

UNIVERSITY EXAMINATIONS

SECOND SEMESTER 2023/2024 ACADEMIC YEAR

SECOND YEAR EXAMINATION FOR THE DEGREE OF
BACHELOR OF SCIENCE (STATISTICS)

STAT 222: INTRODUCTION TO TIME SERIES ANALYSIS

STREAM: R

TIME: 2 HRS

DAY: FRIDAY [11.30 A.M – 1.30 P.M] ***DATE: 12/04/2024***

THIS QUESTION PAPER CONSISTS OF FOUR (4) PAGES

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ANSWER QUESTION ONE (COMPULSORY) AND ANY OTHER TWO QUESTIONS**QUESTION ONE (30 MARKS)**

- a) State four properties of the Autocovariance function **(4 Marks)**
- b) Determine whether the following process is invertible and stationary **(6 Marks)**

$$X_t = 0.75X_{t-1} - 0.05675X_{t-2} + e_t + 1.25e_{t-1}$$

- c) You have been given the following data(y_t) recorded over an 11 time period.

t	y_t
1	74
2	76
3	79
4	79
5	78
6	79
7	79
8	81
9	82
10	83
11	85

- i) Plot the series? **(3 Marks)**
- ii) Is the series stationary. Explain **(2 Marks)**
- iii) Transform the series by differencing. Name the differenced series w_t . **(2 Marks)**
- iv) Is the transformed series stationary? **(2 Marks)**
- v) Calculate the ACF of w_t upto lag 3 **(6 Marks)**
- vi) Calculate the PACF of w_t upto lag 2 **(4 Marks)**
- vii) Identify the time series model **(3 Marks)**



QUESTION TWO (20 MARKS)

- a) Determine the stationarity conditions for an AR(2) time series process. **(13 Marks)**
- b) The ACF of an AR(2) process can be real or imaginary. Explain the significance of these two results. **(4 Marks)**
- c) State whether the following models are causal or invertible
- ii) $X_t + 1.6X_{t-1} = e_t - 0.4e_{t-1} + 0.04e_{t-2}$ **(3 Marks)**

QUESTION THREE (20 MARKS)

- a) Consider the data given below.

tim												
e	1	2	3	4	5	6	7	8	9	10	11	12
		17										
xt	152	9	176	166	169	194	187	179	204	197	192	205

- i) Fit a three moving average. **(4 Marks)**
- ii) Plot the trend and the data on the same axis **(6 Marks)**
- iii) Calculate the seasonal variation **(4 Marks)**
- iv) Which model would be appropriate in analysing the data. Why. **(3 Marks)**
- v) Forecast for periods 13, 14 and 15 **(3 Marks)**

QUESTION FOUR (20 MARKS)

- a) Explain **four** objectives of time series analysis **(8 Marks)**
- b) i) Consider the following AR(2) process. Is it invertible? **(3 Marks)**
- ii) Is it stationary? **(3 Marks)**
- iii) Obtain the ACF and Pacf of the process. **(6 Marks)**



QUESTION FIVE (20 MARKS)

a) Find a process that has the following autocorrelation function **(5 Marks)**

$$\gamma(0) = 10, \quad \gamma(1) = 0 \quad \gamma(2) = -4 \quad \text{and } 0 \text{ for } |k| > 2$$

b) Describe the steps involved in the box and Jenkins approaching in time series modeling **(8 Marks)**

c) Consider the MA(2) process $X_t = e_t - 0.1e_{t-1} + 0.21e_{t-2}$

d) Find the ACF of the time series model $X_t = e_t - 0.1e_{t-1} + 0.21e_{t-2}$ **(7 Marks)**

