EASTERN UNIVERSITY, SRI LANKA

DEPARTMENT OF MATHEMATICS

THIRD EXAMINATION IN SCIENCE - 2008/2009

FIRST SEMESTER (Feb., 2010)

ST 301 - TIME SERIES ANALYSIS

Answer all questions

Time: Two hours

Graph papers and Calculator will be provided

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1. (a)   i. What is a time series?

   ii. Describe three situations, where a time series analysis is required.

   iii. State the purposes of time series analysis.

   (b)   i. What do you mean by smoothing in context of time series analysis?

   ii. List two basic techniques of smoothing.

   iii. The production of cigarette (in billions) for the period 1997 - 2008 are shown as follows:

Year	Cigarette production (billion)	Year	Cigarette production (billion)
1997	744	2003	689
1998	694	2004	698
1999	667	2005	677
2000	669	2006	710
2001	665	2007	695
2002	658	2008	719

1. Construct an exponentially smoothed series with an exponential smoothing constant, $w = 0.5$.

2. Graph the time series and the set of exponentially smoothed values.

3. What can you say from your time series smoothing?

4. Estimate the cigarette production for the year 2009.

5. Discuss why exponential smoothing is recommended as a forecasting tool in this problem.

[25 marks]

2. (a) i. Explain clearly what is meant by trend of a time series.

   ii. List the different methods used to measure the trend in a time series.

   iii. Explain how you will decide about the type of trend to be fitted to a given time series data.

(b) The number of airline passengers (in thousands) traveling to Canada annually is shown below:

Year	Passengers		Year	Passengers
1998	181		2004	458
1999	184		2005	639
2000	230		2006	647
2001	235		2007	792
2002	302		2008	801
2003	409		2009	942

   i. Plot the time series

   ii. Which trend model is likely to fit best? Explain.

   iii. Estimate the appropriate trend model using least squares method.

   iv. Forecast the number of airline passengers for the year 2010.

[25 marks]

3. (a) i. Distinguish between seasonal variation and residual variation in a time series with suitable examples.

   ii. Explain the meaning of seasonally adjusted time series and why seasonal adjustment is needed.

iii. Explain how do you deseasonalize the time series data using

    1. additive model

    2. multiplicative model.

(b) The number of new mortgage loans issued by a building society in each quarter for three years is shown below:

Year	Quarter			
	1	2	3	4
2007	32	46	50	26
2008	36	48	50	30
2009	38	48	52	34

  i. Use an appropriate moving average to estimate the trend.

  ii. Use the additive model to estimate the seasonal index for each quarter.

  iii. Interpret the seasonal indexes.

  iv. Calculate the seasonally adjusted series.

[25 marks]

4. (a) i. Discuss the adjustment needed in a time series, before using it for time series analysis.

    ii. 1. Distinguish between the additive model and multiplicative model in time series analysis.

       2. Discuss the superiority of multiplicative model over additive model.

(b) The following trend line and the seasonal indexes were computed for 10 years of quarterly observations. Assume multiplicative model forecast the four values for the next year (11th year).

$$\hat{Y}t = 150 + 3t; \quad t = 1, 2, ..., 40$$

Quarter	1	2	3	4
Seasonal index	0.7	1.2	1.5	0.6

(c) i. The trend line obtained for annual data is $\hat{Y} = 30 + 9t$. Convert this equation on quarterly basis.

    ii. The trend line obtained for monthly data is $\hat{Y} = 2.5 + 0.0625t$. Convert this equation into annual trend equation.

[25 marks]

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