UNIVERSITY OF MINES AND TECHNOLOGY, TARKWA

FIRST SEMESTER EXAMINATION, APRIL 2023

COURSE NO: MA 381
COURSE NAME: STATISTICAL MODELLING
CLASS: MA III

TIME: 3 HOURS

Name: _____ Index Number: _____

ANSWER ANY THREE (3) QUESTIONS

QUESTION 1

(a) Complete the table below with regard to Statistical Modelling.

Non -Parametric Test	What it does	Parametric Counterpart
Wilcoxon Signed Rank		
	Compare Two (2) Independent Medians	
		One-Way ANOVA
Friedman		
Chi-Square Test of Independence		

(b) Define: (i) unbiased estimator; (ii) best-unbiased estimator

(c) The continuous random variable X is distributed with the probability density function $f(x) = \frac{x^2}{2} + \frac{\theta x}{3} + \frac{1}{3}, -1 \le x \le 1$, and $f(x) = 0$, elsewhere, and $0 < \theta < 2$.

i. Find the mean and variance of X.

[20 Marks]

QUESTION 2

(a) Outline the "method of moments" for the estimation of a parameter.

(b) A random sample of n observations $x_1, x_2, \ldots, x_n$ is selected from a population where they possess a gamma distribution with parameters a and b, such that $f(x,a,b) = \frac{b^a x^{a-1}}{\Gamma(a)} e^{-bx}, x > 0,$

$a>0$, $b>0$. Obtain the moment estimates for a and b, given the observed values 15.5, 9.5, 6.8, 46.0, 34.5, 5.7, 20.9, 8.5, 14.9, and 17.7.

(c) The following data come from an independent measures study comparing three treatment conditions at the UMaT Clinic. Use the Kruskal-Wallis test to find out, at a 5% level of significance, whether there are differences between the treatments.

TREATMENT						
	A	14	3	21	5	16
	B	2	14	9	12	5
	C	26	8	14	19	20

[20 Marks]

QUESTION 3

(a) State the steps in hypothesis testing

(b) Let $x_1, x_2, \ldots, x_n$ be a random sample of n observations from a Poisson distribution. Find the Maximum Likelihood Estimator for lambda.

[20 Marks]

QUESTION 4

(a) What is meant by "parameter" in statistical inference?
(b) Describe the method of maximum likelihood.

(c) Two brands of cars were tested for the length of life (in 1000's of kilometers) on 16 cars chosen at random from all cars of a particular model. Do the results below show that the median lengths of life for the two brands differ significantly at the 1% level of significance? Use a Mann-Whitney U- test.

BRAND 1	38	45	37	44	39	41	39	32
BRAND 2	41	37	43	33	40	38	31	39

[20 Marks]

Examiner: Dr B. Odoi