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**UNIVERSITY EXAMINATIONS
2023/2024 ACADEMIC YEAR
FOURTH YEAR FIRST SEMESTER
MAIN EXAMINATION**

**FOR THE DEGREE OF BACHELOR OF EDUCATION AND
BACHELOR OF SCIENCE**

COURSE CODE: STA 415

COURSE TITLE: NON-PARAMETRIC METHOD

DATE: 04 /12/2023

TIME: 9:00 AM - 11:00 AM

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 ONE (30 MARKS)

- (a) Why are non-parametric tests mostly applied in medical research data? (2 marks)
- (b) State two assumptions of the Wilcoxon rank-sum test (2 marks)
- (c) What are the limitations of non-parametric methods? (3marks)
- (d) Discuss the difference between parametric and non-parametric tests (6 marks)
- (e) As a data analyst, what is the procedure you follow after data collection? Briefly discuss the steps you will follow before conducting appropriate analysis (6 marks)
- (f) Name three advantages of non-parametric tests (3 marks)
- (g) To determine if the order of questions has a significant impact on students' performances in an exam, 20 students are randomly equally divided into 2 groups A and B. Everyone were asked to answer an exam paper. The exam papers for both groups consist of same questions. The questions were ranked from easy to hard in the papers for group A while they were ranked from hard the easy for group B. The scores each student got are as follows.

A	82	82	84	94	90	72	91	71	76	70
B	40	60	52	72	72	81	75	78	74	62

Use the Wilcoxon signed rank test and assume normal approximation to assess whether students' performances in the two groups are significantly different (Take $\alpha = 0.001$) (8 marks)

QUESTION TWO [20 MARKS]

A study was conducted on some selected individuals to see if physical exercise has an effect in reducing depression. Individuals in the study were randomly assigned to one of the groups namely: no exercise; 20 minutes of jogging per day and 60 minutes of jogging per day respectively. At the end of a month, we ask each participant to rate how depressed they now feel, on a Likert scale that runs from 1 ("totally miserable") through to 100 ("extremely happy"). At the beginning of the session, a preliminary test is given, and the scores are shown in the following table.

No exercise	20 minutes of jogging per day	60 minutes of jogging per day
23	22	59
26	27	66
51	39	38
49	29	49
58	46	56
37	48	60
29	49	56
44	65	62

- (a) State any FIVE assumptions of Kruskal-Wallis test (5marks)
- (b) Formulate the null and the alternative hypothesis (2 marks)
- (c) At the 0.05 level, use the Kruskal-Wallis test to determine whether evidence exists to conclude if physical exercise alleviates depression? (13 marks)

QUESTION THREE [20 MARKS]

- a) The effectiveness of advertising for two rival products (Brand X and Brand Y) was compared. Market research at a local shopping centre was carried out, with the participants being shown adverts for two rival brands of coffee, which they then rated on the overall likelihood of them buying the product (out of 10, with 10 being "definitely going to buy the product"). Half of the participants gave ratings for one of the products, the other half gave ratings for the other product. Use Mann-Whitney U Test (10 marks)

Obs	Brand X ratings	Brand Y ratings
1	3	9
2	4	7
3	2	5
4	6	10
5	2	6
6	5	8

- b) When does one employ McNemar test? (2 marks)
- c) Below is the data from the 334 women with breast cancer. Screen film mammograms detected 136 women, digital mammograms detected 138, but only 84 of these women were detected by both modalities. Use McNemar test to show if there is any association between the two types of mammograms employed. The data are displayed in this 2x2 table (8 marks)

		Screen mammogram		Total
		Detected	Missed	
Digital Mammogram	Detected	84	54	138
	Missed	52	144	196
	Total	136	198	334

QUESTION FOUR [20 MARKS]

- (a) The following example shows the ranks medical students on patients according to their clinical performance (X_i) and test scores (Y_i). The table shows the data obtained. Use Spearman's Rank Correlation Coefficient to test if there is any association between the clinical performance and test scores. (10 marks)

Obs	1	2	3	4	5	6	7
Clinical performance (x)	3	1	2	4	6	7	5
Test scores (y)	3	2	1	7	5	6	4

- (b) A researcher is interested in whether a drug affects appetite in rats. Eight rats were tested twice, once with the drug and once without the drug, in a random order. The rats need to climb a slope to get a food pellet, and the number of times each animal climbed the slope in a 5-minute period was recorded. The data are not normally distributed (Use Wilcoxon signed rank test, take $\alpha = 0.05$) (10 marks)

Obs	1	2	3	4	5	6	7	8
With drug	10	25	11	26	18	14	16	25
No drug	15	22	18	24	19	22	20	23

QUESTION FIVE [20 MARKS]

Six subjects participated in an experiment to compare four methods of relieving stress. Each subject was placed in a stressful situation on four different occasions. Each time a different method for reducing stress was used with the subject. The response variable is the amount of decrease in stress levels as measured before and after treatment application. The results were as follows.

		SUBJECT					
		1	2	3	4	5	6
TREATMENT	A	16	16	17	28	19	14
	B	26	20	21	29	24	23
	C	22	23	22	36	26	19
	D	21	20	20	31	23	18

- a) State two assumptions of Friedman's test (2marks)
- b) Can we conclude based on Friedman test, that the four methods differ in effectiveness? (9 marks)
- c) Make all possible pair-wise comparisons of the four methods. (9 marks)

Use $\alpha = 0.05$.