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RAJARATA UNIVERSITY OF SRILANKA

FACULTY OF APPLIED SCIENCES, MIHINTALE

B.Sc. (General) Degree

Third Year Semester I Examination - October 2014

MAT 3208--Time Series

Answer **all** Questions Time allowed: **Two Hours**

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1)

a) Define the term Time Series and give mathematical formulas for two decomposition time series models.

b) Briefly explain the 4 component of time series.

c) Explain the following terminology used in time series analysis.

(i) IID noise

(ii) Auto covariance function

(iii)Auto correlation function

(iv)Stationary process

2)

a) What are the five methods of time series forecasting and give their formulas.?

b) The following data show~~s~~ sales of boats from 1980 through 1993, with data in thousands of boats.

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year	Sales
1980	105
1981	126
1982	101
1983	107
1984	103
1985	79
1986	80
1987	85
1988	90
1989	80
1990	75
1991	72
1992	78
1993	90
1994	100
1995	98
1996	93
1997	104

(i) Construct a graph for the time series. Does the overall trend appear to be upward or downward?

(ii) Construct 5-yearly moving average for this series.

(iii) Using the constant $\alpha=0.3$, fit an exponentially smoothed curve to the original time series.

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3)

a) Fit a straight line trend to the following series of cost of living index numbers in a certain city by using least square method.

Year	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970
Cost of living index no.	110	125	115	135	150	165	155	175	180	200

b) In 1984, two forecasting models were used to predict annual sales for the period 1990–1999. The forecasts and actual sales are listed below. For each model, calculate MAD and MSE to determine which model worked best for the period 1990–1999.

Model 1 (linear model): $\hat{y}_t = 0.3987 + 0.2593x$

Model 2 (quadratic model): $\hat{y}_t = 0.8095 + 0.0539x + 0.0187x^2$

year	Year code (x_i)	Actual sales
1990	1	0.93
1991	2	0.91
1992	3	1.13
1993	4	1.38
1994	5	1.56
1995	6	1.75
1996	7	2.14
1997	8	2.44
1998	9	2.79
1999	10	3.22

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4)

a) consider the AR(1) model,
$X_t = \varphi X_{t-1} + Z_t;\; t = 0,1,2,\ldots$

Where $Z_t \sim WN(0, \sigma^2)$ and $|\varphi|<1$ and Z_t is uncorrelated with x_s for each s and t. Show that AR (1) is stationary.

b) Let X_t be defined by,

$$X_t = \sum_{j=1}^{q} \left(A_j cos\lambda_j t + B_j sin\lambda_j t\right), t = 0,1,2,\ldots$$

Where $\lambda_1, \ldots \lambda_n$ are constants and $A_1, \ldots, A_q, B_1, \ldots, B_q$ are independent, zero mean random variables all having variance σ^2. Show that $\{X_t\}$ is a stationary process.

d) Write the following models in B notation, and state whether they are causal and/or invertible. Assume that $Z_t \sim WN(0, \sigma^2)$.

(i) $X_t - 0.2X_{t-1} = Z_t$
(ii) $X_t = Z_t + 0.7X_{t-1} - 0.2Z_{t-1}$
(iii) $X_t + 0.1X_{t-1} = Z_t - 0.5Z_{t-1}$
(iv) $X_t - 0.5X_{t-1} = Z_t + 0.3Z_{t-1} - 0.4Z_{t-2}$

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