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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)

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.  
2. Any revealing of identification, appeal to evaluator and /or equations written eg. 42+8 = 50, will be treated as malpractice.



- 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 <sub>1</sub>	D <sub>2</sub>	D <sub>3</sub>	D <sub>4</sub>	Available units
S <sub>1</sub>	6	1	9 <sub>(50)</sub>	3 <sub>(20)</sub>	70
S <sub>2</sub>	11 <sub>(55)</sub>	5	2	8	55
S <sub>3</sub>	10 <sub>(30)</sub>	12 <sub>(35)</sub>	4	7 <sub>(25)</sub>	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

- 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.  
 i) What is the typists utilization rate?  
 ii) What is the average number of letters waiting to be typed?  
 iii) What is the average waiting time needed to have a letter typed?  
 iv) What is the total daily cost of waiting letters to be mailed. (10 Marks)

- 9 a. Define:  
 i) Strategy  
 ii) 2 person zero sum game  
 iii) Pay off matrix. (06 Marks)  
 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

(10 Marks)

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