



MAASAI MARA UNIVERSITY

REGULAR UNIVERSITY EXAMINATIONS

2022/ 2023 ACADEMIC YEAR

**FIRST YEAR SECOND SEMESTER EXAMINATION FOR THE DEGREE IN MASTER
IN BUSINESS ADMINISTRATION**

COURSE CODE: MBA 8210

COURSE TITLE: OPERATIONS RESEARCH.

DATE: APRIL, 2023

TIME: 3 HOURS

INSTRUCTIONS TO CANDIDATES

Answer Question ONE and any other TWO questions

This paper consists of SIX printed pages.

QUESTION ONE (30 Marks)

- a) Define the following in relation to the network analysis
 - i. Activity (1 Mark)
 - ii. Event (1 Mark)
 - iii. Dummy activity (1 Mark)
- b) State three rules that must be followed when drawing a network. (3 Marks)
- c) Distinguish between deterministic demand and probabilistic demand. (2 Marks)
- d) A company uses 100,000 units per year. The set up cost is \$250 and holding cost per unit inventory per month is \$0.03. Determine the economic order quantity and how often should an order be placed. (4 Marks)

- e) A company makes three types of toys T_1 , T_2 and T_3 . Each toy requires processing by three machines A, B and C which can manufacture parts, assemble and pack respectively. Machine time required and expected profit per toy is as follows.

Toy	Time in hours			Unit Profit
	A	B	C	
T_1	4	2	1	5
T_2	2	2	3	4
T_3	4	3	2	3

The machines are available for up to 80, 50 and 40 hours respectively in a week.

- i. Formulate the problem as a linear programming model which maximizes weekly profit. (2 Marks)
 - ii. Write down the initial simplex tableau (3 Marks)
 - iii. Perform one iteration and obtain the second tableau. (3 Marks)
- f) A department of a company has five employees with five jobs to be performed. The time that each man takes to perform each job is summarized in the matrix table below. How should the jobs be allocated one per employee so as to minimize total man hours required? (5 Marks)

Jobs\Employees	1	11	111	1V	V
A	10	5	13	15	16
B	3	9	18	13	6
C	10	7	2	2	2
D	7	11	9	7	12
E	7	9	10	4	12

- g) Busy Transport Company records that the arrival of trucks carrying goods is .30 per day. Assuming the interarrival time follows an exponential distribution and the service time is also an exponential with an average of 36 minutes. Calculate:

- i. The expected queue size (1 Marks)
- ii. Probability that the queue size exceeds 10 (2 Marks)
- iii. If the input of tracks increases to an average of 33 per day, what will be change in (i) and (ii) (2 Marks)

QUESTION TWO (20 Marks)

Consider the following linear programming model

Maximize $Z = 2X_1 + 5X_2 + 3X_3 + 4X_4 + X_5$

Subject to $X_1 + 3X_2 + 2X_3 + 3X_4 + X_5 \leq 6$

$4X_1 + 6X_2 + 5X_3 + 7X_4 + X_5 \leq 15$

With $x_j \geq 0$ for $j = 1,2,3,4,5$

- a) Write the dual of the LP model (1 Mark)
- b) Which is the more efficient way for obtaining an optimal solution
 - i. Applying the simplex method directly to the primal problem or
 - ii. Applying simplex method to the dual problem instead. Explain (3 Marks)
- c) Apply the more efficient way in (b) to determine the optimal solution to both problems (primal and dual) (7 Marks)
- d) Powerco has three electric power plants that supply the electric needs of four cities. Formulate an initial feasible solution to Powerco transportation problem using:
 - i. Northwest Corner method. (4 marks)
 - ii. Minimum Cost Method. (5 marks)

From(Plant)	City I	City II	City III	City IV	Supply (Million kwh)
Plant 1	\$8	\$6	\$10	\$9	35
Plant 2	\$9	\$12	\$13	\$7	50
Plant 3	\$14	\$9	\$16	\$5	40
Demand (Million kwh)	45	20	30	30	180

QUESTION THREE (20 Marks)

- a) A company has factories F1,F2 and F3 that supply products to warehouses W1,W2 and W3.The weekly capacities of the factories are 200,160 and 90 units respectively. The weekly warehouse requirements are 180,120 and 150 units respectively. The unit shipping cost in kshs. Are as follows;

	Warehouse			Supply
	W1	W2	W3	
F1	16	20	12	200
F2	14	8	18	160
F3	26	24	16	90
Demand	180	120	150	450

Determine the optimal distribution for this company in order to minimize its total shipping cost using North-West Corner method (6 Marks)

- b) Describe tge procedure for ABC analysis in inventory control (3 Marks)
- c) The details of material stocked in a company are given below with the unit cost and the annual consumption in *sbs.*. Classify the material in to *A* class, *B* class and *C* class by *ABC* analysis.

(8 marks)

S.No.	Item Code No.	Annual consumption in <i>sbs.</i>	Unit price in <i>sbs.</i>
1	501	30,000	10
2	502	280,000	15
3	503	3,000	10
4	504	110,000	5
5	505	4,000	5
6	506	220,000	10
7	507	15,000	5

8	508	80,000	5
9	509	60,000	15
10	510	8,000	10

- d) State and explain the three main reasons for holding inventory and give a few reasons why only minimal inventories should be held. (3 marks)

QUESTION FOUR (20 Marks)

Jokete construction Ltd. Has been awarded a road construction project. It is planning department has produced the following data for the activities identified as constituting the road project.

Activity number	Immediate preceding activities	Expected time (months)	Expedited time (months)	Normal cost (sh. Million)	Crash cost (sh. Million)
1	2	5	3	50	72
2	-	3	2	20	30
3	1	2	1	15	30
4	3	3	1	8	20
5	1	4	4	30	30
6	4	8	4	13	21
7	8	5	1	45	65
8	1	2	1	45	52
9	6,7,10	2	2	40	40
10	8,5	3	2	22	34

- a)
- i. Draw a network for the road construction project based on expected activity durations. What is the expected duration of the project? (6 Marks)
 - ii. List the critical activities (3 Marks)
 - iii. Compute the expected cost of the project (4 Marks)

- b) After receiving the estimated time to complete the road, the client has asked Jokete Ltd. To reduce the completion time by 7 months. What would be the minimum extra cost to meet this revised deadline? (3 Marks)
- c) The client has now requested a further five months reduction in the project duration. Comment on this request. (4 Marks)

QUESTION FIVE (20 Marks)

The Marangi Paint company produces both interior and exterior paints from two raw materials, M1 and M2. The following table provides the basic data for the problem:

Data for Marangi Paint Problem

	Tons of raw material		Maximum daily available (tons)
	Exterior paint	Interior paint	
Raw material M1	6	4	24
Raw material M2	1	2	6
Profit per ton (\$1000)	5	4	

A market survey indicates that, the daily demand for interior paint cannot exceed that of exterior paint by more than 1 ton. Also the maximum daily demand for interior paint is 2 tons. Marangi Paint Company wants to determine the optimum (best) product mix for interior and exterior paints that maximizes the daily profits. Use the Simplex Method to determine the optimum (best) product mix for interior and exterior paints that maximizes the daily profits. (20 Marks)