JARAMOGI OGINGA ODINGA UNIVERSITY OF SCIENCE AND TECHNOLOGY

SCHOOL OF SPATIAL PLANNING AND NATURAL RESOURCE MANAGEMENT

UNIVERSITY EXAMINATION FOR THE DEGREE OF BACHELOR OF ARTS IN PLANNING AND MANAGEMENT

YEAR I SEMESTER I 2023/2024 DECEMBER EXAMS

MAIN UNIVERSITY EXAMINATION

COURSE CODE:	APP 802
COURSE TITLE:	QUANTITATIVE METHODS
STREAM:	MASTER IN PLANNING AND DESIGN
SCHOOL:	SCHOOL OF SPATIAL PLANNING AND NATURAL RESOURCE MAMAGEMENT
ACADEMIC YEAR:	2023/2024
VENUE	TBD
DATE:	TBD
TIME:	3 HOURS

Instructions:

1. **Answer QUESTION ONE and ANY OTHER TWOquestions**
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 1

Consider the following frequency tabulation of a sample of land parcels in a peri-urban area in Ha:

X_i(Ha.)	f_i (Number)
1.85–1.95	2
1.95–2.05	1
2.05–2.15	2
2.15–2.25	3
2.25–2.35	5
2.35–2.45	6
2.45–2.55	4
2.55–2.65	3
2.65–2.75	1

a) Using the midpoints of the indicated ranges of X_i,
   i) Calculate the mean parcel size in Ha. **(5 Marks)**
   ii) Calculate the median parcel size in Ha. **(3 Marks)**
   iii) Determine the mode of the frequency distribution. **(2 Marks)**

b) Consider the following data, which are a sample of amino acid concentrations (mg/100 ml) in arthropod hemolymph: **240.6, 238.2, 236.4, 244.8, 240.7, 241.3, 237.9.**
   i) Determine the range of the data **(1 Marks)**
   ii) Calculate the "sum of squares" of the data. **(5 Marks)**
   iii) Calculate the variance of the data. **(2 Marks)**
   iv) Calculate the standard deviation of the data. **(2 Marks)**

QUESTION 2

Discuss the principles, typical application, data requirements and limitations of:
a) Cluster Analysis **(10 Marks)**
b) Principal Component Analysis (PCA) **(10 Marks)**

QUESTION 3

a) Differentiate between the characteristics of qualitative and quantitative data **(3 Marks)**
b) Discuss the following types of data and approaches in analysis:
   i) Data on ratio scale **(5 Marks)**
   ii) Data on interval scale **(6 Marks)**
   iii) Data on ordinal scale **(6 Marks)**

QUESTION 4

Based on the normal distribution and the Standard Score (Z), discuss:
a) Type I and Type II statistical errors in hypothesis testing (8 Marks)
b) Long-term probabilities in hypothesis testing (6 Marks)
c) Statistical power of tests (6 Marks)

QUESTION 5

The following computer-based analysis shows the demand for middles class housing in two separate towns A and B. The demand is classified as low or high for 92 respondents with additional data on mortgage prices. Discuss and interpret these results based on qualitative approach to data analysis. **(20 Marks)**

Binary Logistic Regression: Demand versus Source, Price

Link function	**Logit**

Response Information

Variable	**Value**	**Count**	
Demand	Low	70	(Event)
	High	22	
	Total	92	

Deviance Table

Source	**DF**	**Adj Dev**	**Adj Mean**	**Chi-Square**	**P-Value**
Regression	2	7.574	3.787	7.57	0.023
Price	1	4.629	4.629	4.63	0.031
Town	1	4.737	4.737	4.74	0.030
Error	89	93.640	1.052		
Total	91	101.214			

Model Summary

Deviance	**Deviance**	
R-Sq	**R-Sq(adj)**	**AIC**
7.48%	5.51%	99.64

Coefficients

Term	**Coef**	**SE Coef**	**VIF**
Constant	-1.99	1.68	
Price	0.0250	0.0123	1.12
Town			
Town B	-1.193	0.553	1.12

Odds Ratios for Continuous Predictors

	Odds Ratio	**95% CI**
Price	1.0253	(1.0010, 1.0503)

Odds Ratios for Categorical Predictors(Odds ratio for level A relative to level B)

Level A	**Level B**	**Odds Ratio**	**95% CI**
Town			
Town B	Town A	0.3033	0.1026, 0.8966)

Regression Equation

P(Low) = exp(Y')/(1 + exp(Y'))

Town

Town A Y' = -1.987 + 0.02502 Price
Town B Y' = -3.180 + 0.02502 Price

Goodness-of-Fit Tests

Test	DF	Chi-Square	P-Value
Deviance	89	93.64	0.348
Pearson	89	88.63	0.491
Hosmer-Lemeshow	8	4.75	0.784

Observed and Expected Frequencies for Hosmer-Lemeshow Test

Group	Event Probability Range	Demand = Low		Demand = High	
		Observed	Expected	Observed	Expected
1	(0.000, 0.580)	4	4.4	5	4.6
2	(0.580, 0.668)	6	6.4	4	3.6
3	(0.668, 0.714)	6	6.3	3	2.7
4	(0.714, 0.745)	8	6.6	1	2.4
5	(0.745, 0.780)	8	6.9	1	2.1
6	(0.780, 0.812)	6	7.2	3	1.8
7	(0.812, 0.838)	8	8.3	2	1.7
8	(0.838, 0.869)	12	12.9	3	2.1
9	(0.869, 0.941)	10	9.1	0	0.9
10	(0.941, 0.967)	2	1.9	0	0.1

Measures of Association

Pairs	Number	Percent	Summary Measures	Value
Concordant	1045	67.9	Somers' D	0.38
Discordant	461	29.9	Goodman-Kruskal Gamma	0.39
Ties	34	2.2	Kendall's Tau-a	0.14
Total	1540	100.0		

SN	USEFUL FORMULAE
1.	$\overline{X} = \dfrac{\sum_{i=1}^{n} X_i}{n}$ or $\overline{X} = \dfrac{\sum X_i}{n}$
2.	$\overline{X} = \dfrac{\sum_{i=1}^{k} f_i X_i}{n}$
3.	sample median $= X_{(n+1)/2}$.
4.	$\text{median} = \begin{pmatrix} \text{lower limit} \\ \text{of interval} \end{pmatrix} + \left(\dfrac{0.5n - \text{cum. freq.}}{\text{no. of observations in interval}} \right) \begin{pmatrix} \text{interval} \\ \text{size} \end{pmatrix}$
5.	sample range = largest X − smallest X.
6.	$\text{sample SS} = \sum X_i^2 - \dfrac{\left(\sum X_i\right)^2}{n}$
7.	$\text{sample SS} = \sum f_i X_i^2 - \dfrac{(\sum f_i X_i)^2}{n}$
8.	$s^2 = \dfrac{\sum (X_i - \overline{X})^2}{n - 1}$.
9.	$s^2 = \dfrac{\sum X_i^2 - \dfrac{\left(\sum X_i\right)^2}{n}}{n - 1}$
10.	$s = \sqrt{\dfrac{\sum X_i^2 - \dfrac{\left(\sum X_i\right)^2}{n}}{n - 1}}$.