

Total No. of Questions : 5]

SEAT No. :

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M.C.A. - I (Management)

MT - 21 : OPTIMIZATION TECHNIQUES

(Revised 2020) (Semester - II)

Time : 2½ Hours]

[Max. Marks : 50

Instructions to the candidates:

- 1) All questions are compulsory.
- 2) Use of statistical table and non-programmable calculator is allowed.
- 3) Figures to the right indicate full marks.

Q1) Use the simplex method to solve the following LP problem [10]

Maximize $Z = 10x + 15y + 20z$ S.T

$$10x + 5y + 2z \leq 2,700$$

$$5x + 10y + 4z \leq 2,200$$

$$1x + 1y + 2z \leq 500 \text{ and All } x, y \text{ and } z \text{ are } \geq 0$$

OR

Use two-phase simplex method to solve the following LP problem: [10]

Minimize $Z = x_1 + x_2$ subject to the constraints

$$2x_1 + x_2 \geq 4,$$

$$x_1 + 7x_2 \geq 7 \text{ and } x_1, x_2 \geq 0$$

Q2) a) The 'School of International Studies for Population' found out, through its survey, that the mobility of the population (in per cent) of a state to a village, town and city is in the following percentages. [7]

		To		
		Village	Town	City
From	Village	50	30	20
	Town	10	70	20
	City	10	40	50

What will be the proportion of population in village, town and city after two years, given that the present population has proportions of 0.7, 0.2 and 0.1 in the village, town and city, respectively?

P.T.O.

- b) Consider a M/s XYZ company, which is developing its annual plans in terms of three objectives: [3]

- i) Increased profits
- ii) Increased market share and
- iii) Increased sales. M/S XYZ has formulated three different strategies for achieving the stated objectives. The table below gives relative weightage of objectives and scores project the strategy. Find the optimal strategy that yields maximum weighted or composite utility.

Measure of → Performance of Three objectives	ROI (Profit)	% Increase (Market share)	% Increase (Sales growth)
Weights →	0.2	0.5	0.3
Strategy			
S ₁	7	4	9
S ₂	3	6	7
S ₃	5	5	10

OR

- a) A company manufactures around 200 mopeds. Depending upon the availability of raw materials and other conditions, the daily production has been varying from 196 mopeds to 204 mopeds, whose probability distribution is as given below: [7]

Production/day:	196	197	198	199	200	201	202	203	204
Probability:	0.05	0.09	0.12	0.14	0.20	0.15	0.11	0.08	0.06

The finished mopeds are transported in a specially designed three-storied lorry that can accommodate only 200 mopeds. Using the following 15 random

numbers: 82, 89, 78, 24, 53, 61, 18, 45, 23, 50, 77, 27, 54

and 10, simulate the mopeds waiting in the factory?

- i) What will be the average number of mopeds waiting in the factory?
- ii) What will be the number of empty spaces in the lorry?

- b) The following matrix gives the payoff of different strategies (alternatives) S₁, S₂, S₃ against conditions (events) N₁, N₂, N₃ and N₄: [3]

	N ₁	N ₂	N ₃	N ₄
S ₁	₹ 4,000	₹ -100	₹ 6,000	₹ 18,000
S ₂	20,000	5,000	400	0
S ₃	20,000	15,000	-2,000	1,000

Indicate the decision taken under the regret approach.

- Q3) a) There are seven jobs, each of which has to go through the machines A and B in the AB. Processing times in hours are given as [7]

Job :	1	2	3	4	5	6	7
Machine A :	3	12	15	6	10	11	9
Machine B :	8	10	10	6	12	1	3

Determine a sequence of these jobs that will minimize the total elapsed time T. Also find idle time for machines A and B.

