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KIRIRI WOMENS' UNIVERSITY OF SCIENCE AND TECHNOLOGY
UNIVERSITY EXAMINATIONS, 2024/2025 ACADEMIC YEAR
FOURTH YEAR, FIRST SEMESTER EXAMINATION
FOR THE DEGREE OF BACHELOR OF SCIENCE IN MATHEMATICS
KMA 2408 NON-PARAMETRIC METHODS

Date: 9TH AUGUST, 2024
Time: 8:30AM-10:30 AM

INSTRUCTIONS TO CANDIDATES
ANSWER QUESTION ONE (COMPULSORY) AND ANY OTHER TWO QUESTIONS

QUESTION ONE: COMPULSORY (30 MARKS)

a) Discuss the merits and demerits of non-parametric over parametric methods of hypothesis testing. **(6 Marks)**

b) A driver buys fuel either at the total (T) or mobile stations (M). The following arrangement shows the order of the stations from which he bought fuel of a certain period of time;

TTTMTMTMMTTMTMTMTMTMMTMT

Test for randomness at the 5% level of significance. **(6 Marks)**

c) The following random sample data are weights in grams of 14 packages of certain kind of cigarettes.
100.8, 100.0, 102.6, 100.3, 98.2, 101.0, 100.5, 102.5, 100.0, 97.1, 103.6, 100.9, 99.8 and 101.0
Use the sign test based on binomial probability and 0.01 level of significance to test the null hypothesis $H_0: \mu = 100$ against the alternative, $H_1: \mu < 100$. **(6 Marks)**

d) The following are weights in pounds before and after of 16 people who stayed on a certain reducing diet for four weeks **(6 Marks)**

Before	147.0	183.5	132.1	161.6	197.5	206.3	177.0	215.4	147.7	208.1	166.8
After	137.9	176.2	129.0	163.8	193.5	201.4	180.6	203.2	149.0	195.4	158.3

Use the signed rank test to test whether the weight reducing diet is effective at 5% significance level

e) A two-way table is given below

Gender	**Smoking**		**Total**
	Yes	**No**	
Male	20	40	60
Female	10	30	40
Total	30	70	100

Test whether there is an association between gender and smoking at 5% level of significance **(6 Marks)**

QUESTION TWO: (20 MARKS)

a) The cost of land per acre (in thousands of dollars) is presented below for 15 pieces of land is an exclusive housing subdivision

98.2	96.0	97.3	95.2	97.5
100.3	97.0	96.1	99.1	93.2
98.5	96.8	95.3	94.5	97.4

Use Wilcoxon signed rank test to test whether or not the mean cost of land is 98.5 at 5% significance level

i. Formulate hypothesis **(1 Mark)**
ii. Compute test statistic **(6 Marks)**

iii. Test the hypothesis at 5% level of significance **(3 Marks)**

b) A movie producer is bringing out a new movie. In order to map out her advertising, she wants to determine whether the movie will appeal most to a particular age group or whether it will appeal equally to all age groups. The powder takes a random sample from persons, advertising a pre-reviewing show of the new movie and obtained the result in thetable below

	Age group (years)				
Persons	< 20 years	20.39 years	40-60 yrs	60>	Total
Liked the movie	320	80	110	200	710
Disliked the movie	50	15	70	60	195
Indifference	30	5	100	40	175
Total	400	100	280	300	1080

Required:

i. Write hypothesis **(1 Mark)**
ii. Compute expected value for each cell **(7 Marks)**
iii. Test the hypothesis at 5% level of significance **(2 Marks)**

QUESTION THREE: (20 MARKS)

a) The following is an arrangement of men (M) and women (W) lined up to purchase tickets for FIFA world cup final 2018 in Russia.

WMWMMMMWWMMMMWWWMMM
MMWWWMWMMMMWMMWMMMW
MMMM

Test for randomness at 5% level of significance

Required;

i) Write hypothesis **(1 Mark)**
ii) Compute test statistic **(5 Marks)**
iii) Test hypothesis at 5% significance level **(4 Marks)**

b) The following data are measured for the number of customers serviced per shift at counterof equity and KCB bank in Nairobi town.

Equity	120	136	107	109	129	117	125	110	124	-	-	-	-
KCB	131	144	116	111	103	122	141	139	130	133	132	135	148

Test whether the two samples come from the same population at 5% significance level

Required:

i) Write hypothesis **(1 Mark)**
ii) Compute test statistic **(5 Marks)**
iii) Test hypothesis at 5% significance level **(4 Marks)**

QUESTION FOUR: (20 MARKS)

a. Using the Kolmogorov-Smirnov methods, test the hypothesis that the following sample come from a normal distribution with a mean of 0.7 and variance of 1 at 5% significance level

0.19 1.65 1.77 1.43 0.33 1.59 1.81 0.17
0.03 0.81 1.15 0.45 1.51 0.83 1.33

i) Formulate hypothesis **(1 Mark)**
ii) Compute test statistic **(6 Marks)**
iii) Test the hypothesis at 5% significance level **(3 Marks)**

b. The following are the number of hours which ten students studied for an experimentation and the marks which they obtained

Number of hours	8	2	15	18	5	10	13	11	5	8
Marks scored	65	33	85	94	54	70	72	79	44	56

i. Compute the spearman's rank correlation coefficient **(5 Marks)**

ii. Is the spearman's rank coefficient in (i) significantly greater than zero? Assume alpha = 1% **(5 Marks)**

QUESTION FIVE: (20 MARKS)

a) The following is a sequence of weights of boxes sampled from a production line in company manufacturing asbestos.

45 58 56 47 38 50 63 60 49 54 52 55 44 58 64 60 49 68 67 50 60
51 53 45 44 49 51 50 57 50 54 56 55 60 49 68 47 52 66 47 56 54

Use one sample median test to check whether the line require adjustment to eliminate sequential under packaging. Use 1% level of significance

i. Write the hypothesis **(1 Mark)**

ii. Compute test statistic **(6 Marks)**

iii. Test the hypothesis at 1% level of significance **(3 Marks)**

b). Using the Kolmogorov-Smirnov methods, test the hypothesis that the following sample come from a normal distribution with mean 0.5 and variance of 1 at 5% sig. level

-0.81 0.41 0.36 0.92 -0.56 1.86 1.74 0.56 0.95 0.24 1.74
-0.15 -0.74 0.94 -0.64 0.32 0.82 0.70 0.10 -1.26 -1.06 0.15
0.55 -0.48 -0.49 0.16

i. Write the hypothesis **(1 Mark)**

ii. Compute test statistic **(6 Marks)**

iii. Test the hypothesis at 5% significance level **(3 Marks)**