

BBM 113: BUSINESS MATHEMATICS I
ANSWER QUESTION ONE AND ANY OTHER THREE QUESTIONS

QUESTION ONE

a) Discuss the areas of application of business mathematics to a manager. (5 marks)

b) Highlight **Four** assumptions of markov process. (4 marks)

c) If $A = \{m, n, o, p\}$ $B = \{m, o, p, q\}$ $C = \{m, p, r\}$; and the universal set is defined as

$U = \{k, l, m, n, o, p, q, r, s, t\}$, the: what is

i) $A \cup B$ ii) $A \cap C$ iii) $B \cap C$ iv) $(A \cup B)'$ v) $(A \cap C)'$ (4 marks)

d) Given the following demand function: $Q = (40 - 2P)/3$; where Q is the level of output and P, the price per unit. The cost function is defined as $TC = 0.5Q^2 + 10Q - 225$. i) Derive the revenue function and the profit function. ii) calculate the corresponding break-even point

(6 marks)

e) A firm has an advertising budget of shs 720 000. It wishes to allocate this budget to two media: magazines and televisions, so that total exposure is maximized. Each page of magazine advertising is estimated to result in 60 000 exposures, whereas each spot on television is estimated to result 120 000 exposures. Each page of magazine advertising cost is shs 9000 and each spot in television costs shs 12 000. Formulate the linear programming problem.

(6 marks)

QUESTION TWO

a) Explain the importance of break-even analysis in a small business. (6 marks)

b) You are given consumption function; $C = 120 + 0.75Y^d$ where Y^d is disposable income. You are also given the following information: $Y^d = Y - T$ and that $T = tY$. Where Y is total income; T, total tax; and t, tax rate.

(i) Express consumption C, as a function of total income, Y.

(ii) Find the level of C if $t = 0.3$ and $Y = 5000$

(9 marks)

QUESTION THREE

- a) Discuss the application of functions in business (6 marks)
- b) Solve the following set of functions using matrix algebra inverse method

$$3X_1 - 3X_2 + 3X_3 = 6$$

$$4X_2 - 4X_1 + 3X_3 = 13$$

$$X_1 - 4X_3 + 4X_2 = -3$$

(9 marks)

QUESTION FOUR

- a) Using examples demonstrate the meaning of the following concepts
- i) Union of sets (2 marks)
 - ii) Intersection of set (2 marks)
 - iii) Compliment of a set (2 marks)
 - iv) A disjoint (2 marks)
- b) A music shop specializes in organs and various other keyboard machines. Many modern machines have MIDI, and any machine can either be portable or fixed. The shop also stocks second-hand machines. Part of the manager's quarterly report, reflecting the stock position, reads: 'Currently, 62 machines are in stock of which 16 are second-hand. New MIDIs account for the majority of stock at 34, of which 24 are portable. There are 34 portable machines in total, 28 having MIDI. We currently have no fixed, second hand MIDIs or non-MIDI, second-hand portables.'
- How many of the machines in stock:
- i) have MIDI?
 - ii) are new portables?
 - iii) that are new and fixed, do not have MIDI?
 - iv) are second-hand, portable MIDIs? (7 marks)

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QUESTION FIVE

- a) Highlight Four management applications of linear programming. (4 marks)
- b) A factory produces two products Hedon and Hedex each of which must pass through two production processes A and B. Product Hedon requires 5 hours in A and 4 in B, while product Hedex requires 5 hours in A and 3 in B. The maximum capacity of process A for a certain period is 6000 hours and, due to cost and manpower agreements, process B must be used for at least 2400 hours over the same period. Due to fixed commitments, at least 300 Hedex products must be produced, while a maximum of 250 Hedon products will be produced over the given period.
- i) Formulate the constraints for above problem.
 - ii) If Hedon has a contribution of Kshs. 50 and Hedex Kshs. 70, construct the first two tables.

(11 marks)

QUESTION SIX

- a) Outline four applications of transition matrix in business. (4 marks)
- b) A bank classified its customers as loyal, switchers or split, depending on the number of orders placed in a year. Records indicate there are 200 customers who are classified as loyal and 200 also classified as switchers and 200 as split; Furthermore each year 10 of the loyal customers are re-classified as switchers and 24 as split; 10 of the switchers customers are re-classified as loyal and 10 as split; and 18 of the split customers are re-classified as loyal and 20 as switchers. Determine:
- i) The transition matrix
 - ii) The percentage of customers that the company expect to have in each category in the long-run

(11 marks)