(Knowledge for Development)

KIBABII UNIVERSITY

UNIVERSITY EXAMINATIONS

2020/2021 ACADEMIC YEAR

FOURTH YEAR FIRST SEMESTER

MAIN EXAMINATION

FOR THE DEGREE OF BACHELOR OF SCIENCE

COURSE CODE: STA 449

COURSE TITLE: NON – PARAMETRIC METHODS

DATE: 20/7/2021 **TIME:** 2 PM - 4 PM

INSTRUCTIONS TO CANDIDATES

Answer Question One and Any other TWO Questions

TIME: 2 Hours

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QUESTION 1:

a) State the parametric alternative to the following non-parametric tests:

i) The sign test (2 marks)

ii) The Wilcoxon test(U test) (2 marks)

iii) The kruskal-wallis test(H test) (2 marks)

iv) The Friedman's test (2 marks)

b) The non-parametric tests; the sign test and the paired sign test are considered wasteful of information. Explain why this is so and state the statistical remedy to that. (4 marks)

c) Prove that under the assumptions required by the Signed- rank test, T^+ (which is the sum of the ranks assigned to positive differences) is a value of a random variable with mean,

$$\mu = \frac{n(n+1)}{4}$$ (5 marks)

and the variance,

$$\sigma^2 = \frac{n(n+1)(2n+1)}{24}$$ (5 marks)

d) . The bacteria counts per unit volume are shown for two types of cultures A and B. Four observations were made for each culture

Culture A	Culture B
27	32
31	29
26	35
25	28

Does the data present sufficient evidence to indicate a difference in the population distribution of bacteria counts? Test using a value of α near 0.05 (5 marks)

e) Using the number of runs above and below the median, test the randomness of the following set of 2-digit numbers.

15, 17, 01, 65, 69, 69, 58, 40, 81, 16, 16, 20, 00, 84, 40, 22, 28, 26, 44, 66, 36, 86, 66, 17, 34, 49, 85, 40, 51, 10. (3 marks)

QUESTION 2:

The green pod yield (kg) under four treatment is as tabulated below

No. of plots	Treatment			
	1	2	3	4
1	3.17	3.44	3.15	2.48
2	3.40	2.88	2.69	2.37
3	3.50	2.97	3.10	2.58
4	2.87	3.27	2.80	2.84
5	3.88	3.94	3.45	3.00
6	4.00	3.87		2.48
7	3.60	3.25		

The hypothesis that there is no difference among four treatments by:

i) the median test (10 marks)

ii) the Kruskal walli's test (10 marks)

QUESTION 3:

a) The following are the scores of certain randomly selected students at mid-term (MT) and final examinations.

MT scores X	55	57	72	90	57	74	
Final score Y	80	76	63	58	56	37	75

The hypothesis H_0 that the distribution of scores at two occasions is the same against H_1

i.e. $H_0: F_Y(x) = F_X(x)$ Vs $H_1: F_Y(x) \neq F_X(x)$

Use the Mann-Whitney U-test. (10 marks)

b) . On a lonely country road, the number of vehicles passing a particular spot is noted for 60 consecutive minute as follows.

Number of vehicles	0	1	2	3	4	5
Number of minutes	25	15	10	5	3	2

Test $H_0: F(x) = F_0(x)$

Where $F_0(x)$ is a Poisson distribution at 5% level of significance.

Hint

λ can be estimated using the above:

λ = mean number of vehicles per minute.

$$\lambda = \frac{Number\ of\ vehicles}{number\ of\ minutes} = \frac{15}{60} = 0.25$$ (10 marks)

QUESTION 4:

In 100 families each containing three children, the number of girls are shown.

No. of girls	0	1	2	3
No. of families	8	27	45	20

What frequencies would you expect if the number of the girls in families with three children has a binomial distribution $B(n,p) = B(3,0.5)$.

Are these data consistent with this distribution? (20 marks)

QUESTION 5:

a) A die is thrown 120 times with the following results

Face	1	2	3	4	5	6
Frequency	18	23	16	21	18	24

Is the die fair?. Test at $\alpha = 0.05$ level of significance. (10 marks)

b) A genetic theory indicates that for a certain species of flowers, white, red, and blue flowers, should occur in the ration 5:3:1. Suppose that in a random sample of 180 flowers, 90 are white, 65 are red, and 25 are blue. What frequencies would we expect if the theory is correct? At 1% level of significance, test the genetic theory that

H_0: *the genetic theory is correct*

H_1: *the genetic theory is incorrect* (10 marks)