RAJARATA UNIVERSITY OF SRI LANKA
FACULTY OF APPLIED SCIENCES

B.Sc. (Four Year) Degree in Industrial Mathematics

Fourth Year– Semester II Examination – February/March 2019

MAT 4302– FINANCIAL MATHEMATICS

Time: Three (03) hours

Answer **All** questions

The use of a non-programmable calculator is permitted

1. Briefly explain each of the following providing examples:

  (a) BEP in FM   (20 marks)

  (b) I_{OSI} versus I_{ESI} (20 Marks)

  (c) Continuous compounding method (CCM)   (20 marks)

  (d) Types of assets   (20 marks)

  (e) Coupon Bonds   (20 marks)

2. Obtain the complete solution of a linear non-homogeneous recurrence relation

  via *five-step method.*   (30 marks)

  John currently has 5900 US-dollars in a savings account that pays 5 %

  Interest each month and he withdraws 300 US-dollars **each month** as monthly

  expenditure. Model the Scenario as a *dynamical system.*   (40 marks)

(continued)

Find the stationary level (Y_{ss}) and determine when the account get depleted.

(30 marks)

3. A micro-market model is described by the sets in the usual notation

$$S = \{(Q, P): Q - P^3 = 5 - 20P\} \quad \text{and}$$

$$D = \{(Q, P): Q + 2P = 40\}.$$

Depict S and D by indicating the market forces Q_s and Q_d in their explicit

forms as functions of unit price and sketching their graphs.   (90 marks)

Determine the *equilibrium set* E in the market model and comment on your

results via the zeros of the excess demand E_d (p).   (10 marks)

4. (a) Define the *return k* (s, t) on an investment and discus its characteristic

properties with respect to the models SIM, CIM and CCIM.   (30 marks)

(b) Find the exact time (ET) and approximate time (AT) from 19th September

2018 to 29th March 2020.   (30 marks)

(c) A bank charges 6% interest (SIM) in advance. Find the *face* of a nine-month

money- note which a merchant must sign in order to receive 6000 dollars

from the bank.   (40 marks)

5. In a money-market the bond prices are given by $A(0) = 90, A(1) = 100$

   and ; stock prices are given by $S(0) = 25$ dollars and

$$S(1) = \{ \begin{array}{l} 30 \; with \; probability \; p, \\ 20 \; with \; probality \; 1-p \end{array} , \text{where } 0 < p < 1.$$

   Find a portfolio whose value at time 1 is

$$W(1) = \{ \begin{array}{l} 2160 \; if \; stock \; prices \; go \; up, \\ 1040 \; if \; stock \; prices \; go \; down \end{array}. \text{(50 marks)}$$

   Determine the initial wealth of the *investor* and find $K_A, ,K_S$ and K_W in the

   Usual notation.   (50 marks)

6. (a) Explain the terminology SB-Portfolio, NAP, Radom-variable and Expected-

   value in Financial Mathematics.   (20 marks)

   (b) Write down the standard result for the expected value $E(K(n,m))$ of the

   aggregate return $K(n,m)$ which can be utilized under independent events in

   connection with the expected value $E(K(i))$ of one step returns $K(i)$, where

   $n \le i \le m$.   (20 marks)

   The table given below depicts the dynamical behavior of a stock-market.

Market Scenario

Scenario	Probability	S(0)	S(1)	S(2)
ω_1	0.25	100	110	120
ω_2	0.25	100	105	100
ω_3	0.50	100	90	100

Find the expected returns $E(K(1))$, $E(K(2))$ and $E(K(0,2))$.   (30 marks)

Calculate the value of R [K (1), K (2)] = $\dfrac{[1+E(K(0,2))]}{[1+E(K(1))][1+E(K(2))]}$.   (10 marks)

Using the above result comment on the returns $K(1)$ and $K(2)$.   (20 marks)

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