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OFFICE OF THE DEPUTY PRINCIPAL
ACADEMICS, STUDENT AFFAIRS AND RESEARCH

UNIVERSITY EXAMINATIONS

2018 /2019 ACADEMIC YEAR

SECOND YEAR SECOND SEMESTER REGULAR EXAMINATION

FOR THE DEGREE OF BACHELOR OF SCIENCE (APPLIED STATISTICS WITH COMPUTING)

COURSE CODE: **STA218**

COURSE TITLE: **INTRODUCTION TO TIME SERIES ANALYSIS**

DATE: 23/4/2019 **TIME: 9.00 AM - 12.00 PM**

INSTRUCTION TO CANDIDATES

- **SEE INSIDE**

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STA 218: INTRODUCTION TO TIME SERIES ANALYSIS

STREAM: ASC **DURATION: 3 Hours**

INSTRUCTION TO CANDIDATES

Answer **ALL** questions from section A and **ANY THREE** Questions in section B.

All questions in section B carry Equal Marks

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SECTION A (31 marks): Answer ALL questions.

QUESTION ONE 16MKS

a) Explain the following four categories of time series.

i) Economic time series [1mk]

ii) Marketing time series [1mk]

iii) Demographic time series [1mk]

iv) Physical time series [1mk]

b) Explain the following as used in time series analysis.

i. Trend variations [1mk]

ii. Seasonal variations [1mk]

iii. Cyclic variations [1mk]

iv. Random variations [1mk]

c) Explain briefly the merit and demerit of each of the following methods of measuring trend?

i) The eye inspection or free hand method [2mks]

ii) The principal of least squares [2mks]

iii) The method of semi average [2mks]

iv) The method of moving average [2mks]

QUESTION TWO 15MKS

a) The sales of production in a company in (kshs) for the year 1990-1995 are given as follows

Year	1990	1991	1992	1993	1994	1995
Production	74	80	85	92	98	105

Fit the logarithmic straight line. [5mks]

b) The sales of a company in (million tones)is given in the table below.

i) Fit a straight line trend and find trend values. [4mks]

ii) Hence estimate the sales for the year 2011. [2mks]

Year	1999	2000	2001	2002	2003	2004	2005
Sales (m. tonnes)	35	37	62	69	70	84	92

c) Discuss four objectives of time series analysis [4mks]

SECTION B (39 marks)

QUESTION THREE (13MKS)

a) Plot the following data and ascertain trend by the method of free hand. [3mks]

Year	1998	1999	2000	2001	2002	2003	2004	2005	2006
Sales (m. tonnes)	25	27	29	26	28	30	28	31	30

b) Apply the method of link relative to the following data and calculate seasonal indices.

Quarter	**2003**	**2004**	**2005**	**2006**	**2007**
I	6.0	5.4	6.8	7.2	6.6
II	6.5	7.9	6.5	5.8	7.3
III	7.8	8.4	9.3	7.5	8.0
IV	8.7	7.3	6.4	8.5	7.1

[6mks]

c) Compute the exponential smoothened time series with W=0.2 for the following monthly data.

[4mks]

Jan	Feb	March	April	May	June	July	Aug	Sept	Oct	Nov	Dec
5886	5485	6269	5776	6109	5867	6196	6045	5839	6180	6180	6362

Given exponential smoothing $S_t = W_{yt} + (1 - W)S_{t-1}$ for t>1

QUESTION FOUR (13 MKS)

a) The price in Kshs of a commodity during 2000-2004 is given below.

Year	2000	2001	2002	2003	2004
Sales "000"	15	17	18	15	13

Fit a parabola $y = a_0 + a_1x + a_2x^2$ to this data. Estimate the price of the commodity for the year 2005. [5mks]

b) Consider an autoregressive process of order 1 (AR (1)) given by $\boldsymbol{X_t = \propto X_{t-1} + e_t}$ where $\boldsymbol{a}$ is a constant. If $|\propto| < 1$, show that X_t may be expressed as infinite order of a MA process.

[5mks]

c) For an AR(1) process given by $X_{t+1} = \propto X_t + e_{t+1}$. Find the optimal two steps ahead forecast. Hence find expectation. [3mks]

QUESTION FIVE (13MKS)

a) From the data below calculate the seasonal indices by the method of ration to moving average.

[7mks]

Year	Quarter	Output of salts in millions
1995	I	70
	II	64
	III	63
	IV	65
1996	I	67
	II	60
	III	58
	IV	63
1997	I	70
	II	65
	III	65
	IV	69
1998	I	72
	II	61
	III	58
	IV	64
1999	I	62
	II	57
	III	53
	IV	60

b) Calculate the 5-yearly and 7-yearly moving averages for the following data of a number of commercial industrial failures in a country during 1980-1987. [6mks]

Year	No. of failure	Year	No of failure
1980	24	1988	10
1981	27	1989	14
1992	29	1990	12
1983	33	1991	15
1984	21	1992	13
1985	13	1993	10
1986	13	1994	4
1987	11	1995	2

QUESTION SIX (13MKS)

a) Write short notes on the following stochastic time series.

i) Purely random process [2mks]

ii) Random work process [2mks]

iii) Moving average process [2mks]

iv) Autoregressive process [2mks]

b) Calculate the seasonal indices for the data given below by the method of ratio to moving averages. [5mks]

Year	Output of salt in millions tones			
	I	II	III	IV
1995	70	64	63	65
1996	67	60	58	63
1997	70	65	65	69
1998	72	61	58	64
1999	62	57	53	60

c) The following data gives the quarterly averages of price of a commodity for 4 years. Calculate the seasonal variation by method of simple average. [5mks]

Year	1st quarter	2nd quarter	3rd quarter	4th quarter
1967	40.32	44.2	46.0	48.0
1968	50.1	53.1	55.3	59.5
1969	47.2	50.1	52.1	55.2
1970	55.2	59.0	61.6	65.3

d) Explain the following terms

i) Stationary time series [1mk]

ii) Strictly stationary time series [1mk]

iii) Weak stationary time series [1mk]

QUESTION SEVEN (13MKS)

a) Explain two importance of studying seasonal variation. [4mks]

b) The sales of a company for the year 1999-2005 are given below. [5mks]

Year	1999	2000	2001	2002	2003	2004	2005
Sales	32	47	65	92	132	190	275

Estimate the figures for the year 2008 using $y = ab^x$

c) Given a quadratic function $U_x = a_0 + a_1x + a_2x^2$. Find the first, second and third order difference. [4mks]

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