JARAMOGI OGINGA ODINGA UNIVERSITY OF SCIENCE AND TECHNOLOGY

SCHOOL OF SPATIAL PLANNING AND NATURAL RESOURCE MANAGEMENT

UNIVERSITY EXAMINATION FOR THE DEGREE OF BACHELOR OF SPATIAL PLANNING AND DESIGN AND BACHELOR OF SCIENCE IN WATER RESOURCES AND ENVIRONMENTAL MANAGEMENT

2ND YEAR 1ST SEMESTER 2022DECEMBER EXAMS

MAIN CAMPUS (REGULAR)

YEAR OF STUDY:	TWO	**SEMESTER:**	ONE
COURSE CODE:	PNP 1206		
TITLE:	QUANTITATIVE TECHNIQUES IN PLANNING		
SCHOOL:	SCHOOL OF SPATIAL PLANNING AND NATURAL RESOURCE MANAGEMENT		
TIME:	2 HOURS		

Instructions:

1. **Answer Question ONE (COMPULSORY) and ANY other 2 questions**
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.**

Q1. a) Explain the difference between descriptive and inferential statistics **(2 Marks)**

b) Outline at least three (3) characteristics of a confidence interval **(3 Marks)**

c) Explain the statistical use of simple linear regression and its relationship to normality **(3 Marks)**

c) Illustrate the possible outcomes associated with tossing of a coin together with throwing a die, using the concept of $(k_1)(k_2)$ **(2 Marks)**

e) Sampling errors cannot allow for generalization about the population from a sample. Explain this statement **(4 Marks)**

f) Describe concepts behind hypothesis testing in statistics **(6 Marks)**

g) Explain the meaning and application of Time Series Analysis **(5 Marks)**

h) Give the following data, construct the Analysis of Variance Table by showing which calculations are required **(5 Marks)**

i) $\text{Total SS} = \sum_{i=1}^{k}\sum_{j=1}^{n_i}(X_{ij} - \overline{X} = 479.7$

ii) $\text{groups SS} = \sum_{i=1}^{k} n_i(\overline{X}_i - \overline{X}) = 338.9$

iii) $\text{within-groups (error) SS} = \sum_{i=1}^{k}\left[\sum_{j=1}^{n_i}(X_{ij} - \overline{X}_i = 140.8\right.$

iv) Within-groups (error) SS = Total SS - Groups SS = 479.7 - 338.9 = 140.8

v) Total DF = N-1 = 19 – 1 = 18

vi) Group DF = k – 1= 4 – 1 = 3

vii) Within-groups (error) DF = N - k = 19 - 4 = 15

viii) Within-groups (error) DF = Total DF - Groups DF = 18 - 3 = 15

Q2. a) Explain the Kendall's Rank Correlation Coefficient, given the following 2 sets of XY variables,

i) X: 1 2 3 4 5 6
Y: 1 2 3 4 5 6

ii) X: 1 2 3 4 5 6
Y: 6 5 4 3 2 1

(10 Marks)

b) State the assumptions in regression analysis and their implications **(10 Marks)**

Q3. Discuss the correlation coefficient, given the following equations: **(20 Marks)**

i) $$r = \frac{\sum xy}{\sqrt{\sum x^2 \sum y^2}}$$

ii) $$r = \frac{\sum XY - \frac{\sum X \sum Y}{n}}{\sqrt{\left(\sum X^2 - \frac{\left(\sum X\right)^2}{n}\right)\left(\sum Y^2 - \frac{\left(\sum Y\right)^2}{n}\right)}}.$$

iii) $$s_r = \sqrt{\frac{1 - r^2}{n - 2}}.$$

Q4. a) Discuss the errors in hypothesis testing, given the following table **(15 Marks)**

	If H_o is true	If H_o is false
If H_o is rejected	Type I error	No error
If H_o is not rejected	No error	Type II error

b) Explain briefly the application of Principal Component Analysis (PCA) in handling with multivariate datasets **(5 Marks)**

Q5. To investigate the effect of Agro-Ecological Zone and Gradient upon Growth of plantation forest, a Binary Logistic Regression analysis was done with output shown below. Explain each meaning of each section of these outputs **(20 Marks)**

Binary Logistic Regression: Growth versus Gradient (cm), AgroEZ

Method

Link function	Logit
Categorical predictor coding	(1, 0)
Rows used	92

Response Information

Variable	Value	Count
Growth	Poor	70 (Event)
	Good	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
Gradient (cm)	1	4.629	4.629	4.63	0.031
AgroEZ	1	4.737	4.737	4.74	0.030
Error	89	93.640	1.052		
Total	91	101.214			

