



TECHNICAL UNIVERSITY OF MOMBASA
Faculty of Business & Social Studies
DEPARTMENT OF BUSINESS STUDIES

UNIVERSITY EXAMINATIONS FOR
MASTERS IN BUSINESS ADMINISTRATION

BMS 5201: INTRODUCTION TO MANAGEMENT SCIENCE

SPECIAL/SUPPLEMENTARY EXAMINATIONS

SERIES: FEBRUARY 2015

TIME: 3 HOURS

INSTRUCTIONS:

– Answer any **FOUR** questions.

This paper consists of Four printed pages

QUESTION 1

- a) Discuss **SIX** phase approach to operations Research (OR). **(6 marks)**
- b) Trace the history of OR. **(6 marks)**
- c) Differentiate between soft OR and Har OR. **(6 marks)**
- d) Outline and discuss the steps involved in decision analysis. **(6 marks)**

- e) In the context of inventory control, define the following:
 - i) Buffer stock
 - ii) Replenishment point
 - iii) Carrying cost **(3 marks)**

QUESTION 2

- a) Explain how linear programming can be applied to solve management problems. **(6 marks)**
- b) Explain the following limitations of a linear programming model: proportionality, additive, divisibility and deterministic. **(8 marks)**
- c) Given a mathematical formulation of linear programming. **(4 marks)**
- d) The Bata Shoe Company has contracted with an advertising firm to determine the types and amount of advertising it should have for its stores. The three types of advertising available are radio, TV and Newspaper. The retail store desires to know the number of each type of advertisement it should purchase in order to maximize exposure. It is estimated that each advertisement will reach the following potential audience and cost the following amount. The following resource constraints exist:
1. There is a budget limit of Kshs. 100,000 available for advertising.
 2. The TV station has enough time available for 4 commercials.
 3. The radio station has enough time available for 10 radio commercials.
 4. The newspaper has enough space available for 7 adverts.
 5. The advertising agency has time and staff to produce at most a total of 15 commercial adverts.

Required:

Formulate an LF but do not solve.

(7 marks)

QUESTION 3

- a) What is Monte Carlo simulation? **(3 marks)**
- b) What are the advantages and disadvantages of simulation? **(8 marks)**
- c) A farmer has 10 acres of land and is cultivating tomatoes on the entire land. Due to fluctuation in water availability, the yield per acre differs. The probability distribution yields are given below:
- i) The farmer is interested to know the yield for the next 12 months if the same water availability exists. Simulate the average yield using the following random numbers.

Yield of tomatoes per acre (Kg.)	200	220	240	260	280
Probability	0.15	0.25	0.35	0.13	0.12

(7 marks)

- ii) Due to fluctuating market price, the price per Kg of tomatoes varies from Kshs. 50 to Ksh.s. 100 per Kg. the probability of price variation is given in the table. Simulate the price for next 12 months to determine the revenue per acre. Also find the average revenue per acre. Use the following random numbers:
53, 74, 05, 71, 06, 49, 11, 13, 62, 69, 85 and 69

Price per Kg. (Kshs.)	5.50	6.50	7.50	8.00	10.00
Probability	0.05	0.15	0.30	0.25	0.15

QUESTION 4

- a) Define the following relating to marker process:
- i) Absorbing state
 - ii) Transient state
 - iii) Recurrent state
 - iv) Periodic state
- (8 marks)**
- b) An OR analyst is analyzing switching between two different products. He knows that in period 1 the market shares for the two products were 55% and 45% but that in period 2 the corresponding market shares were 67% and 33% and in period 3; 70% and 30%, respectively.

The analyst believes that an accurate representation of the market share in any period can be obtained using marker processes. Assuming his believe is correct:

- i) Estimate the transition matrix.
- ii) Calculate the market shares in period 4 using the estimated transition matrix.
- iii) If the actual market shares for period 4 were 71% and 29% would you revise your estimate of the transition matrix or not? Give reasons for your decision.

(17 marks)

QUESTION 5

- a) Lets say DM has two decisions to make, with the second decision dependent on the outcome of the first. Before deciding about building a new plant, DM has the option of conducting his own marketing research survey, at a cost of \$10,000. The information from his survey could help him decide whether to construct a large plant, a small plant, or not to build at all. Before survey, DM believes that the probability of a favourable market is exactly the same as the probability of a unfavourable market: each state of nature has a 50% probability. There is a 45% chance that the survey results will indicate a favourable market . Such a market survey will not provide DM with perfect information, but it may help quite a bit nevertheless by conditional (posterior probabilities.
- 78% is the probability of a favourable market given a favourable result from the market survey.
 - 27% is the probability of a favourable market given a negative result from the market survey.

Required:

- i) Construct a decision tree diagram.
- ii) What is the best decision to undertake. **(15 marks)**

b) Use graphical method to solve the following game. Find the value of the game and strategy for each player.

$$\begin{matrix} & \text{Player } y \\ \text{Player } x & \begin{pmatrix} -6 & -2 \\ -3 & -4 \\ 2 & -9 \\ -7 & -1 \end{pmatrix} \end{matrix}$$

(10 marks)

QUESTION 6

a) The demand for an item is 18,000 units/year. The cost of one purchase is Ksh. 400/-. The holding cost is Ksh. 12 per unit per year. The item cost is Kshs. 1 per item. The shortage cost is Kshs. 5/- per unit per year. Determine

- i) The optimum order quantity
- ii) The time between orders
- iii) The number of orders per year
- iv) The optimum shortages
- v) The maximum shortages
- vi) The time of items being held
- vii) The optimum annual cost

(15 marks)

b) A certain petrol pump, customers arrive in a poisson process with an average time of 5 minutes between arrivals. The time intervals between services at the petrol pump follow exponentially distribution and as such the mean time taken to service a unit is 2 minutes. On the basis of this information you are required to answer the following questions.

- i) What would be the expected average queue length?
- ii) What would be the average number of customers in the queuing system?
- iii) How long on average a customer does spend in this system.
- iv) How much should the flow of customers be increased to justify the opening of a second service point if the management is willing to open the same provided the customer has to wait for 5 minutes for service.

(10 marks)