R18

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
B. Tech III Year I Semester Examinations, February - 2022
OPERATIONS RESEARCH
(Mechanical Engineering)

Time: 3 hours   **Max. Marks: 75**

Answer any five questions
All questions carry equal marks

- - -

1.a) Define Operations Research and discuss its characteristics.
  b) Solve the following linear programming problem by graphical method.

Maximize $Z = 5x_1 + 3x_2$
Subject to $3x_1 + 5x_2 \leq 15$
                       $5x_1 + 2x_2 \leq 10$
                       and $x_1, x_2 \geq 0$ [7+8]

2. Use big M method to solve the following LPP.

Maximize $Z = 3x_1 - x_2$
s.t $2x_1 + x_2 \leq 2$
             $x_1 + 3x_2 \geq 3$
                       $x_2 \leq 4$
             and $x_1, x_2 \geq 0$ [15]

3. A steel company has three open-hearth furnaces and five rolling mills. The transportation cost (Rs. per quintal) for shipping steel from furnaces to rolling mills is shown in the following table. Determine the optimal basic feasible solution by Vogel's Approximation method.   [15]

	M1	M2	M3	M4	M5	Capacity (in quintals)
F1	4	2	3	2	6	8
F2	5	4	5	2	1	12
F3	6	5	4	7	3	14
Requirement (in quintals)	4	4	6	8	8	

4. Solve the following travelling salesman problem so as to minimize the cost per cycle:

[15]

		To				
		A	B	C	D	E
From	A	-	3	6	2	3
	B	3	-	5	2	3
	C	6	5	-	6	4
	D	2	2	6	-	6
	E	3	3	4	6	-

5. There are seven jobs, each of which has to go through the machines A and B in the order AB. Processing times in hours are given below:

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. [15]

6. The following morality rates have been observed for a certain type of light bulbs in an installation with 1,000 bulbs:

End of the week	1	2	3	4	5	6
Probability of failure	0.09	0.25	0.49	0.85	0.97	1.00

There are a large number of such bulbs which are to be kept in working order. If a bulb fails in service, it costs Rs.3 to replace but if all the bulbs are replaced in the same operation, it can be done for only Rs.0.70 a bulb. It is proposed to replace all bulbs at fixed intervals, whether or not they have burnt out, and a continue replacing burnt out bulbs as they fail. (a) What is the best interval between group replacements? (b) At what group replacement price per bulb, would a policy of strictly individual replacement become preferable to the adopted policy? [15]

7.a) Explain the following:
   i) Two-person zero-sum game
   ii) Pure strategy
   iii) Saddle point
   b) Use graphical method to solve the following game and find the value of the game. [7+8]

	Player B			
Player A	B1	B2	B3	B4
A1	2	2	3	-2
A2	4	3	2	6

8. A drive-in bank window has a mean service time of 2 minutes, while the customers arrive at a rate of 20 per hour. Assuming that these represent rates with a Poisson distribution, determine
   a) The proportion the teller will be idle,
   b) How long a customer will wait before reaching the server?
   c) What fraction of customers will have to wait in line? [15]

---ooOoo---