2nd SEM. 2013/2014

UNIVERSITY OF SWAZILAND

FINAL EXAMINATION PAPER

PROGRAMME: BSc. in Agricultural Economics and Agribusiness Management Year III

COURSE CODE: AEM 306

TITLE OF PAPER: QUANTITATIVE METHODS FOR AGRIBUSINESS DECISIONS

TIME ALLOWED: 2: 00 HOURS

INSTRUCTION: 1.THIS PAPER CONSISTS OF **FIVE** QUESTIONS.
2. ANSWER ANY **FOUR** QUESTIONS.
3. EACH QUESTIONS CARRIES 25 POINTS

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QUESTION 1. (25 points)

1.1 Evaluate the following determinant using the Laplace expansion

$$A = \begin{vmatrix} 10 & 2 & 1 \\ 2 & 0 & 4 \\ 1 & 2 & 6 \end{vmatrix}$$

(6 points)

1.2 Explain Leontief input-output model in Economics? **(6 points)**

1.3 A company has two inter-acting branches, A_1 and A_2 .Branch A_1 consumes E0.5of its own output and E0.3 of A_2 output for every E1 it produces. Branch A_2 consumes E0.6 of A_1 output and E0.4 of its own output per E1 of output.The company wants to know how much each branch should produce per month in order to meet exactly a monthly external demand of E 50,000 for A_1 product and E 40,000 for A_2 product.

Construct the consumption matrix and determine the production schedule for the above external demand.**(13 points)**

QUESTION 2. (25 points)

2.1A manufacturer knows that if x (hundred) products are demanded in a particular week (i) the total cost function (E000) is 14 +3x,and (ii) the total revenue function (E 000) is $19x - 2x^2$.

a) Derive the total profit function.**(4 points)**
b) Find the profit break-even points.**(4 points)**
c) Calculate the level of demand that maximizes profit and the amount of profit obtained. **(4 points)**

2.2Monthly sales revenue in thousands of Emalangeni is given by

$$TR(x_1,x_2) = 7x_1 + 4x_2 + 2x_1x_2 - x_1^2 - x_2^2 + 2$$

Where x_1 is inventory in thousands of Emalangeni and x_2 is floor space in thousands of square feet. Costs in thousands of Emalangeni as a function of inventory and floor space are given by

$TC(x_x,x_2) = x_1 + x_1x_2 + x_2 + 10$.

What is the maximum profit? Verify this is indeed the maximum profit?**(13 points)**

QUESTION3.(25 points)

3.1 Given cost and incomefunctions of a sugar producer
$C(x) = x^2 + 3x + 10$
and $I(x) = 2x - x^2$ respectively where x is daily production in tons and I (x) and C(x) are measured in E .

a) For which value of x will the income be maximized?(**4 points)**

b) Determine the gross profit and the value of x which will maximize the gross profit.(**4 points)**

c) The producer is taxed at a rate of 33% on the value of x for which it is a maximum. Determine his net profit and the value of x for which it is a maximum.(**4 points)**

3.2 Calculate the definite integrals.

a) $\int_0^1 x^3 + 5x + 2dx$ (**3 points)**

b) $\int_0^1 e^x dx$ **(3 points)**

3.3 The total revenue obtained (in E000) from selling x hundred items in a particular day is given by R, which is a function of variable x.

Given that $\frac{dR}{dx} = 20 - 4x$:

a) Determine the total revenue function R(**3 points)**

b) Find the number of items sold in one day that will maximize the total revenue and evaluate this total revenue?(**4 points)**

QUESTION 4.(25 points)

4.1 The demand and the supply for a certain product (in hundreds) in terms of its price (in cents) are given by the following equations:

$D(P) = -x^2 + 14$ (demand)

$S(P) = x^2 - x + 2$ (supply)

Find a) the consumers surplus(**4 points)**

b) the producers` surplus, when the market is in equilibrium.**(4 points)**

4.2 Use the Lagrange –multiplier method to find the stationery value of Z and use the bordered Hessian to determine if the stationary value of Z is a maximum or a minimum.
$Z = 3x - y - xy$, subject to $x + y = 8$. **(9 points)**

4.3. Use the graphical procedure to solve the following linear programming problem

Maximize $Z = 4x_1 + 5x_2,$

Subject to $-x_1 + 2x_2 \leq 4$

$x_1 + x_2 \leq 2$

$x_1 + x_2 \leq 3$ and

$x_1 \geq 0, x_2 \geq 0.$ **(8 points)**

QUESTION 5 (25 points)

5.1 Find the point of supply elasticity ε_s from supply function $Q = p^2 + 5$, and determine whether the supply is elastic at p = 4. **(10 points)**

5.2 A furniture manufacture makes three types of table;provincial x1, contemporary x2 and modern x3.The provincial model requires 2 hours for standing and 3 hours for staining. Its profit margin is 36.The contemporary model requires 2 hours for sanding and 2 hours for staining .Its profit margin is 28.The modern model requires 4 hours for standing and 1 hour for staining while contributing a profit margin of 32.

a) Formulate the linear programming problem and show production should be allocated to maximize if 60 hours are available for sanding and 8 hours for staining.
b) Using the graphical approach of linear programming find the optimal solution to this problem.
(15 points)