Model Summary

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

Coefficients

Term	Coef	SE Coef	VIF
Constant	-1.99	1.68	
Gradient (cm)	0.0250	0.0123	1.12
AgroEZ			
UM3	-1.193	0.553	1.12

Odds Ratios for Continuous Predictors

	Unit of Change	Odds Ratio	95% CI
Gradient (cm)	10	1.2843	(1.0101, 1.6330)

Odds Ratios for Categorical Predictors

Level A	Level B	Odds Ratio	95% CI
AgroEZ			
UM3	UM1	0.3033	(0.1026, 0.8966)

Odds ratio for level A relative to level B

Regression Equation

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

AgroEZ

UM1 Y' = -1.987 + 0.02502 Gradient (cm)
UM3 Y' = -3.180 + 0.02502 Gradient (cm)

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

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		

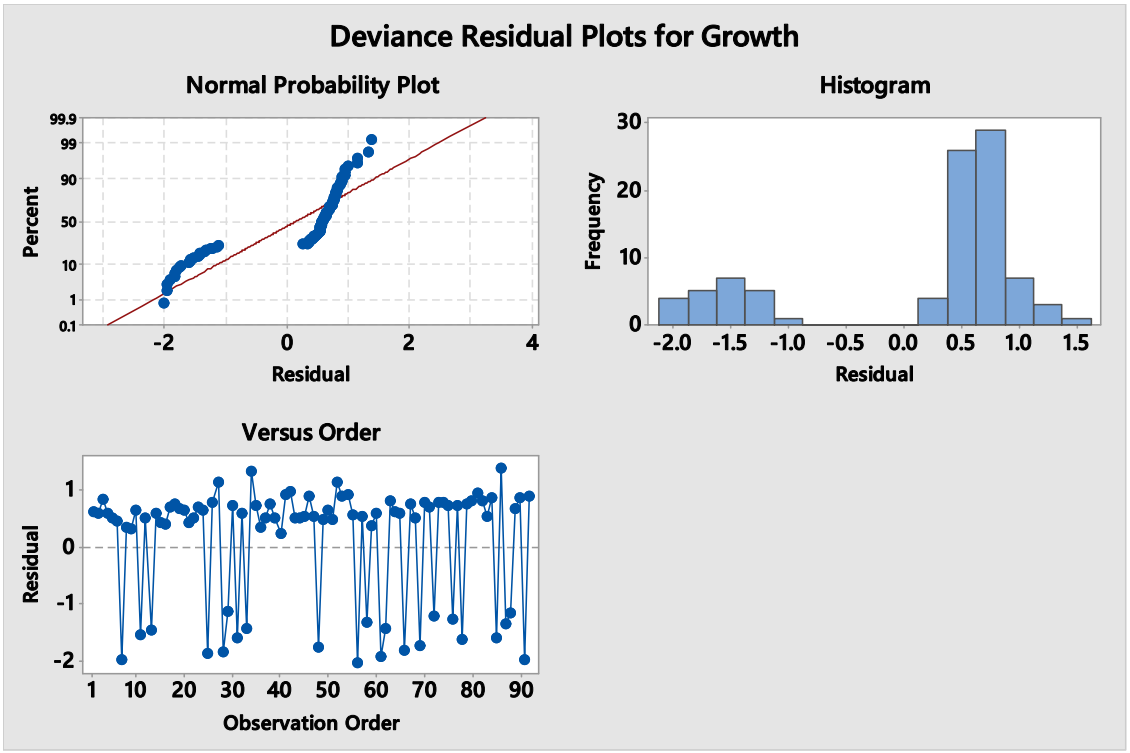
Association is between the response variable and predicted probabilities

Fits and Diagnostics for Unusual Observations

Obs	Observed Probability	Fit	Resid	Std Resid	
56	0.0000	0.8689	-2.0159	-2.04	R
86	1.0000	0.3828	1.3858	1.46	X

R=Large residual; X=Unusual X

Deviance Residual Plots for Growth


Deviance Residual Plots for Growth
Normal Probability Plot
Percent
99.9
99
90
50
10
1
0.1
-2
0
2
4
Residual
Histogram
Frequency
30
20
10
0
-2.0
-1.5
-1.0
-0.5
0.0
0.5
1.0
1.5
Residual
Versus Order
Residual
1
0
-1
-2
1
10
20
30
40
50
60
70
80
90
Observation Order