



# MACHAKOS UNIVERSITY

University Examinations for 2018/2019 Academic Year

SCHOOL OF BUSINESS AND ECONOMICS

DEPARTMENT OF BUSINESS ADMINISTRATION

FIRST YEAR SECOND SEMESTER EXAMINATION FOR  
BACHELOR OF COMMERCE

BMS102: MANAGEMENT MATHEMATICS II

DATE:

TIME:

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**INSTRUCTIONS:** Attempt Question ONE and any other TWO question

**QUESTION ONE (COMPULSORY) ( 30 MARKS)**

- a) Define the following:
- i) A steady state (2 marks)
  - ii) Stochastic process (2 marks)
  - iii) Mutually exclusive events (2 marks)
- b) Solve the following system of equations using the matrix approach
- $$\begin{aligned} 2x_1 + 4x_2 + 6x_3 &= 18 \\ 4x_1 + 5x_2 + 6x_3 &= 24 \\ 3x_1 + x_2 - 2x_3 &= 4 \end{aligned}$$
- (3 marks)
- c) If the probability that a student A will fail a maths exam is 0.3 and the probability that student B will fail the same exam is 0.15 and that the probability that both student A and B will fail the maths exam is 0.08. What is the probability that
- i) At least one of these students will fail the exam (2 marks)
  - ii) Neither student A nor student B will fail the exam (2 marks)

- d) Outline the assumptions of the EOQ model clearly indicating using an appropriate model that it occurs at the point where holding costs is equal to ordering cost (6 marks)
- e) An economy consists of three industries X, Y and Z and each produces one product. The interaction of the use of X, Y and Z production over some fixed period of time is as shown below:

|   | X   | Y  | Z  | Final demand | Total production |
|---|-----|----|----|--------------|------------------|
| X | 100 | 40 | 80 | 140          | 360              |
| Y | 40  | 60 | 40 | 180          | 320              |
| Z | 60  | 40 | 40 | 100          | 240              |

Suppose demand is expected to increase by 30% for X and Y and reduce by the same percentage for Z industries. What must the total output be to meet this projected demand?

(4  
marks)

- e) Highlight the assumptions of Markov analysis (3 marks)
- f) A continental corporation operates a large fleet of cars for which an extensive preventive maintenance program is utilized. The cars can be classified in one of the three states: Good (G), Fair (F) and Poor (P). The transition matrix of these cars is as follows

|   | G   | F   | P   |
|---|-----|-----|-----|
| G | 0.6 | 0.3 | 0.1 |
| F | 0.2 | 0.6 | 0.2 |
| P | 0.1 | 0.4 | 0.5 |

Assume that there are 100 cars in good shape, 60 in fair shape and 20 in poor shape

- i) How many cars will be found in each condition next week? (2 marks)
- ii) How many cars will be found in each condition once the process stabilizes? (3 marks)

**QUESTION TWO (20 MARKS)**

- a) Explain four reasons for holding stock despite it being an expensive affair (8 marks)
- b) ABC departmental store sells 25,000 type A shirts a year. The supplier offers a generous quantity discount. The price list is given below: -

| Quantity      | Price per shirt (\$) |
|---------------|----------------------|
| 0-999         | 2.50                 |
| 1,000-1749    | 2.00                 |
| 1750 - 2, 499 | 1.50                 |
| Over 2,500    | 1.00                 |

Given that order cost is \$ 20. Inventory carrying cost is 20% of the value of the item. Determine the best inventory policy for ABC. (12 marks)

**QUESTION THREE (20 MARKS)**

- a) State four assumptions of input-output model (4 marks)
- b) An aircraft uses high tensile bolts at an approximately constant rate of 50,000 units per year. The bolts cost Sh. 20 each and the purchase department estimated that the cost of placing an order is Sh. 5,000. The holding cost per unit is 15% of the unit cost. No shortages are allowed. Required:
- i) What is the economic order quantity? (2 marks)
- ii) How frequently should the orders be placed? (2 marks)
- iii) If orders could be executed only once in two months, the ordering quantity would be higher than the optimal quantity. By this what would be the change in the total cost? (2 marks)
- c) The table below illustrates the 12 possible payoffs in the record and tape companies

Table 1:

|                             |          | Decision Maker's Alternatives |          |             |
|-----------------------------|----------|-------------------------------|----------|-------------|
|                             |          | Expand                        | Build    | Subcontract |
| State of nature<br>(Demand) | High     | 500,000                       | 700,000  | 300,000     |
|                             | Moderate | 250,000                       | 300,000  | 150,000     |
|                             | Low      | -250,000                      | -400,000 | -10,000     |
|                             | Failure  | -450,000                      | -800,000 | -100,000    |

Identify the optimal decision using:-

- i)     Maximax Criterion                                                 (2 marks)
- ii)    Maximin Criterion                                                (2 marks)
- iii)   Minimax Regret Criterion                                      3 marks)
- iv)   The Criterion of Realism (Hurwicz's rule) using  $\alpha = 0.7$  (3 m a r k s )

**QUESTION FOUR (20 MARKS)**

- a) Briefly explain the advantages of linear programming (5 marks)
- b) A firm makes two products X and Y and has a total production capacity of nine tonnes per day, X and Y requiring the same production capacity. The firm has a permanent contract to supply at least two tonnes of X and at least three tonnes of Y per day to another company. Each tonne of X requires twenty machine hours production time and each tonne of Y requires fifty machine hours production time. The daily maximum possible number of machine hours is three hundred and sixty. The entire firm's output can be sold and the profit made is Sh. 80 per tonne of X and Sh. 120 per tonne of Y.
- i. Formulate the above as a linear programming problem. (5 marks)
- ii. Using the graphical method, determine the number of tonnes of X and Y that the company should produce, hence the maximum profit. (10 marks)

**QUESTION FIVE (20 MARKS)**

An aircraft uses high tensile bolts at an approximately constant rate of 50,000 units per year. The bolts cost Sh. 20 each and the purchase department estimated that the cost of placing an order is Sh. 5,000. The holding cost per unit is 15% of the unit cost. No shortages are allowed. Required:

- a) What is the economic order quantity? (4 marks)
- b) How frequently should the orders be placed? (4 marks)
- c) If orders could be executed only once in two months, the ordering quantity would be higher than the optimal quantity. By this what would be the change in the total cost? (3 marks)
- d) The company has received the following offer from the supplier

| Quantity                         | Price per unit |
|----------------------------------|----------------|
| Up to 20,000 pieces per order    | 20.00          |
| Above 20,000 pieces up to 30,000 | 19.50          |
| Above 30,000 pieces up to 45,000 | 19.25          |
| Above 45,000                     | 19.00          |

Should they make use of this offer? (6 marks)

- e) If the entire requirements have to be bought in a single order, what should be the justifiable unit price offer to the company? (3 marks)