# UNIVERSITY OF SWAZILAND
## FACULTY OF SOCIAL SCIENCE
## DEPARTMENT OF ECONOMICS

### MAIN EXAMINATION: NOVEMBER 2013

TITLE PAPER:     MATHEMATICS FOR ECONOMISTS
COURSE CODE:    ECON 208
TIME ALLOWED:  THREE (3) HOURS

INSTRUCTIONS:
1. Answer ANY four questions .
2. Show all relevant workings to your answer.
3. All questions carry a total of 25 marks

SPECIAL REQUIREMENTS: CALCULATOR

**DO NOT OPEN THE QUESTION PAPER UNTIL INSTRUCTED TO DO SO BY THE INVIGILATOR**

## QUESTION 1

Write short explanatory notes on the following

a) Behavioural vs definitional equation
b) Autonomous expenditure vs induced expenditure
c) Technological matrix and idempotent matrix
d) Primal vs dual in linear programming
e) The question that the input output model attempts to answer.

[5 marks each]

## QUESTION 2

a) Given the simple model of national income determination

$$Y = C + I + G$$
$$C = 80 + 0.6Y$$
$$I = 100 + 0.2Y$$
$$G = 400$$

   i.   Express the system in the form of a matrix       [3 marks]

   ii.   List the endogenous variables of the model      [ 3 marks]

   iii.   Solve the system for the equilibrium values of the endogenous variables

[8 marks]

b) It is known in the university bookshop that when the price of a certain book is E10, there will be no purchases, but it is thought that for every lilangeni drop in price, twelve new purchases would appear. Furthermore, it is known that the publishers refuse to offer any copies for sale at a price of E3 or less, but they are prepared to offer nine copies for E4 and an additional nine copies for each one lilangeni rise in price.

   i)     Find two equations showing the quantity demanded ($Q_d$) in terms of price P, and the quantity supplied ($Q_s$) in terms of price P.

[4 marks]

   ii)    Find the equilibrium price at which the quantity demanded will equal the quantity supplied.       [7 marks]

## QUESTION 3

a) What is the objective of linear programming? What restricts the usefulness of the graphical approach as a tool for solving LP problems?

[6 marks]

b) Using the concept of the dual solve the following LPP using the simplex algorithm.

$$Min \ C = 60X1 + 80X2$$
$$s.t \ 2X1 + 3X2 \geq 36$$
$$2X1 + 2X2 \geq 28$$
$$8X1 + 2X2 \geq 32$$
$$X1, X2 \geq 0 \qquad \text{[19 marks]}$$

## QUESTION 4

a) Explain what is meant by break even analysis [5 marks]

b)   Given the following demand and cost functions for "Bonnita Holdings":

$$P = 12 - Q$$
$$C = 10 + 2Q + Q^2$$

i)     determine the break- even level of output.                [5 marks]
ii)    find the net revenue function                              [3 marks]
iii)   determine the level of output at which net revenue is maximum and hence find the value of maximum net revenue

[5 marks]

iv)    what is the level of output and price at equilibrium?

[4 marks]

v)     what is the level of output at maximum profit?

[3 marks]

## QUESTION 5

(a) Show that the following matrix is idempotent

$$\begin{pmatrix} 2 & -2 & -4 \\ -1 & 3 & 4 \\ 1 & -2 & -3 \end{pmatrix}$$

[5 marks]

(b) A country produces guns (G) and butter (B) using capital (K) and labour (L), with capital receiving a rental of r and labour receiving a wage of w. The technical coefficients are given as aij = the amount of input i required for the production of one unit of output j.

i.e

$a_{LB} = 3$      $a_{LG} = 2$
$a_{KB} = 9$      $a_{KG} = 4$

The zero profit conditions are:

$$\frac{L}{G}w + \frac{K}{G}r = P_G$$

$$\frac{L}{B}w + \frac{K}{B}r = P_B$$

Where $P_G$ = price of guns
$\quad\quad P_B$ = price of butter

(i) Write out the system in matrix form      [ 4 marks]

(ii) write out the matrix of technical coefficients      [4 marks]

(iii) find the determinant and inverse of the matrix of technical coefficients
[6 marks]

(iv) what is the solution to this system, i.e. Express w and r in terms of the commodity prices      [6 marks]