(Knowledge for Development)

KIBABII UNIVERSITY

UNIVERSITY EXAMINATIONS

2020/2021 ACADEMIC YEAR

FOURTH YEAR FIRST SEMESTER

SPECIAL/SUPPLIMENTARY EXAMINATION

FOR THE DEGREE OF BACHELOR OF SCIENCE

COURSE CODE: **STA 449**

COURSE TITLE: **NON-PARAMETRIC METHODS**

DATE: 13/01/2022 **TIME:** 11:00 - 1:00 PM

INSTRUCTIONS TO CANDIDATES

Answer Question One and Any other TWO Questions

TIME: 2 Hours

This Paper Consists of 4 Printed Pages. Please Turn Over.

QUESTION 1: (30 marks)

(a) Non parametric tests are also called distribution free tests, explain why it is so. (1 marks)

(b) State the non-parametric alternative to:

(i) One sample t- test (2 marks)

(ii) Two –sample t-test (2 marks)

(iii) One-way analysis of variance(ANOVA) (2 marks)

(iv) Two-way analysis of variance (ANOVA) (2 marks)

(c) 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

Do the data present sufficient evidence to indicate a difference in the population distributions of bacteria count. Test at 0.05 level of significance. (6 marks)

(d) 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)

(e) School children taking coaching in three private schools secured the following scores out of 100.

No. of children	Schools		
	1	2	3
1	33	32	55
2	38	15	68
3	39	87	27
4	48	32	88
5	58	22	

By applying the Kruskal-Wallis test at 0.01 level of significance, test the hypothesis that the students studying in the three private schools have identical distribution of marks. (5 marks)

QUESTION 2: (20 marks)

(a) The following are the final examination grades of samples from three groups of students who were taught Mathematics by three different methods.

First method: 94 88 91 74 87 97

Second method: 85 82 79 84 61 72 80

Third method: 89 67 72 76 69

Use the H test at the 0.05 level of significance to test the null hypothesis that the three methods are equally effective (10 marks)

(b) The following are speeds (in miles per hour) at which every fifth passenger car was timed at a certain checkpoint : 46 58 60 56 70 66 48 54 62 41 39 52 45 62 53 69 65 65 67 76 52 52 59 59 67 51 46 61 40 43 42 77 67 63 59 63 63 72 57 59 42 56 47 62 67 70 63 66 69 and 73.Test the null hypothesis of randomness at the 0.05 level of significance (10 marks)

QUESTION 3: (20 marks)

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.

$$H_0: F_Y(x) = F_X(x) \quad \text{Vs} \quad H_1: F_Y(x) \neq F_X(x)$$

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:

$\lambda =$ mean number of vehicles per minute.

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

QUESTION 4: (20 marks)

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: (20 marks)

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)