MANICALAND STATE UNIVERSITY OF APPLIED SCIENCES

FACULTY OF ENGINEERING, APPLIED SCIENCES AND TECHNOLOGY

DEPARTMENT OF APPLIED STATISTICS

MODULE: STATISTICAL INFERENCE II

CODE: ASTA 225

SESSIONAL EXAMINATIONS

DECEMBER 2023

DURATION: 3 HOURS

EXAMINER: MR MANYEMBA

INSTRUCTIONS

1. *Answer **All** in Section A*
2. *Answer **three** questions in Section B.*
3. *Start a new question on a fresh page*
4. *Total marks 100*

Additional material(s): *Non-programmable electronic scientific calculator.*

SECTION A [40 marks]

Answer **ALL** Questions being careful to number them A1 to A4.

A1. Distinguish between the following terms:

(a) truly non parametric procedures and distribution free procedures, and [4]

(b) non parametric model and non parametric statistics. [4]

A2. State one non parametric test for each of the following:

(a) location for two independent samples, [2]

(b) location for two related samples, [2]

(c) variability for two independent samples, [2]

(d) randomness for one sample, [2]

(e) ordered alternatives for three or more related samples, [2]

(f) goodness of fit, [2]

(g) association, [2]

(h) equality of location parameters for three or more independent samples, and [2]

(i) dichotomised data for two samples, [2]

A3. The following data are the times in minutes taken by church pastor to pray:

6.2, 7.3, 4.1, 8.2, 4.2, 5.5, 7.1, 4.8

Apply the Jackknife procedure to find the 95% confidence interval for σ^2. [10]

A4. Briefly describe the reasons why you could be forced to use non-parametric test instead of parametric test. [4]

SECTION B [60 marks]

Answer any **THREE** Questions being careful to number them B5 to B8.

B5. An awareness campaign was done by students on a local university if they would write the examination under the influence of drugs or not. A group of 79 students participated in the activity and the students were asked the same questions after the awareness campaign and the following results were obtained:

		After Awareness	
		Yes	**No**
Before Awareness	**Yes**	22	24
	No	18	15

(a) Use McNemar test at $\alpha = 0.05$ to test if the awareness influenced students. [16]

(b) Determine the $p - value$ for the above test. [4]

B6. (a) State the three main types of extreme value distributions and give an example in where all the types are applied. [4]

(b) The following data shows the shelf lives in months of 12 vaccines for COVID-19.

5.6 4.3 6.0 4.9 5.1 5.0 5.6 4.1 6.4 4.6 5.1 5.6

Can we conclude that the shelf life time follows a normal distribution using the Kolmogorov-Smirnov one sample test. Use $\alpha = 0.05$. [16]

B7. A researcher compared the abilities of four water treatment chemicals (A, B, C and D)in purifying water coming from 11 samples, the results were collected as shown in the table below(1 represent clean water and 0 for dirty water).

Samples	1	2	3	4	5	6	7	8	9	10	11
Chemical A	1	1	0	0	1	1	1	1	1	1	1
Chemical B	1	1	0	1	1	0	0	0	0	0	1
Chemical C	0	1	0	1	1	0	1	1	0	0	1
Chemical D	0	1	0	1	1	1	1	1	0	0	1

Do the data provide sufficient evidence to indicate differences among the chemicals? Use Cochran's test at $\alpha = 0.05$. [20]

B8. (a) State the similarities and differences between Page's test and Friedman test. [4]

(b) A scientist compared three drugs in the treatment of COVID-19 on patients who tested positive to the disease. The results obtained in the table below are the times in minutes for the patients to fully recover from the disease.

Patient	1	2	3	4	5	6	7	8	9
Drug A	4000	1600	1600	1200	840	352	224	200	184
Drug B	3210	1040	647	570	445	156	155	99	70
Drug C	6120	2410	2210	2060	1400	249	224	208	227

Using Friedman's test, determine at the 5% level of significance whether there are difference among the three drugs. [16]

END OF EXAMINATION PAPER