



MASENO UNIVERSITY
UNIVERSITY EXAMINATIONS 2016/2017

**THIRD YEAR FIRST SEMESTER EXAMINATIONS FOR THE
DEGREE OF BACHELOR OF SCIENCE WITH INFORMATION
TECHNOLOGY**

MAIN CAMPUS

**MAS 309: TIME SERIES ANALYSIS AND
FORECASTING**

Date: 3rd December, 2016

Time: 8.30 - 11.30 am

INSTRUCTIONS:

- Answer question ONE and any other TWO questions.
- Start each question on a fresh page.
- Indicate question numbers clearly at the top of each page.
- Observe further instructions on the answer booklet.



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MAS 309: TIME SERIES ANALYSIS AND FORECASTING
INSTRUCTIONS TO CANDIDATES

ANSWER QUESTIONS 1 AND ANY OTHER TWO QUESTIONS
QUESTION 1: (30 Marks) (COMPULSORY)

a) Explain the following terms as used in time series analysis:

- i) Random walk process (1mk)
- ii) Stationarity in the strong sense (1mk)
- iii) Purely random process (1mk)
- iv) Moving average process (1mk)

b) What are the merits and demerits of a moving average method in the analysis of time series trend fitting? (6mks)

c) Plot the following data and as certain trend by the method of semi-averages.

Year	1999	2000	2001	2002	2003	2004	2005
Sales in tones('000')	104	124	99	109	112	106	116

(5mks)

d) Fit a parabola $Y = a + bX + cX^2$ to the data given below and estimate the value for the year 2006 and comment on it.

Year	2000	2001	2002	2003	2004
Sales (in '000' shs)	30	32	33	30	28

(8mks)

e) Consider an autoregressive process of order 1 (AR (1)) given by

$$X_t = \alpha X_{t-1} + e_t, \text{ where } \alpha \text{ is a constant.}$$

If $|\alpha| < 1$, show that X_t may be expressed as infinite order of a MA Process. (7mks)

QUESTION 2: (20 Marks)

- a) Give four importance of time series analysis. **(4mks)**
b) Calculate the seasonal indices for the data given below by the method of ratio to moving averages.

year	Output of salt in million tones			
	I	II	III	IV
2005	70	64	63	65
2006	67	60	58	63
2007	70	65	65	69
2008	72	61	58	64
2009	62	57	53	60

(6mks)

- c) Fit a trend line to the following data by the freehand method.

Year	1998	1999	2000	2001	2002	2003	2004	2005	2006
Production of steel (in m. tones)	40	42	44	41	43	45	43	46	45

(3mks)

- d) Using the method of least squares, find the weights of a cubic polynomial $U_t = a_0 + a_1t + a_2t^2 + a_3t^3$ by the method of moving average to set of 5 points. **(7mks)**

QUESTION 3: (20 Marks)

- a) Describe the different components of time series analysis. **(8mks)**
b) Given AR(1) process as $X_t = \alpha X_{t-1} + e_t$

Find

- i) An optimal one-step-ahead forecast (1mk)
- ii) An optimal two-steps-ahead forecast (2mks)
- c) Fit a least squares straight-line trend for the following data and find the trend values. Estimate the sales for the year 2011.

year	1999	2000	2001	2002	2003	2004	2005
Sales (Ksh)	35	37	62	69	70	84	92

(4mks)

- d) Apply the method of link relatives to the following data and calculate seasonal indices:

Quarter	Quarterly figures				
	1992	1993	1994	1995	1996
I	7.0	6.4	7.8	8.2	7.6
II	7.5	8.9	7.6	6.8	8.4
III	8.8	9.4	10.3	8.5	9.0
IV	9.7	8.3	7.4	9.5	8.1

(5mks)

QUESTION 4: (20 Marks)

- a) Give a brief description of the following as used in time series analysis
 - i) Cyclical variation (2mks)
 - ii) Method of moving average (2mks)
 - iii) Method of least squares (2mks)
- b) Explain briefly the main stages in setting up a Box - Jenkins forecasting models. (4mks)

- c) Fit a logarithmic straight line to the following data.

year	1990	1991	1992	1993	1994	1995
Production (in m. tones)	74	80	85	92	98	105

(6mks)

- d) Calculate the 5-yearly and 7-yearly moving averages for the following data of a number of commercial industrial failures in a country during 1995 to 2010.

Year	No. of failures	Year	No. failures
1995	33	2003	19
1996	36	2004	23
1997	38	2005	21
1998	42	2006	24
1999	30	2007	22
2000	22	2008	19
2001	22	2009	3
2002	20	2010	1

(4mks)

QUESTION 5: (20 Marks)

- a) Using Box-Jenkins approach to forecasting where $X_t = \sum_{i=0}^{\infty} \theta_i e_{t-i}$ and

$$X_t(K) = \sum_{j=0}^{\infty} \omega_j e_{t-j}$$

Find the mean squared forecasting error

(6mks)

- b) The sales of a company in (Kshs) for the year 1999-2005 are given below.

year	1999	2000	2001	2002	2003	2004	2005
Sales (m. tones)	30	45	63	90	130	188	273

Estimate sales figures for the year 2009 using an equation of the form $Y = ab^X$, where $X = \text{years}$ and $Y = \text{sale}$.

(6mks)

- c) The price (in Kshs) of a commodity during 1999-2004 is given below

Year	1999	2000	2001	2002	2003	2004
Price	90	97	118	130	171	182

Fit a parabola $Y = \alpha_0 + \alpha_1 X + \alpha_2 X^2$ to this data and estimate the price of commodity for the year 2010.

(8mks)