the intuition of the production manager using sign test at 5% level of significance.

(5 marks)

- b) To find out whether a new serum will arrest Leukemia, 9 patients, who have all reached an advance stage of the disease, are selected. Five patients receive the treatment and four do not. The survival times, in years, from the time the experiment commenced are:

Treatment	2.1	5.3	1.1	4.6	0.9
No treatment	1.9	0.5	2.8	3.1	

Use the rank test at 5% level of significance to determine if the new serum is effective.

(10 marks)

QUESTION FIVE-15 MARKS

- a) The arrival rate of customers at the loan counter of a branch bank appears to follow Poisson distribution. The observed frequencies of the arrival rates are as summarized below;

Period	Arrival rate	Observed frequency
1	0	2
2	1	6
3	2	18
4	3	12
5	4	8
6	5	3
7	6	1

Check whether the given data follow Poisson distribution using the K-S test at $\alpha = 0.05$

(5 marks)

- b) The following data represent the operating times in hours for 3 types of scientific pocket calculators before a recharge is required.

Calculator														
A					B					C				
4.9	6.1	5.2	4.6	4.3	5.5	5.8	5.4	5.5	4.8	6.4	6.5	6.6	6.8	5.6
					6.2	5.2				6.3				

- i. State the most suitable test for this data.
- ii. Use the test in (i) at 5% level of significance to test the hypothesis that the operating times for all the three calculators are equal.

(10 marks)

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