- b) A marketing manager of an insurance company has kept complete records of the sales effort of the sales personnel. These records contain data regarding the number of insurance policies sold and net revenues received by the company as a function of four different sales strategies. The manager has constructed the conditional payoff matrix given below, based on his records. (The state of nature refers to the number of policies sold). The number within the table represents utilities. Suppose you are a new salesperson and that you have access to the original records as well as the payoff matrix. Which strategy would you follow? [3]

State of nature	N ₁	N ₂	N ₃
Probability	0.2	0.5	0.3
Strategy ↓	Utility	Utility	Utility
S ₁ (1 call, 0 follow up)	4	6	10
S ₂ (1 call, one follow up)	6	5	9
S ₃ (1 call, two follow-ups)	2	10	8
S ₄ (1 call, three follow-ups)	10	3	7

OR

- a) A manufacturing company processes 6 different jobs on two machines A and B in the order AB. Number of units of each job and its processing times in minutes on A and B are given below. Find the optimal sequence and total elapsed time and idle time for each machine. [7]

Job Number	Number of unit of each job.	Machine A : time in minutes.	Machine B :time in minutes.
1	3	5	8
2	4	16	7
3	2	6	11
4	5	3	5
5	2	9	7.5
6	3	6	14

- b) What are the components of the decision tree? [3]

- Q4)** A project consists of 9 activities and the three-time estimates are given below. Find the project completion time (TE). Draw the network for the given project and find the project completion time? [10]

Activities		Days		
i	j	T_o	T_L	T_p
10	20	5	12	17
10	30	8	10	13
10	40	9	11	12
20	30	5	8	9
20	50	9	11	13
40	60	14	18	22
30	70	21	25	30
60	70	8	13	17
60	80	14	17	21
70	80	6	9	12

OR

An insurance company has decided to modernize and refit one of its branch offices. Some of the existing office equipments will be disposed of but the remaining will be returned to the branch after the completion of the renovation work. Tenders are invited from a number of selected contractors. The contractors would be responsible for all the activities in connection with the renovation work excepting the prior removal of the old equipment and its subsequent replacement. The major elements of the project have been identified, as follows, along with their durations and immediately preceding elements.[10]

Activity	Description	Duration (weeks)	Immediate Predecessors
A	Design new premises	14	–
B	Obtain tenders from the contractors	4	A
C	Select the contractor	2	B
D	Arrange details with selected contractor	1	C
E	Decide which equipment is to be used	2	A
F	Arrange storage of equipment	3	E
G	Arrange disposal of other equipment	2	E
H	Order new equipment	4	E
I	Take delivery of new equipment	3	H, L
J	Renovations take place	12	K
K	Remove old equipment for storage or disposal	4	D, F, G
L	Cleaning after the contractor has finished	2	J
M	Return old equipment for storage	2	H, L

Draw the network diagram showing the interrelations between the various activities of the project. Find the effect on the overall duration of the project if the estimates or tenders can be obtained in two weeks from the contractors by reducing their numbers.

Q5) a) In a small town, there are only two stores, ABC and XYZ, that handle sundry goods. [7]

The total number of customers is equally divided between the two, because the price and the quality of goods sold are equal. Both stores have good reputation in the community, and they render equally good customer service. Assume that a gain of customers by ABC is a loss to XYZ and vice versa. Both stores plan to run annual pre-Diwali sales during the first week of November sales are advertised through a local

newspaper and through radio and television. With the aid of an advertising firm store, ABC constructed the game matrix given below. (Figures in the matrix represent a gain or loss of customers).

Strategy of XYZ

Strategy of ABC	Newspaper	Radio	Television
Newspaper	30	40	-80
Radio	0	15	-20
Television	90	20	50

Determine the optimal strategies and the worth of such strategies for both ABC and XYZ.

- b) A firm manufactures three types of products. The fixed and variable costs are given below: [3]

	Fixed Cost (Rs.)	Variable Cost per Unit (Rs.)
Product A :	25,000	12
Product B :	35,000	9
Product C :	53,000	7

The likely demand (units) of the products is given below:

Poor demand :	3,000
Moderate demand :	7,000
High demand :	11,000

If the sale price of each type of product is Rs. 25, then prepare the payoff matrix.

OR

- a) Two competitors are competing for the market share of the similar product. The payoff matrix in terms of their advertising plan is shown below: [7]

Competitor A	Competitor B		
	No Advertising	Medium Advertising	Heavy Advertising
No Advertising	10	5	-2
Medium Advertising	13	12	13
Heavy Advertising	16	14	10

Suggest optimal strategies for the two firms and the net outcome thereof.

- b) Explain three types of decision-making environments in brief. [3]

