ST. JOSEPH'S COLLEGE(AUTONOMOUS) BENGALURU-27
M.Sc., MATHEMATICS - III SEMESTER
SEMESTER EXAMINATION: October 2022
(Examination conducted in December 2022)
MTDE9422 – OPTIMIZATION TECHNIQUES

Date:

Registration number:

Time- 2 ½ hrs

Max Marks - 70
(7 x 10 = 70)

Answer any 7 full questions
This question paper contains 2 printed pages
Each question carries 10 marks

1. Use the graphical method to solve the following LPP problem: Maximize $Z = 15x_1 + 10x_2$ subject to the constraints $4x_1 + 6x_2 \leq 360, 3x_1 \leq 180,\ 5x_2 \leq 200\ and\ x_1, x_2 \geq 0.$

2. Solve the following LPP using penalty (Big - M) method: Maximize z = $6x_1 + 4x_2$ subjected to the condition $2x_1 + 3x_2 \leq 30; 3x_1 + 2x_2 \leq 24; x_1 + x_2 \geq 3\ and\ x_1, x_2 \geq 0.$

3. (i) Obtain initial feasible solution for the following Transportation table using Vogel's Method.

Source	Destination A	B	C	Supply
1	2	7	4	5
2	3	3	1	8
3	5	4	7	7
4	1	6	2	14
Demand	7	9	18	

(ii) A book binder company has one printing machine and one binding machine. There are manuscripts of a number of different books. Processing times for printing and binding are given in the following table.

Book	Time in hours: Printing	Binding
A	5	2
B	1	6
C	9	7
D	3	8
E	10	4

Determine the sequence in which books should be processed on the machines so that the total time required is minimized. [5+5]

4. (i) A department head has four subordinates and four tasks have to be performed. Subordinates differ in efficiency and tasks differ in their intrinsic difficulty. Time each man would take to perform each task is given in the effectiveness matrix. How the tasks should be allocated to each person so as to minimize the total man-hours?

Task	Subordinate I	II	III	IV
A	8	26	17	11
B	13	28	4	26
C	38	19	18	15
D	19	26	24	10

(ii) Find an optimal sequence for the sequencing problems of four jobs and five machines when passing is not allowed of which processing time (in hours) is given below. Also find the total elapsed time.

Jobs	Machines M1	M2	M3	M4	M5
A	7	5	2	3	9
B	6	6	4	5	10
C	5	4	5	6	8
D	8	3	3	2	6

[5+5]

5. (i) Solve the following 3×3 game using dominance property, whose payoff matrix is as follows:

	B1	B2	B3
A1	2	0	4
A2	1	2	3
A3	4	1	2

(ii) For the game with payoff matrix

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

Determine the best strategies for players A and B and also the value of the game. Is this game fair and strictly determinable? [5+5]

6. Solve the game with the given payoff matrix by graphical method.

	B1	B2	B3	B4
A1	1	3	-3	5
A2	2	5	4	-4

7. Determine the early start and late finish in respect of all node points and identify critical path for the following network.

Activity:	1-2	1-3	1-4	2-5	4-6	3-7	5-7	6-7	5-8	6-9	7-10	8-10	9-10
Duration:	10	8	9	8	7	8	7	7	6	5	12	13	15

8. i) At a one-man barber shop, customers arrive in Poisson distribution with mean arrival rate of 5 per hour. Cutting time was exponentially distributed with an average of 10 minutes. It is assumed that because of his excellent reputation, customers were always willing to wait. Calculate the following. (a) Average number of customers in the system (b) Average number of customers waiting for a haircut (c) The percentage of customer who have to wait (d) The percentage of customer who can walk in without waiting.

ii) Explain Floyd's algorithm. [5+5]

9. i) What are the Characteristics of Canonical form of LPP?

ii) Define (a) Slack variable (b) Surplus variable (c) Artificial variable

iii) Solve the travelling salesman problem to minimize the cost per cycle.

	A	B	C	D	E
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	-

[2+3+5]

10. i) Consider a modified form of matching biased coins game problem. The matching player is paid Rs. 8 if the two coins turn both heads and Rs. 1 if the coins turn both tails. The non-matching player losses Rs. 3 when the two coins do not match. Given the choice of being the matching or non-matching player, which one would you choose and what would be your strategy?

ii) Find out the time estimate (t_e) for the following project and construct the Network Diagram.

Activity	A	B	C	D	E	F	G	H	I
Predecessor Activity	-	A	A	B	C	D, E	D, E	F	G
Optimistic time	2	3	8	9	8	16	19	2	1
Most Likely time	4	6	10	12	9	21	22	5	3
Pessimistic time	6	9	12	15	10	26	25	8	5

[5+5]