



WI-2016

JOMO KENYATTA UNIVERSITY

OF

AGRICULTURE AND TECHNOLOGY

UNIVERSITY EXAMINATIONS 2016/2017

THIRD YEAR SECOND SEMESTER EXAMINATIONS FOR THE DEGREE OF
BACHELOR OF SCIENCE IN ACTUARIAL SCIENCE, STATISTICS AND FINANCIAL
ENGINEERING

STA 2401: TIME SERIES ANALYSIS

DATE: JUNE 2017

TIME: 2 HOURS

INSTRUCTIONS: Answer question ONE and any other TWO questions .

QUESTION ONE (30 MARKS)

(a) Distinguish the following terms

- (i) Purely random process and Random walk process
(ii) Moving average process and Autoregressive process
(iii) Deterministic time series and Stochastic time series.

[7 marks]

(b) Consider the process $Y_t = X_t + X_{t-1} + X_{t-2}$ where $\{X_t\}$ is a purely random process with mean zero and variance 4. Obtain the Normalized spectral density function of this process

[6 marks]

(c) Investigate invertibility of the moving average process; $X_t = Z_t + 0.8Z_{t-1} - 0.2Z_{t-2}$

[4 marks]

(d) Define stationarity of a time series in weak sense. Hence investigate whether the following time series is stationary in weak sense

$Y_t = \frac{1}{6}Y_{t-1} + Z_t$ where $\{Z_t\}$ is a white noise process with mean zero and variance 16.

[8 marks]

(e) State the main feature of any time series data

[1 marks]

1

$$X_t = \sum_{j=0}^{\infty} a_j \epsilon_{t-j}$$

- (f) Define Correlogram and explain briefly how it can be used to analyse a time series. [2 marks]
- (g) State the main model concerned in the Box-Jenkin's forecasting procedure and give a reason why stationarity of the process is irrelevant in this procedure [2 marks]

QUESTION TWO (20 MARKS)

Consider the process $Y_t = \frac{1}{4}Y_{t-1} + Z_t$ where $\{Z_t\}$ is a purely random process with mean zero and variance σ^2 .

- (a) Express this process as the sum of infinite moving average process
- (b) Obtain the covariance and the Autocorrelation functions of the process [20 marks]

QUESTION THREE (20 MARKS)

- (a) Obtain the trend values by fitting a polynomial of order three to a set of nine points [15 marks]
- (b) Find the A.C.F of the process $Y_t = Z_t - 1.4Z_{t-1} + 0.6Z_{t-2}$ and $\{Z_t\}$ is a white noise process. [5 marks]

QUESTION FOUR (20 MARKS)

Consider the following data concerning the production of sugar in thousand tones from a certain sugar company

Year	1 st quarter	2 nd quarter	3 rd quarter	4 th quarter
2000	65	59	56	62
2001	60	55	51	58
2002	68	60	61	63
2003	70	58	56	60
2004	68	63	68	67

STA 2401

W1-2-60-1-6

- (a) Fit an exponential curve to obtain the trend values
- (b) Apply ratio to trend method to get the seasonal variations

[20 marks]

$$X_t = ab^t + e_t$$

$$\ln V$$

$$Y_t = a \left(\frac{b}{s}\right)^t$$

$$\frac{1}{s} = \text{growth factor}$$

$$\text{quantity} = \underline{\underline{4}}$$