

UGANDA MARTYRS UNIVERSITY

NKOZI

UNIVERSITY EXAMINATIONS,

FACULTY OF SCIENCE

DEPARTMENT OF MATHEMATICS & STATISTICS

January, 2022

Time Series and Regression Analysis

Course: BSC. General III

DATE: 28/01/2022

TIME: 2:00PM- 5:00 Pm

DURATION: 3 HRS

Instructions:

1. Carefully read through ALL the questions before attempting
2. **ANSWER any four Questions.**
3. Provide all the outputs for all procedures
4. Ensure your work is **clear** and **readable**. Untidy work shall be penalized
5. Any type of examination Malpractice will lead to automatic disqualification
6. Do not write anything on the questions paper.

QUESTION ONE

- (a) Describe what it means by the term time series analysis and give the components of it. [05 marks]
- (b) Explain the importance of time series analysis [05 marks]
- (c) List and explain the problems associated with time series analysis [05 marks]
- (d) The following data shows the production (in '000 units) of a commodity from the years 2005 to 2009

Year	2005	2006	2007	2008	2009
Production in ('000 units)	11	13	15	9	5

Fit the trend of the type $Y = a + bX + cX^2$ to the above (take 2007 as the year of origin) and estimate the production for 2015. [10 marks]

QUESTION TWO

The annual production of a firm by wood products company Ltd, since 2001 follows;

YEAR	2001	2002	2003	2004	2005	2006	2007	2008
Production (thousands)	8	11	9	13	10	12	15	14

- (i) plot the production data [06 marks]
- (ii) Determine the least squares equation [10 marks]
- (iii) Determine the points on the least squares for 2001 and 2007 connect the two points to arrive at the straight line [04marks]
- (iv) Based on the equation for the straight line, what is estimated production for 2017? [05 marks]

QUESTION THREE

- (a) Describe non-linear trend analysis. [02 marks]
- (b) It appears that the imports of a product have been increasing by about 10 percent annually.

Year	2005	2006	2007	2008	2009	2010	2011	2012
Imports (thousands of tons)	90	100	124	135	143	155	167	178

- (i) Determine the logarithmic straight line equation [15 marks]
- (ii) By what percentage did imports increase on average, during the period? [03 marks]
- (iii) Estimate imports for the year 2018? [05 marks]

QUESTION FOUR

- (a) Give and explain example of a stochastic model (5 marks)
- (b) List the importance (s) of error term (noise) in any given model (5 marks)

© Consider the table below

X_i	10	11	12	13	14
Y_i	40	46	44	55	45

Use the least squares method and,

- (i) estimate regression function $Y_i = \beta_0 + \beta_1 X_i$ (10 marks)
- (ii) give the econometric meaning of the estimated function (2 marks)
- (iii) Predict the value of Y if $x = 20$ (3marks)

QUESTION FIVE

Given a stochastic demand function $Q_t = \alpha + \beta P_t + e_t$, where Q_t is the quantity demanded of a good, P_t is the price and e_t is the disturbance term. The sales department of ABC supermarket provided the data below. Use the information to answer the questions (a) to (f).

Derivations are not required but write the exact formulae without changing variable names where necessary and use them accordingly.

Month	Jan	Feb	March	April	May	June	July	Aug	Sep	Oct.
Pt	250	200	150	100	80	70	60	50	30	20
Qt	1	3	5	7	9	10	11	12	13	15

- Find and interpret the Ordinary least squares (OLS) estimates of α and β (6 marks)
- Write the estimated demand function $Q_t = \alpha + \beta P_t$ (4 marks)
- Calculate the coefficient of determination and give its meaning (5 marks)
- Test the hypothesis that $\beta = 0$ at 5% level of significance. (5 marks)
- Compute a 95 % confidence interval for β . (5 marks)

QUESTION SIX

A computer software firm collected Data for a sample of 20 employees in a given firm. A suggestion was made that a regression analysis could be used to find out an Annual salary (Y) was related to the years of experience (X), from the data, the following computer output was generated.

Source	df	SS	MSS	F.ratio	P-value
Regression	2	500.33	250.16	42.76	0.0023
Error	17	99.46	5.85		
Total	19	599.79			

Variable	Coefficient	Se	t-ratio	P-value
Constant	3.174	6.156	6.54	0.613
X	1.403	0.1986	4.48	0.003

REQUIRED

- Write down the estimated regression equation. (3 marks)
- Compute and interpret the adjusted coefficient of determination (5 marks)
- Interpret the coefficient of the independent variable and its P-value (2 marks)
- Construct the 95% confidence intervals for the parameter estimates. (5 marks)
- Test at 5 % level of significance, the hypothesis that the coefficient of years of experience is statistically different from zero. (5 marks)
- Test the hypothesis that the model as specified is useful for prediction at 5 % level of significance. (5 marks)

END