

UNIVERSITY OF SWAZILAND
FINAL EXAMINATION PAPER 2005

TITLE OF PAPER: APPLIED LINEAR REGRESSION

COURSE CODE : ST 403

TIME ALLOWED : TWO(2) HOURS

**INSTRUCTIONS : THIS PAPER HAS FIVE QUESTIONS.
 ANSWER ANY FOUR(4) QUESTIONS.
 EACH QUESTION CARRIES 15 MARKS.**

REQUIREMENTS: Scientific Calculator

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GRANTED BY THE INVIGILATOR**

QUESTION ONE

- (a) *Explain two consequences of multicollinearity in economic modelling of regression variables.*
- (b) *State clearly three consequences of applying ordinary least squares method to the model $Y = X\beta + U$, (where U is the error term) when $E(U_t U_{t+s}) \neq 0$ for all t and $s \neq 0$.*

QUESTION TWO

Given that $Y_t = \alpha + \beta X_t + U_t$ and U_t follows a first order autoregressive scheme $U_t = \rho U_{t-1} + \epsilon_t$.

Show that

$\sigma_u^2 = \sigma_\epsilon^2 / (1 - \rho^2)$ for all t , with $|\rho| < 1$ and ϵ_t satisfies the assumption $E(\epsilon_t) = 0$ and $E(\epsilon_t \epsilon_{t-s}) = \sigma_\epsilon^2$, for $s=0$.

QUESTION THREE

In a multiple linear regression model $Y = X\beta + U$, if all the assumptions necessary for the least squares method hold except that $E(UU') \neq \sigma^2 I$.

- (a) What happens to the estimates of the parameters by the Ordinary least squares method?
- (b) Suggest an alternative estimating procedure and

Find:

- (i) the estimates of the parameters.
- (ii) var-covariance matrix of the estimates.

QUESTION FOUR

The regression results below are obtained for linear multiple regression model fitted on an Actuarial data covering twenty years.

- (i) Find the values of the asterisked cells.
- (ii) Test for $\beta_2=0$, given that $t_{n-1,0.25}=2.093$
- (iii) Compute F-value for the regression model.

ANALYSIS OF VARIANCE TABLE

(a) REGRESSION COEFFICIENTS

<i>Regression coefficient</i>	<i>Estimated regression coefficient</i>	<i>Estimated standard deviation</i>	<i>t-value</i>
B₀	33.87407	***	18.68
B₁	***	0.00889	-11.44
B₂	8.05547	1.45911	***

(b) ANOVA RESULTS

<i>Source of variation</i>	<i>Df</i>	<i>SS</i>	<i>MS</i>
Regression	***	1504.41	***
Error	***	***	10.38
Total	***	1680.80	

QUESTION FIVE

In a study of factors thought to be related to admission patterns of a large general hospital. The administrator obtained these data on ten communities in the hospital's catchment's area

<i>Persons per 1000 population admitted during study period. (Y)</i>	<i>Index of availability of other health services. (x₁)</i>	<i>Index of indigency. (x₂)</i>
61.6	6.0	6.3
53.2	4.4	5.5
65.5	9.1	3.6
64.9	8.1	5.8
72.7	9.7	6.8
52.5	4.8	7.9
50.2	7.6	4.2
44.0	4.4	6.0
53.8	9.1	2.8
53.5	6.7	6.7

Given that

$$\sum X_1^2 = 525.73, \sum X_1 X_2 = 374.31, \sum Y^2 = 33349.92, \sum X_2^2 = 331.56, \sum X_1 Y = 4104.32, \sum X_2 Y = 31$$

(i) Obtain the regression equation of Y on X_1 and X_2

(ii) Predict the admission population when $X_1=11.5$ and $X_2=5$, using the fitted regression model.