JARAMOGI OGINGA ODINGA UNIVERSITY OF SCIENCE AND TECHNOLOGY

SCHOOL OF BIOLOGICAL, PHYSICAL, MATHEMATICS AND ACTUARIAL SCIENCE

UNIVERSITY EXAMINATION FOR DEGREE OF BACHELOR OF   SCIENCE ACTUARIAL

2022/2023

MAIN REGULAR

COURSE CODE: WAB 2417

COURSE TITLE: NON PARAMETRIC METHODS

EXAM VENUE: LAB 17   **STREAM: (BSc. Actuarial)**

DATE: 7/12/2022   **EXAM SESSION: 9.00-11.00AM**

TIME: 2.00 HOURS

Instructions:

1. **Answer question 1 (Compulsory) and ANY other 2 questions**
2. **Candidates are advised not to write on the question paper.**
3. **Candidates must hand in their answer booklets to the invigilator while in the examination room.**

QUESTION ONE (20 MARKS)

a) State and explain clearly any three Non Parametric tests that would apply to inference on two samples. **[6 Marks]**

b) Fifteen coins are tossed and the number of heads and tails are observed as follows:

HHH TTT HH TTT H H H H

Test this data for randomness using the run test **[6Marks]**

c) The performance of a school in sixteen years in the final examination was recorded as follows based on the mean grade index to one decimal place.
10.5, 6.9, 8.3 , 7.8, 5.7, 9.9 , 11.2, 10.4, 9.7, 8.8, 8.3, 7.6, 7.3, 6.8, 6.9, 6.5
Apply Cox and Stuart test to this data topredictthe long term future performance of the school. **[6Marks]**

d) Let $Y_1 < Y_2 < Y_3 < ... < Y_{10}$ be the order statistic of a random sample from a distribution of the continuous type. Compute the value of $\Pr(Y_3 < \xi_{0.3} < Y_7)$ hence state the associated confidence interval. **[6 Marks]**

e) A group of 21invalids were treated for fever using a paracetamol. The signs of the differences of their body temperature in comparison with the previous were recorded as follows:

$$+ + + + + - - + + + + + + + - - + + +$$

One suspects that the paracetamol was effective in managing body fever. By stating clearly the null and alternative hypotheses, apply the two sample sign test to test the hypothesis. **[6 Marks]**

QUESTION TWO (20 MARKS)

a) In a study of drug abuse in a given slum area, the investigators found that the median IQ of arrested abusers who were 16 years of age or older was 113. Suppose that the researcher wishes to know whether to conclude that the median IQ of arrested abusers who are 16 or older in another slum area is different from 107 and picks data from a sample of 15 persons from the population of interest as follows:

77, 120, 88, 104, 125, 118, 113, 111, 112, 124, 107, 119, 127, 105, 126

What decision would they make at 5% level?
Give a brief description of the test you have applied to this case. **[10 Marks]**

b) Let Yn denote the nth order statistic of a random sample of size n from a distribution of the continuous type. Find the smallest value of n for which
$$(Y_1 < \xi_{0.5} < Y_n) \geq 0.95$$ **[10 Marks]**

QUESTION THREE (20 MARKS)

a) A survey was carried out on salaries of top management officers of two companies and the amounts earned per month for some officers of the companies noted as follows in thousands of shillings.

Company A	61	56	45	60	59	35	54	71
Company B	76	47	48	42	62	44	55	83

       Do the two companies pay their managers similar salaries? Apply Mann – Whitney U-Test.   **[10 Marks]**

b) Ten students scored marks in two subjects X and Y. Use Kendall's correlation coefficient to test the association of the performance in the two subjects based on the following data set.   **[10 Marks]**

STUDENT	A	B	C	D	E	F	G	H		I	J
X	48	43	39	57	21	47	58	38		33	28
Y	41	36	29	40	35	45	32	29		41	33

QUESTION FOUR (20 MARKS)

a) It is suspected that childhood background greatly influences adult level of participation in hunting and fishing activities amongst some communities in Kenya. A survey reported data on this issue as shown below.

Source of introduction	Residence In Youth	
	Rural	Urban
Parents	110	40
Other relatives	22	34
Friends	56	40
No one	34	24
Combination	14	18
Spouse	8	7

Test the null hypothesis of independence.   **[10 Marks]**

b) In a simulation study, a student generated the following three-digit numbers from a computer package

      303 499 522 677 812 202 900 111 976 332
      654 278 002 566 734 970 504 234 266 675
      887 256 241 181 901 600 200 254 116 765

Describe an assumption that is applied to randomness of computer generated numbers. Are these numbers random? **[10 Marks]**

QUESTION FIVE (20 MARKS)

a) Three treatments A, B, C were applied to 7 blocks as follows:

	1	2	3	4	5	6	7
A	21	29	16	20	13	5	4
B	23	30	19	19	10	12	10
C	15	21	18	18	14	6	2

Apply Friedman's test to check for difference in treatment effects. **[12 Marks]**

c) The government is interested in recruiting security officers who poses basal metabolic rate in milliliters within a given range. Personnel were sent to the field to get recruits. Upon presentation of data of various recruits, the central placement committee suspected that data from two officers were largely biased to a community from a specific geographical region. Apply Kolmogorov-Smirnov test to the data to verify the claims of the committee

Recruits by X	200	254	233	218	245	249
Recruits by Y	212	244	253	260	239	

[8 Marks]