Name of Examination:
Faculty:
Subject:
Title:
Instructions:
Time Allowed:

Rain Semester Examinations, 201012011
Social Sciences
DSS 604
ADVANCED STATISTICAL TECHNIQUES
Attempt any three questions
3 Hours


These Questions do not require the use of computer

1a) Given that $Y=b_{0}+b_{1} X_{1}+b_{2} X_{2}+b_{3} X_{3}+b_{4} X_{4}+b_{5} X_{5}+e$ is a linear regression model where $X_{i s}$ are independent variables, $Y$ is the dependent variable and ' $e$ ' is the error term. Derive the normal equations associated with the regression model.

Ib) What are the assumptions of classical linear regression analysis?
The data below show the number of children ever born $(P)$, age at marriage $(Q)$ and age of mother $(R)$ of ten randomly selected women of childbearing age in a small rural village

| $P$ | 3 | 4 | 4 | 2 | 3 | 4 | 2 | 2 | 3 | 5 |
| :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- |
| $Q$ | 18 | 20 | 15 | 30 | 17 | 16 | 24 | 21 | 17 | 18 |
| $R$ | 24 | 32 | 28 | 31 | 22 | 20 | 25 | 26 | 30 | 32 |

i) Using matrix notation, obtain the first-order regression equation and interpret your results.
ii) From your equation in i) predict the number of children ever born of a woman aged 32 who married at age 24.

2a) With adequate examples, briefly discuss the following:
i) Univariate, bivariate and multivariate analyses
ii) Standardized and unstandardized regression coefficients
iii) Probit Regression Analysis
iv) Binary and Multinornial logistic regression analyses
v) Log-linear analysis

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2b) The following tables were obtained from a computer printout of the relationship between average weekly sales, number of television slots per week and the number of salesmen in 10 locations.

| Model | Sum of <br> Squares | df | Mean <br> Square | F | Sig. <br> (P-Value) | R |
| :--- | :--- | :--- | :--- | :--- | :--- | :--- |
| Regression | $* * * *$ | $* *$ | 76.122 | $* * *$ | 0.000 | 0.928 |
| Residual | 11.756 | $* *$ | $* * * *$ |  |  |  |
| Total | $* * * *$ |  |  |  |  |  |
| Model |  | B | Std Error | Beta | t | Sig. |
| Constant | 5.811 | 1.197 |  | 4.854 | 0.002 |  |
| Weekly adv. | 1.957 | 0.411 | 0.917 | 4.757 | 0.002 |  |
| No of salesmen | $8.246 E-02$ | 0.293 | 0.054 | 0.281 | 0.787 |  |

(a) Develop a regression equation model explaining the relationship between average weekly sales, number of television slots and the number of salesmen. Interpret this result.
(b) Which of the independent variables is the best predictor of sales and why?
(c) Predict the average weekly sales in a location with 12 tv slots per week and 5 salesmen.
(d) Comment on the linear relationship between sales, advertisement and the number of salesmen stating clearly your null and alternative hypotheses.

3a). With adequate examples, under which circumstance(s) will you use the following:
i) Bivariate Regression
ii) Bivariate Correlation
iii) Multiple Regression analysis
iv) Beta coefficient
v) Chi Square test
vi) Independent t- test
vii) Binary Logistic Regression Analysis
viii) One-Way Analysis of Variance
ix) Coefficient of multiple determination.
x) Multinomial Logistic Regression Analysis

3b) In an attempt to examine the relationship between the numbers of years spent in school (S), age at marriage (A), wealth quintile (W) and number of children ever born (C) in a certain fertility study, a researcher decided to fit a recursive model to the data using the following path coefficients:

$S \& A=0.3204$
$S \& W=0.2496$
$S \& C=-0.0425$
$W \& A=0.1490$
$W$ \& $C=-0.0178$
$A \& C=-0.2578$
I. State the causal variable(s)
II. State the response variables(s)
iii Describe the relationships graphically.
iv Construct a table of the values of direct and indirect effects of the explanatory variables on the response variable.

4a) Identify and discuss different levels of measurement scales you know in statistics

4b)
i). Choose a researchable topic of your interest with a one - paragraph statement of the problem.
ii) State three research questions/objectives relating to your research interest.
iii) List all the important variables associated with the research topic
iv) State three hypotheses emanating from your research
v). Draw an analysis plan that will help you achieve your research objectives at different levels of analysis. Justify the choice of your statistical methods


