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UNIVERSITY OF SWAZILAND

FINAL EXAMINATION PAPER

PROGRAMME: **BSc in AGRICULTURAL ECONOMICS AND AGRI-BUSINESS MANAGEMENT (III)**

COURSE CODE: **AEM 307**

TITLE OF PAPER: **QUANTITATIVE METHODS FOR AGRIBUSINESS**

TIME ALLOWED: **TWO HOURS**

INSTRUCTION: **ANSWER ALL THREE (3) QUESTIONS**

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QUESTION ONE

a. A firm sells its product in each of two distinct markets- A and B. In market A the quantity demanded (Q_A) is given in terms of the price charged in that market (P_A) by :

$$Q_A = 2500 - 0.5\ P_A{}^2$$

The equivalent demand function for market B is:

$$Q_B = 2500 - 0.75\ P_B{}^2$$

There are no fixed costs, and the variable production costs are constant and equal to E4.00 per unit. Develop the total profit-volume model for this particular firm that wishes to maximize its profit from sales in both markets.

(20 Marks)

b. For most products, higher prices result in a decreased demand whereas lower prices result in an increased demand. Let

X = annual demand for a product in units
P = price per unit

Assume that the firm accepts the following price-demand relationship as being realistic:

$$X = 800 - 10P$$
where the price P must be between E20.00 and E70.00

i)   How many units can the firm sell at the E20.00 and E70.00 per unit price, respectively?

(5 Marks)

ii)   Show the mathematical model for the total revenue, which is the annual demand multiplied by the unit price.

(5 Marks)

iii)   Based on other considerations, the firm's management will only consider price alternatives of E30.00, E40.00 and E50.00. Use your model from part (ii) to determine the price alternative that will maximize the total revenue.

(5 Marks)

iv)   What are the annual demand and total revenue corresponding to your recommended price?

(5 Marks)

QUESTION TWO

A farmer from Luyengo has been trying to figure out the correct amount of fertilizer that should be applied to his maize field. After getting his soil analysed by a soil scientist at UNISWA, Luyengo Campus, he was advised to put at least 60 pounds of nitrogen, 24 pounds of phosphorus compounds, and 40 pounds of potassium compounds on his field this season.

After checking the local discount stores, he finds that one store is currently having a sale on packaged fertilizer. One type on sale is a 20-5-20 mixture containing 20% nitrogen, 5% phosphorous compounds, 20% potassium compounds, and selling at E4.00 for a 20 pound bag. The other type on sale is a 10-10-5 mixture also containing 10% nitrogen, 10% phosphorous compounds, and 5% potassium compounds, and selling for E5.00 for a 40 pound bag.

The farmer would like to know how many bags of each type he should purchase so that he can combine the ingredients to form a mixture that will meet the minimum recommended requirements, but at the same time would like to spend as little as possible to keep his maize field healthy. What should he do?

Show the linear programming model of the above problem and solve it using the graphical method.

(30 marks)

QUESTION THREE

a.   In an inventory model whereby volume discounts are not permitted, briefly describe how the economic order quantity relates to ordering costs, costs of holding an inventory and the unit cost of the inventory. Based on your answer, develop a model for the minimum-cost order quantity.

(10 Marks)

b.   A company in Manzini purchases a component used in the manufacturing of irrigation pumps directly from the supplier in South Africa. The company's pump production operation, which is operated at a constant rate, will require 1000 components per month throughout the year. Assume ordering costs are E25.00 per order, unit cost E2.50 per component, and annual inventory holding costs are charged at 20%. There are 250 working days per year and the lead time is 5 days. Answer the following inventory policy questions for the company.

    i)   What is the Economic Order Quantity (EOQ) for this company?   **(5 Marks)**

    ii)   What is the reorder point?   **(5 Marks)**

    iii)   What is the cycle time?

    (5 Marks)

    iv)   What are the total annual inventory holding and ordering costs associated with your recommended EOQ?

    (5 Marks)