

2nd SEM. 2013



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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. ANSWER ALL FOUR QUESTIONS
2. EACH QUESTIONS CARRIES 25 POINTS

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Question 1. (25 points)

1.1 What is quantitative analysis? **(2 points)**

1.2 Find the solution of the equation system

$$7x - y - z = 0$$

$$10x - 2y + z = 8$$

$$6x + 3y - 2z = 7 \text{ using Cramer's rule?}$$

(9 points)

1.3 What is input-output model in economics?

(5 points)

1.4 Consider an economy with two goods, X and Y. The matrix of coefficients and the final demand is given by

$$A = \begin{pmatrix} 0.5 & 0.2 \\ 0.4 & 0.1 \end{pmatrix} \text{ and the demand vector } D = \begin{pmatrix} 7 \\ 4 \end{pmatrix}$$

Find the production vector that enables the economy to meet the demand.

(9 points)**Question 2. (25 points)**

2.1 Given the consumption function $C = a + bY$ (with $a > 0$; $0 < b < 1$)

a) Find its marginal function and its average function

(5 points)

b) Find the income elasticity of the consumption E_{cy} and determine its sign, assuming $Y > 0$.

(5 points)

c) Show that this consumption function is inelastic at all positive income levels. **(3 points)**

2.2 A firm has the following total-cost and demand functions;

$$C = \frac{1}{2} Q^2 - 3Q + 10$$

$$Q = 25 - p$$

a. Write out the total-revenue function R in terms of Q .

(3 points)

b. Formulate the total-profit function Π in terms of Q .

(3 points)

c. Find the profit-maximizing level of output Q .

(3 points)

d. What is the maximum profit?

(3 points)

Question 3. (25 points)

3.1 Given cost and income functions of a sugar producer

$$C(x) = x^2 + 4x + 40$$

and $I(x) = 3x - x^2$ 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 30% 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) $\int_0^1 -x^2 + 3x + 4 dx$ (4 points)

b) $\int_1^1 e^{-2x} dx$ (4 points)

3.3 If the marginal propensity to save (MPS) is the following function of income, $S'(y) = 0.4 - 0.2y^{-1/3}$, and if the aggregate saving S is nil when income y is 100, Find the saving function $S(y)$ (5 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:

$$D(P) = -x^2 + 11 \quad (\text{demand})$$

$$S(P) = x^2 - x + 4 \quad (\text{supply})$$

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.

$$Z = 2x - y - xy, \text{ subject to } x + y = 7. \quad \mathbf{(9 \text{ points})}$$

4.3. Use the graphical procedure(isoprofit line or corner point solution) to solve the following linear programming problem

$$\text{Maximize } Z = 10x_1 + 20x_2,$$

$$\text{Subject to } -x_1 + 2x_2 \leq 10$$

$$x_1 + x_2 \leq 8$$

$$5x_1 + 3x_2 \leq 30 \text{ and}$$

$$x_1 \geq 0, x_2 \geq 0.$$

(8 points)