MURANG'A UNIVERSITY OF TECHNOLOGY

SCHOOL OF PURE AND APPLIED SCIENCES

DEPARTMENT OF MATHEMATICS AND ACTUARIAL SCIENCE

UNIVERSITY ORDINARY EXAMINATION

2018/2019 ACADEMIC YEAR

4 YEAR 1 SEMESTER EXAMINATION FOR, BACHELOR OF SCIENCE APPPLIED STATICS AND PROGRAMMING,MATHEMATICS AND COMPUTER SCIENCE,MATHEMATICS AND ECONOMISC

AMS 407 – NON PARAMETRIC METHODS

DURATION: 2 HOURS

DATE: 18/04/2019

TIME: 2:00-4:00 PM

Instructions to candidates:

1. Answer question One and Any Other Two questions
2. Mobile phones are not allowed in the examination room.
3. You are not allowed to write on this examination question paper.

SECTION A: ANWER ALL QUESTIONS IN THIS SECTION

QUESTION ONE (30 MARKS)

a) i) Define the efficiency of a non-parametric hypothesis test. 2marks

ii) What is sign test in non-parametric methods? 2marks

b) Write any three advantages and disadvantages of non-parametric tests. 6mks

c) A random sample of 15 children of one month or older shows the following pulse rates (beats per minute)

119, 120, 125, 122, 118, 117, 126, 114, 115, 126, 121, 120, 124, 127, 126.

Assuming that the distribution of pulse rate is symmetric about its median and continuous, is there any evidence to suggest that the median pulse rate of one month or older children is 120 beats per minute at 5% level of significance. 5marks

d) A sequence of Heads (H) and Tails (T) in tossing of a coin 16 times is given below.

H T T T H T H T H H T H T T H H

i. Count the number of runs. 2marks

ii. Test whether the Heads and the Tails occur in random order. 3marks

e) A police department wishes to compare the average number of monthly robberies at four locations their town. The table below shows the location and average monthly robberies.

Location	**Average Monthly Robberies**
1	15
2	10
3	19
4	16

Use Chi-square goodness of fit to determine whether robberies are concentrated in one or more of the locations. Use α = 5% level of significance. 5marks

f.) A grocery store owner wishes to know whether married couples have similar tastes in vegetables. Members of the couple were independently asked to rate their preference s for seven vegetables from most preferred (rank 1) to least preferred (rank 7). Their data is given below.

Vegetable	Husband	Wife
Broccolli	4	3
Cauliflower	3	1
Brussel Spronts	6	7
Okra	1	2
Cabbage	5	5
Spinach	2	4
Turnips	7	6

Calculate the Spearman's rank collection 5mks

SECTION B – ANSWER ANY TWO QUESTIONS IN THIS SECTION

QUESTION TWO (20 MARKS)

A machine on an automated assembly line produces a unique type of bolt. If the machine fails more than three times in an hour, the total production on the line is slowed down. The machine has often exceeded the number of acceptable failures for the last week. The machine is expensive and more cost effective to repair but the maintenance crew cannot find the problem. The plant manager asks you to determine if the failure rates are random or if a pattern exists. Use $\alpha = 5\%$. The table below shows the number of failures per hour for a 24 hrs period. 10mks

Hour	Number of Failures	Hour	Number of Failures	Hour	Number of Failures	Hour	Number of Failures
1	6	8	9	15	5	22	9
2	4	9	2	16	9	23	4
3	2	10	0	17	1	24	5
4	2	11	0	18	0		
5	7	12	0	19	1		
6	5	13	7	20	8		
7	7	14	6	21	5		

b) A counseling department for a school system is conducting a study to investigate the association between children's attendance in public and private pre-schools and their behavior in the kindergarten classroom. It is the researcher's desire to see if there is any positive association between early exposure to learning and behavior in the classroom.

	Behavior in kindergarten		
	Poor	**Average**	**Good**
Public pre-school	12	25	10
Private pre-school	6	12	0
No pre-school	2	23	10

Determine whether there is any association between type of pre-school experience and behavior in kindergarten in the first 6 weeks of school. Use $\alpha = 5\%$. 10mks

QUESTION THREE (20 MARKS)

a) A graduate student performed a pilot study for his dissertation. He wanted to examine the effects of animal companionship on elderly males. He selected 10 male participants from a nursing home. Then he used an ABAB research design where A represented a week with absence of a cat and B represented a week with presence of a cat. At the end of each week, he administered a 20-point survey to measure quality of life satisfaction. The survey is represented below.

Participant	**Week 1**	**Week 2**	**Week 3**	**Week 4**
1	7	6	8	9
2	9	8	10	7
3	15	18	16	17
4	7	6	8	9
5	7	8	10	11
6	10	14	13	11
7	12	19	11	13
8	7	4	2	5
9	8	7	9	5
10	12	16	14	15

Use a friedman test to determine if one or more of the groups are significantly different. 10marks

Use α= 10% level of significance.

b.) Eight men were involved in a study to examine the resting heart rate regarding frequency of visits to the gym. The assumption is that the person who visits the gym more frequently for a workout will have a slower heart rate. The table below shows the number of visits each participant made to the gym during the month the study was conducted. It also provides the men heart rate measured at the end of the week during the final ---weeks of the month.

Participant	**Number of visits**	**mean heart rate**
1	5	100
2	12	89
3	7	78
4	14	66
5	2	77
6	8	103
7	15	67
8	17	63

Use the spearman rank-order correlation to test whether there is any association between the number of visits and mean heart rates (use α=5%). 10marks

QUESTION FOUR (20 MARKS)

a) i) Define the Kendall's Rank correlation coefficient. 2marks

ii) The interviewers ranked 12 candidates (A through L) for a position. The results form the most preferred to the least preferred are:

Interviewer 1 A B C D E F G H I J K L

Interviewer 2 A B D C F E H G J I L K

Calculate the Kendall Tau correlation and interpret the result. 8marks

b.) The following data were obtained from a table of random numbers of normal distribution with mean 3 and standard deviation 1

2.1, 1.9, 3.2, 2.8, 1.0, 5.1, 4.2, 3.6, 3.9, 2.7

Test by K-S test that the data have come from the same normal distribution at 5% level of significance 10mks