

CHUKA



UNIVERSITY

UNIVERSITY EXAMINATIONS

FIRST YEAR EXAMINATION FOR THE AWARD OF DEGREE OF BACHELOR OF COMMERCE

BCOM 162: BUSINESS MATHEMATICS II

STREAMS: BCOM Y1S2 (ODEL)

TIME: 2 HOURS

DAY/DATE: MONDAY 6/08/2018

2.30 P.M - 4.30 P.M.

INSTRUCTIONS:

- Answer question ONE and any other TWO
- Do not write on the question paper

QUESTION ONE: [30 MARKS]

(a) Explain the meaning of the following probability terms. Give examples.

- (i) Mutually exclusive events [2 Marks]
(ii) Independent events [2 Marks]
(iii) Equally likely events [2 Marks]
(iv) Sure events [2 Marks]

(b) Given function $y = 120X - X^2 + 0.02X^3$, determine the turning points of this curve.

[3 Marks]

(c) A firm considers production of either product A, B and C to be strategies while the likely demands for the products are considered as states of nature. The payoffs (Kshs.000) associated with the products are given in the table below:

	Strategies		
Demand	A	B	C
High	700	500	300
Moderate	300	450	300
Low	150	0	300

Use the table to determine the best production strategy using the following criteria

- (i) Laplace

[2 Marks]

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- (ii) Suppose the states of nature are believed to occur with probabilities 0.3, 0.5 and 0.2 for Low, Medium and High respectively, which product should the firm produce? [2 Marks]
- (d) An electric manufacturer has two lines A and B assembling identical electronic units. 5% of the units assembled on line A and 10% of those assembled on line B are defective. All defective units must be reworked at a significant increase in cost. During the last eight-hour shift, a line A produced 200 units while line B produced 300 units. One unit is selected at random from the 500 units produced.
- (i) If it is found to be defective, find the probability that it was assembled on line A. [3 Marks]
- (ii) Find the probability that the unit is defective given that it was assembled on line B. [2 Marks]
- (e) A stereo manufacturer can sell all the stereos of a particular type that he can produce. The total cost (Kshs) of producing q stereos per week is given by $300q + 2000$. The demand function (Kshs.) is estimated as $500 - 2q$.

Required:

- (i) Derive the revenue function, R . [2 Marks]
- (ii) Obtain the total profit function. [2 Marks]
- (iii) How many units per week should be produced in order to maximize profit? [2 Marks]
- (iv) Show that the solution of the equation $dR/dx = dC/dx$ where C represents the cost function, gives the same value for q as in part (iii) [2 Marks]
- (v) What is the maximum profit available [2 Marks]

QUESTION TWO: [20 MARKS]

- (a) Explain the meaning of decision theory and explain three decision making methods. [6 Marks]
- (b) The total profit (P) per acre on a wheat farm, has been found to be related to the expenditure per acre for (a) Labour and (b) soil improvement. If X represents the shillings per acre spent on labour and Y represents the shilling per acre spent on soil improvement:
- a. $P = 48X + 60Y + 10XY - 10X^2 - 6Y^2$

Required:

(i) $\frac{\partial P}{\partial X} \wedge \frac{\partial P}{\partial Y}$ [4 Marks]

(ii) What are the values of X and Y that maximize profits? [3 Marks]

(c) Explain three uses of calculus in business. [3 Marks]

(d) Explain four elements of decision making. [4 Marks]

QUESTION THREE: [20 MARKS]

(a) Find the derivative of the function $y = \frac{2x^4 - x^3 + 7}{1 + x^2}$ [3 Marks]

(b) A firm has analyzed their operating conditions, prices, costs and has developed the following functions: Revenue: $r = 400q - 4q^2$ and Marginal Cost: $dC/dQ = 2Q + 10$ where Q is the number of units sold. The firm will incur a total cost of Kshs.30 when there is zero production. The firm wishes to maximize profit. Assume that all output produced is sold,

(i) What quantity should be sold? [3 Marks]

(ii) What will be the amount of maximum profit? [2 Marks]

(c) Pentico industries must choose a supplier for the raw materials that it uses in its manufacturing divisions at C and B. Each division uses different units of steel, wood and plastic as shown in the table below

	Steel	Wood	Plastic
C	20	30	8
B	22	25	15

The two supply companies being considered, Western and Coastal, can each supply all these materials but at different prices per unit, as prescribed in the following table.

	Western	Coastal
Steel	300	290
Wood	100	90
Plastic	145	180

Using matrix multiplication, decide which supplier should be chosen to supply:

(i) C division [3 Marks]

(ii) B division [3 Marks]

(d) A company produces three products X, Y and Z using raw materials A, B and C. One unit of X requires 1, 2 and 3 units of A, B and C respectively. One unit of Y requires 2, 3 and 2 units of A, B and C respectively and one unit of Z requires 1, 2 and 2 units of A, B

and C respectively. The number of units available for raw material A, B and C are 8, 14 and 13 units respectively. Using the matrix method, find how many units of each product to produce in order to utilize completely the available resources. [6 Marks]

QUESTION FOUR: [20 MARKS]

- (a) In an orderly manner, explain the steps involved in decision making process. [6 Marks]
- (b) Discuss two types of decision making environment. [4 Marks]
- (c) Kaanwa Agro Mills Ltd (KAM) is considering whether to enter a very competitive market for manufacturing of animal feeds. In case KAM decides to enter this market, it must either install a new high technology equipment or pay overtime wages to the entire staff. In either case, market entry could result in
 - (i) High sales
 - (ii) Medium sales
 - (iii) Low sales
 - (iv) No sales

The management of KAM has estimated that if they enter the market there is a 60% chance of their shareholders approving the installation of the new equipment (this means that there is a 40% chance of using overtime). A random analysis of the current market structure reveals that KAM has a 40% chance of achieving high sales, a 30% chance of achieving medium sales, a 20% chance of achieving low sales and a 10% chance of achieving no sales.

Financial analysis of KAM indicates that a high level of sales will yield Kshs.1,000,000 profits; medium level of sales will result in a Kshs.600,000 profit, a low level of sales will result in a Kshs.200,000 profit and a no sale level will cost KAM a loss of Kshs.500,000. Entering the market will require a cash outlay of either Kshs.300,000 to purchase and install the new equipment or Kshs.100,000 for overtime expenses, should the second option be selected. A decision not to enter the market will add zero extra profit to the firm which is currently Kshs.250,000. (Assume that all costs and revenues have been discounted to their present values.)

- (a) Construct a decision tree for the problem showing clearly the courses of action. [6 Marks]
 - (b) By applying an appropriate decision criterion, recommend whether or not KAM should enter the market. [4 Marks]
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