



ST. FRANCIS DE SALES COLLEGE

A FRANSALIAN INSTITUTE OF HIGHER EDUCATION **AUTONOMOUS**

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END SEMESTER EXAMINATION – AUGUST 2025

MANAGEMENT - II SEMESTER MBA

24MBA26 – QUANTITATIVE TECHNIQUES AND OPERATION RESEARCH

Time: 3 Hours

Max. Marks: 70

Instruction: Answer should be written completely in English.

SECTION – A

Answer any FIVE questions. Each question carries FIVE marks.

(5x5=25)

1. Briefly explain how the techniques of Operation Research help in Managerial decision making?

2. A firm is engaged in producing two products P₁ and P₂. Each unit of product P₁ requires 2 kg of raw material and 4 labour hours for processing, whereas each unit of product P₂ requires 5 kg of raw material and 3 labour hours of the same type.

Every week, the firm has the availability of 50 kg of raw material and 60 labour hours. One unit of product P₁ sold earns a profit of ₹20 and one unit of product P₂ sold gives ₹30 as profit.

Formulate this problem as a linear programming problem to determine how many units of each of the products should be produced per week so that the firm can earn maximum profit.
Assume all units produced can be sold in the market.

3. A company has four sales territories. These territories are assigned to four sales representatives of a company. The following table illustrates the monthly sales increase (in lac rupees) estimated for every representative for different territories:

Representatives \ Territory	1	2	3	4
A	200	150	170	220
B	160	120	150	140
C	190	195	190	200
D	180	175	160	190

Find the optimal assignment.

4. Patients arrive at a clinic according to a Poisson distribution at the rate of 20 patients per hour. Examination time per patient is exponential with a mean rate of 30 per hour.



Find:

- i) The traffic intensity.
- ii) The probability that a new arrival does not have to wait.
- iii) The average waiting time of a patient before he leaves the clinic.

5. Draw an arrow diagram showing the following relationships:

Activity	Immediate Predecessor
A	-
B	-
C	-
D	A, B
E	B, C
F	A, B
G	C

6. Determine the optimum strategies and value of the game for the game whose payoff matrix is shown below:

	B₁	B₂
A₁	5	2
A₂	3	4

7. Crux Honda Ltd. manufactures around 150 scooters. The daily production varies from 146 to 154 depending upon the availability of raw materials and other working conditions.

Production per Day	146	147	148	149	150	151	152	153	154
Probability	0.04	0.09	0.12	0.14	0.11	0.10	0.20	0.12	0.08

The finished scooters are transported in specially arranged lorry accommodating 150 scooters, using the following random numbers: 80, 81, 76, 75, 64, 43, 18, 26, 10, 12, 65, 68, 69, 61, 57. Simulate the process to find out:

- a) What will be the average number of scooters waiting in the factory?
- b) What will be the average number of empty spaces on the lorry?

SECTION – B

Answer any THREE questions. Each question carries TEN marks.

(3x10=30)

8. Solve the following LPP by simplex method:

$$\text{Maximize } Z = 100x + 60y + 40z$$

$$\text{Subject to constraints: } x + y + z \leq 100$$

$$10x + 4y + 5z \leq 600$$

$$2x + 2y + 6z \leq 300$$

$$x \geq 0, y \geq 0, \text{ and } z \geq 0$$



9. There are four jobs to be processed on each of the five Machines A, B, C, D, and E in the order ACDBE. Find the total minimum elapsed time, if no passing jobs are permitted.

	A	B	C	D	E
J₁	7	5	2	3	9
J₂	6	6	4	5	10
J₃	5	4	5	6	8
J₄	8	3	3	2	6

10. The activities of a project and other related information are given in the table below:

Activity	Optimistic Time (t₁)	Normal Time (t₂)	Pessimistic Time (t₃)
1-2	30	44	54
1-3	8	12	16
2-3	1	2	3
2-4	2	3	5
3-4	8	10	12
4-5	14	22	25

a) Construct a PERT diagram.

b) Determine the probability of completion of a project in less than 60 days.

11. Reduce the following game with the help of dominance rule and then determine the value of the game:

	B₁	B₂	B₃	B₄
A₁	3	2	4	0
A₂	3	4	2	4
A₃	4	2	4	0
A₄	0	4	0	8

SECTION – C

12. **Compulsory question (Case study). The question carries FIFTEEN marks. (1x15=15)**

Solve the following transportation problem to minimise the total transportation cost for shifting the goods from factories (A, B and C) to warehouses (P, Q and R) where unit transportation cost, availability and demand, at factories and warehouses respectively are given in the following matrix:



		Warehouses			Availability
		P	Q	R	
Factories	A	1	2	0	30
	B	2	3	4	35
	C	1	5	6	35
	Demand	30	40	30	

Find the allocation so that the total transportation cost is minimum.

