

CBCS SCHEME

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15ME81

Eighth Semester B.E. Degree Examination, July/August 2021 Operations Research

Time: 3 hrs.

Max. Marks: 80

Note: Answer any FIVE full questions.

- 1 a. Define Operation Research. Discuss the scope of Operation Research. (06 Marks)
b. A firm manufactures 3 products A, B and C. Time to manufacture product A is twice for B and thrice for C and if the entire labour is engaged in making product A, 1600 units of this product can be produced. These products are to be produced in the ratio 3:4:5. There is demand for at least 300, 250 and 200 units of products A, B and C and the profit earned per unit if Rs.90, Rs.40 and Rs.30 respectively. Formulate the problem as a LPP. (10 Marks)
- 2 a. Discuss the assumptions made in LPP. (06 Marks)
b. Solve the following LPP graphically:
Maximize $Z = 2x_1 + 3x_2$
Subject to constraints $x_1 + x_2 \leq 30$,
 $x_2 \geq 3$,
 $x_2 \leq 12$,
 $x_1 - x_2 \geq 0$,
 $0 \leq x_1 \leq 20$ (10 Marks)
- 3 a. Explain the significance of following variables in LPP:
i) Slack variable
ii) Surplus variable
iii) Artificial variable. (06 Marks)
b. Solve by simplex method the following LPP:
Minimize $Z = x_1 - 3x_2 + 3x_3$
Subject to constraints $3x_1 - x_2 + 2x_3 \leq 7$,
 $2x_1 + 4x_2 \geq -12$,
 $-4x_1 + 3x_2 + 8x_3 \leq 10$,
 $x_1, x_2, x_3 \geq 0$ (10 Marks)
- 4 a. What is Pseudo-optimal solution? (06 Marks)
b. Solve the following LPP by Big-M method
Maximize $Z = 2x_1 + 3x_2 + 4x_3$
Subject to constraint $3x_1 + x_2 + 4x_3 \leq 600$,
 $2x_1 + 4x_2 + 2x_3 \geq 480$,
 $2x_1 + 3x_2 + 3x_3 = 540$,
 $x_1, x_2, x_3 \geq 0$ (10 Marks)

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- 5 a. Define the following with respect to transportation problem:
- Basic feasible solution
 - Optimal solution
 - Degenerate basic feasible solution.
- (06 Marks)
- b. For the following Transportation Problem a solution is given check it for optimality. If not, modify it to obtain a better solution (next best).

	D ₁	D ₂	D ₃	D ₄	Available units
S ₁	6	1	9 ₍₅₀₎	3 ₍₂₀₎	70
S ₂	11 ₍₅₅₎	5	2	8	55
S ₃	10 ₍₃₀₎	12 ₍₃₅₎	4	7 ₍₂₅₎	90
Demand units	85	35	50	45	

(10 Marks)

- 6 The captain of a cricket team has to allot five middle batting positions to 5 batsmen. The average runs scored by each batsman at these positions are as follows:

Batsman	Batting Position				
	I	II	III	IV	V
P	40	40	35	25	50
Q	42	30	16	25	27
R	50	48	40	60	50
S	20	19	20	18	25
T	58	60	59	55	53

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- Find the assignment of batsman to positions which would give the maximum number of runs.
- If another batsman 'U' with the following average runs in batting position as given below:

Batting positions:	I	II	III	IV	V
Average runs scored:	45	52	38	50	49

is added to the team, should he be included to play in the team? If so, who will be replaced by him?

(16 Marks)

- 7 a. Define:
- Preceding activity
 - Dummy activity
 - Network
 - Slack.
- (06 Marks)
- b. Tasks A, B, C, ..., H, I constitute a project. The precedence relationships are A < D, A < E, B < F, D < F, C < G, C < H, F < I, G < I.

Task:	A	B	C	D	E	F	G	H	I
Time, days :	8	10	8	10	16	17	18	14	9

- Draw the network
 - Identify the critical path and duration.
- (10 Marks)

- 8 a. Discuss the operating characteristics of a queueing system. (06 Marks)
- b. A typist at an office of a company receives on the average 20 letters/day for typing. The typist works 8 hours a day and it takes on the average 20 minutes to type a letter. The cost of a letter waiting to be mailed is 80 paise/hr and the cost of the equipment plus salary of the typist is Rs.45 per day.
- What is the typists utilization rate?
 - What is the average number of letters waiting to be typed?
 - What is the average waiting time needed to have a letter typed?
 - What is the total daily cost of waiting letters to be mailed.

(10 Marks)

- 9 a. Define:
- Strategy
 - 2 person zero sum game
 - Pay off matrix.
- b. Solve the following game by using principle of dominance:

		Player B					
		I	II	III	IV	V	VI
Player A	1	4	2	0	2	1	1
	2	4	3	1	3	2	2
	3	4	3	7	-5	1	2
	4	4	3	4	-1	2	2
	5	4	3	3	-2	2	2

(10 Marks)

- 10 a. Discuss any three priority rules of processing n jobs through one machine. (06 Marks)
- b. Four jobs 1, 2, 3 and 4 are to be processed on each of the four machines. A, B, C and D in the order ABCD. The processing times in minutes are given in the table below. Find, for no passing the minimum elapsed time and idle time for each machine.

		Machines			
		A	B	C	D
Jobs	1	58	14	14	48
	2	30	10	18	32
	3	28	12	16	44
	4	64	16	12	42

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(10 Marks)
