UNIVERSITY OF ESWATINI

FACULTY OF SOCIAL SCIENCES

DEPARTMENT OF ECONOMICS

MAIN EXAMINATION PAPER: DECEMBER 2018

TITLE OF PAPER: MATHEMATICS FOR ECONOMICS I

COURSE CODE: ECO205/ IDE- ECO205

TIME ALLOWED: 2 HOURS

INSTRUCTIONS TO CANDIDATES

1. ANSWER ANY THREE QUESTIONS

DO NOT OPEN THIS PAPER UNTIL YOU ARE INSTRUCTED TO DO SO.

Question 1

a) Given a simple national income model in two endogen1ous variables Y and C. Use the method of **matrix invasion** to find the equilibrium level of national income and consumption. [12]

$$Y = C + I_o + G_o$$

$$C = a + bY$$

b) Consider the situation of a mass layoff (that is a firm shuts down) where 1200 people become unemployed and now begin a job search. In case there are two states employed (E) and unemployed (U), with an initial vector.

c) $X_o' = [E \quad U] = [0 \quad 1200]$

Suppose that in any given period an unemployed person will find a job with probability 0.7 and will therefore remain unemployed with a probability of 0.3. Additionally, persons who find themselves employed in any given period may lose their jobs with a probability of 0.1 and will have a 0.9 probability of remaining employed.

i. Set up the Markov transition matrix for this problem [1]

ii. What will be the number of unemployed people after

- 1 Period [2]
- 2 periods [5]
- 3 periods [5]

Question 2

a. Consider an isoquant, in the form of a Cobb - Douglas production function $16k^{\frac{1}{4}}L^{\frac{3}{4}} = 2144$.

i. Find the slope of the isoquant $\frac{\partial K}{\partial L}$ or the marginal rate of technical substitution (MRTS). [8]

ii. Evaluate the MRTS at $K = 256, L = 108$ [2]

b. Suppose we are dealing with an economy with three industries and a given external demand vector such that;

$$A = \begin{bmatrix} 0.2 & 0.3 & 0.2 \\ 0.4 & 0.1 & 0.2 \\ 0.1 & 0.3 & 0.2 \end{bmatrix}, X = \begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix} \; and \; B = \begin{bmatrix} 10 \\ 5 \\ 6 \end{bmatrix}$$

Find the optimal values of x_1, x_2 and x_3 [15]

Question 3

A producer has the possibility of discriminating between domestic and foreign markets for each product where the demands, respectively are

$$Q_1 = 21 - 0.1P_1$$

$$Q_2 = 50 - 0.4P_2$$

The Total Cost function is given by

$$TC = 2000 + 10Q, where\ Q = Q_1 + Q_2$$

a) What price will the producer charge in order to maximize profits if they discriminate between the two markets [14]
b) What price will the producer charge in order to maximize profits if they do not discriminate between the two markets [8]
c) Compare the profits with discrimination and without discrimination [3]

Question 4

a) Optimize the following Cobb-Douglas production function subject to the given constraints by (1) Using the method of Lagrange Multipliers and (2) Finding the critical values. [Hint use the Hessian Determinant] [15]

$$Max\ q = K^{0.3}L^{0.5}\ subject\ to\ 6K + 2L = 384$$

b) Given $MC = 32 + 18Q - 12Q^2, FC = 43$, find
   i. Total cost [5]
   ii. Average cost [3]
   iii. Variable cost [2]