**JARAMOGI OGINGA ODINGA UNIVERSITY OF SCIENCE AND TECHNOLOGY**

**SCHOOL OF MATHEMATICS AND ACTUARIAL SCIENCE**

**UNIVERSITY EXAMINATION FOR DEGREE OF BACHELOR OF   SCIENCE ACTUARIAL**

**SPECIAL RESIT 2020/2021 ACADEMIC YEAR**

**MAIN REGULAR**

**COURSE CODE: SAS 403**

**COURSE TITLE: NON PARAMETRIC METHODS**

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

       DATE:                             EXAM SESSION:

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) Distinguish between Parametric and Non Parametric test hence give three advantages of Non Parametric tests (8marks)

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

   H T H TTT H H H H

   Do you think that the coin tossing is done randomly (6 marks)

c) i) Briefly explain what the Cox and Stuart test is used for in Non -Parametric methods.

   ii) A certain weather station recorded the average rainfall per month to the nearest whole number in milimetres for a town in Kenya for a period of two and a half years as follows:
   14 , 13 , 6 , 12 , 8 , 15,  3,  9 , 11, 18, 19, 14, 20, 8, 10, 15,  7,  6,  13, 14,  19,  23, 24, 18,  13, 10,  9,  11,  8,  11, 16, 12, 16, 14, 6, 5
   Apply Cox and Stuart test to this data and give an advice on a decision that would possibly be made. (8 marks)

d) A group of 32 athletes intended to improve on their personal best times at the next Olympic Games. They intensified training and after the participation at the Olympic Games, the signs of the differences of their best times in comparison with the previous were recorded as follows:
   $+ - - - - - - + + + + 000 + + + - - - - - - + + - + - + + 0 - +0$
   By stating clearly the null and alternative hypotheses, analyze the impact of the intensified training on the results. Give the p-value for the test. (8marks)

**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 and of age or older was 107. 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:

   99, 100, 90, 94, 135, 108, 107, 111, 119, 104, 127, 109, 117, 105, 125

   What decision would they make at 5% level?
   Give a brief description of the test you have applied to this case. (10marks)

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 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 | 65 | 58 | 55 | 50 | 59 | 30 | 65 | 90 |
|-----------|----|----|----|----|----|----|----|----|
| Company B | 76 | 66 | 48 | 49 | 62 | 45 | 55 | 88 |

Do the two companies pay their managers the same salaries? Apply Mann – Whitney U-Test. (10 marks)

b) 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 |     |

(10marks)

**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                | 118   | 47    |
| Other relatives        | 32    | 24    |
| Friends                | 56    | 40    |
| No one                 | 44    | 24    |
| Combination            | 34    | 12    |
| Spouse                 | 2     | 7     |

Test the null hypothesis of independence and determine the P value (10 marks)

b) A continuous random variable X has probability density function defined by

$$f(x) = \begin{cases} x, & 0 < x < 1 \\ 2 - x & , 1 < x < 2 \\ 0, otherwise \end{cases}$$

Compute the quartiles for the distribution                                    (10marks)


**QUESTION FIVE (20 MARKS)**

 Five patients went to a diagnostic center to check their fasting blood sugar levels. After the first test they were not satisfied and so they decided to visit three other centers for confirmatory tests. The outcomes were recorded as follows

| Patient | Fasting blood sugar levels in 4 centres | | | |
|---|---|---|---|---|
|  | 1 | 2 | 3 | 4 |
| 1 | 150 | 145 | 160 | 155 |
| 2 | 190 | 190 | 180 | 190 |
| 3 | 120 | 130 | 130 | 115 |
| 4 | 140 | 140 | 150 | 140 |
| 5 | 110 | 110 | 120 | 120 |

Compare Friedman's test and Quade test on the similarities of the test centre results.
                                                                              (20 marks)