10ME74

Seventh Semester B.E. Degree Examination, Aug./Sept.2020
Operations Research

Time: 3 hrs.   Max. Marks:100

Note: *Answer any FIVE full questions, selecting at least TWO questions from each part.*

PART – A

1 a. Name and explain any three applications of LPP in OR. **(04 Marks)**

b. Obtain the graphical solution to the given LPP.
Minimize $Z = 5x + 10y$
Subject to $x + 2y \leq 120$
$x + y \geq 60$
$x - 2y \geq 0$ **(06 Marks)**

c. The manager of an oil refinery must decide on the optimal mix of 2 possible bending process of which the input for production run as follows:

Process	Inputs (units)		Output (units)	
	Crude-A	Crude-B	gasoline-X	gasoline-Y
1	5	3	5	8
2	4	5	4	4

The maximum crude available is 200 units of Type 'A' and 150 units of type 'B'. The market requirement is that atleast 100 units of gasoline-X and gasoline-Y must be produced. The estimated profit from production run of process-1 and 2 are Rs.300 and Rs.400. Formulate the problem and solve by graphical method. **(10 Marks)**

2 a. Explain Artificial variables with an example. **(04 Marks)**

b. Convert the following LPP to dual form.
Minimize $Z = 2x_1 + x_2 + 3x_3$
Subject to $x_1 - 3x_2 + 4x_3 = 5$
$2x_1 - x_2 \leq 3$
$2x_2 - x_3 \geq 5$
$x_1, x_2 \geq 0$ and x_3 is unrestricted. **(06 Marks)**

c. Solve the given LPP using simplex method:
Maximize $Z = 3x_1 + 5x_2 + 4x_3$
Subject to $x_2 + 2x_3 \leq 6$
$3x_1 + 2x_2 + x_3 \leq 18$
$x_1, x_2, x_3 \geq 0$ **(10 Marks)**

3 a. A company has four factories A, B and C which supply warehouses D, E, F and G. Monthly factory capabilities are 160, 150 and 190 units respectively. Monthly requirements are 80, 90, 110 and 160 units respectively. Unit shipping costs are as follows. Formulate the problem and get the initial solution by VAM method. **(12 Marks)**

Destination / Origin	D	E	F	G
A	42	48	38	37
B	40	49	52	51
C	39	38	40	43

b. Four machines to be assigned to four jobs. The cost matrix is given as follows. Find the proper assignment and total cost by Hungarian method. **(08 Marks)**

Machine / Job	A	B	C	D
1	8	10	17	9
2	3	8	5	6
3	10	12	11	9
4	6	13	9	7

4 a. Explain the Branch and Bound method for Integer Programming. **(05 Marks)**

b. Find the solution to the given LPP using Gomory's fractional cut technique.

Maximize $Z = x_1 + x_2$

Subject to $3x_1 + 2x_2 \le 5$

$$x_2 \le 2$$

x_1 and $x_2 \ge 0$ are integers. **(15 Marks)**

PART – B

5 a. For the following (i) Draw Activity on arrows (ii) Find Total Float and Free Float.

Activity	A	B	C	D	E	F	G	H	I	J
Predecessor	-	-	A	B	C	C	E	F, D	H, G	I
Time	10	8	8	16	7	7	10	12	8	5

(10 Marks)

b. Crash the following project activities and find :
(i) Normal project duration and cost
(ii) Optimum project duration and cost after crashing **(10 Marks)**

Activity		1 – 2	1 – 3	2 – 4	3 – 4
Normal	Time	8	4	2	5
	Cost	100	150	50	100
Crash	Time	6	2	1	1
	Cost	200	350	90	200

6 a. Explain queuing system. Also list and explain queue disciplines. **(05 Marks)**

b. In a railway yard, goods trains arrive at a rate of 30 trains/day. Assuming inter arrival time follows an exponential distribution and service time also an exponential distribution with an average 36 minutes, calculate the following:
(i) The mean queue size
(ii) The probability the queue size exceeds 10
If the input of trains increases to an average of 33 trains/day, what will be the change in (i) and (ii)? **(10 Marks)**

c. What is Traffic Intensity and its unit? **(05 Marks)**

7 a. Explain the theory of dominance in a Game. **(04 Marks)**

b. Obtain optimal strategies for both persons and value of the game for two persons zero sum game whose pay off matrix as follows:

Player – B

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\begin{array}{c} \\ \text{Player} - A \end{array}
\begin{array}{c} \\ A_1 \\ A_2 \\ A_3 \\ A_4 \\ A_5 \\ A_6 \end{array}
\begin{array}{cc} B_1 & B_2 \\ \begin{bmatrix} 1 & -3 \\ 3 & 5 \\ -1 & 6 \\ 4 & 1 \\ 2 & 2 \\ -5 & 0 \end{bmatrix} \end{array}
$$

(08 Marks)

c. Two players A and B play a game in which each has three coins 5p, 10p and 20p. Each player selects the coin without the knowledge of other player. If sum of the coin is an odd number then 'A' with 'B's coin and if sum of the coin is an even number then B with A's coin. Find the strategy of each player and the value of the game. **(08 Marks)**

8 a. A machine operator has to perform three operations on number of different jobs. Determine the order of job and total elapsed time (hrs) with idle time of machines.

				Jobs		
Machines ↓	1	2	3	4	5	6
Turning (A)	5	14	7	4	11	13
Threading (B)	10	8	6	8	5	3
Knurling (C)	15	16	11	14	10	15

(10 Marks)

b. Find the optimum sequence of 2 jobs on 'M' machine (5 machines) using graphical method:

Job 1	Sequence	A	B	C	D	E
	Time	3	4	2	6	2
Job 2	Sequence	B	C	A	D	E
	Time	5	4	3	2	6

(10 Marks)

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