RAJARATA UNIVERSITY OF SRI LANKA
FACULTY OF APPLIED SCIENCES

B.Sc. (General) Degree in Applied Sciences
Third Year - Semester I Examination – June/July 2018

MAT 3208 – TIME SERIES

Time: Two (2) hours

Answer ALL Questions
Calculators will be provided

1. a) Briefly explain about Strictly stationary time series and Weakly stationary time series. **(20 marks)**

   b) State the components in time series. Briefly explain each component by using an example. **(40 marks)**

   c) Explain the following terminologies used in time series:

      i. IID Noise

      ii. White Noise **(20 marks)**

   d) "Every IID is a White Noise, but White Noise is not always IID". Do you agree with this statement? Justify your answer. **(20 marks)**

2. a) Consider the time series defined by the equation $X_t = Z_t + \theta Z_{t-1}$; $t = 0,1,2, \dots$, where $Z_t \sim WN(0, \sigma^2)$ and θ is a real constant. Check whether the series is stationary or not. **(20 marks)**

   b) i. Briefly explain the "Moving Average Method".

      ii. Discuss the advantages and disadvantages of Moving Average Method. **(20 marks)**

c) The number of members of the Collingwood Football Club over the past eight years is shown in the following table.

Year	2010	2011	2012	2013	2014	2015	2016	2017
No. of Members	38,587	42,498	45,972	57,408	71,271	72,688	78,427	72,170

i. Use 3-point Moving Average Method to smooth the data.

ii. Plot both original and smoothed data on the same set of axes. Comment your result.

iii. Predict the number of members in 2019 using the last smoothed value.

(60 marks)

3. a) State the required conditions for Least Squares Method. **(20 marks)**

b) The sales figures of Harold Courtenay's latest novel (in thousands of units) are given in the following table.

Time(week)	1	2	3	4	5	6	7	8	9
Sales (in thousands)	1	3	5	17	21	25	28	27	26

i. Obtain the equation of the trend line for the above data by using the Least Squares Method.

ii. Estimate the trend values and short term fluctuations against each year.

iii. Plot both original and estimated data on the same set of axes.

iv. Use the trend line equation to predict the sales for week 10, 12 and 14.

(80 marks)

4. a) Define the two terms **Stationary** and **Invertible**, in relation to an *ARMA(p,q)* process.

(10 marks)

b) Express each of the following models in B (Backward shift operator) notation and determine whether the models are stationary and/or invertible:

i. $X_t = 0.5X_{t-1} - 0.1X_{t-2} + Z_t$

ii. $X_t - 0.5X_{t-1} + 1.2X_{t-2} = Z_t + 0.7Z_{t-1}$ **(20 marks)**

c) i. Briefly explain the exponential smoothing method for forecasting.

ii. Annual production of wine by a company for past ten years (2008-2017) is shown in the following table. Forecast the wine production for the year 2018 by using exponential smoothing method with $\alpha = 0.2$:

Year	**Wine Production (in millions of gallons)**
2008	57
2009	63
2010	69
2011	61
2012	67
2013	58
2014	56
2015	61
2016	65
2017	68

(70 marks)

END