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10ME74

Seventh Semester B.E. Degree Examination, Feb./Mar.2022
Operations Research

Time: 3 hrs. Max. Marks:100

Note: 1. ***Answer any FIVE full questions, selecting at least TWO questions from each part.***
2. ***Use of Normal distribution table is permitted.***

PART – A

1 a. Explain any two important applications of OR. **(05 Marks)**

b. Apply graphical method to solve the following LPP:

Maximize $z = 5x_1 + 4x_2$

Subjected to the constraints,

$x_1 - 2x_2 \leq 1$

$x_1 + 2x_2 \geq 3$. **(05 Marks)**

c. A firm plans to purchase at least 200 quintals of scrap containing high quality (X) and low quality (Y) metals. It decides that scrap purchased must contain at least 100 quintals of X-metal and not more than 35 quintals of Y-metal. The firm can purchase metals from two suppliers A and B in unlimited quantities. The purchase of X and Y in terms of weight of scrap supplied by A and B are given below:

Metals	Supplier A	Supplier B
High quality (X)	40%	80%
Low quality (Y)	10%	20%

The price of scrap supplied by A and B is Rs.200/quintal and Rs.400/quintal. Formulate as LP model and solve graphically to determine the quantities purchased from A and B suppliers. **(10 Marks)**

2 a. Explain with examples, (i) Slack and Surplus variables (ii) Degeneracy in LPP. **(04 Marks)**

b. Write the Dual of the following LPP:

Minimize $z = 2x_1 + x_2 + 3x_3$.

Subjected to the constraints

$x_1 - 3x_2 + 4x_3 = 5$

$2x_1 - x_2 \leq 3$

$2x_2 - x_3 \geq 5$

$x_1, x_2 \geq 0$ and x_3 unrestricted. **(06 Marks)**

c. Solve the given LPP by simplex method.

Maximize $z = 3x_1 + 5x_2 + 4x_3$,

Subjected to $x_2 + 2x_3 \leq 6$

$3x_1 + 2x_2 + x_3 \leq 18$

x_1, x_2 and $x_3 \geq 0$ **(10 Marks)**

3 a. A company has four factories A, B and C which supply warehouses at 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 at the warehouses. Unit shipping costs are as follows. Determine the optimum distribution for the company using VAM method. Clearly write the distribution schedule and the cost.

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

(12 Marks)

b. For the below cost matrix, determine
(i) Optimal Job assignment.
(ii) Cost of assignment.

Operator \ JOB	1	2	3	4	5
A	10	3	3	2	8
B	9	7	8	2	7
C	7	5	6	2	4
D	3	5	8	2	4
E	9	10	9	6	10

(08 Marks)

4 a. Explain the importance and solution methods of integer programming. **(06 Marks)**

b. Find the optimum integer solution to the following LPP:

Maximum $z = x_1 + x_2$

Subjected to $3x_1 + 2x_2 \leq 5$

$x_2 \leq 2$

$x_1, x_2 \geq 0$ are integers. **(14 Marks)**

PART – B

5 a. The table below gives the lists of jobs and their duration in days.

Jobs:	1 – 2	1 – 3	2 – 5	3 – 7	5 – 7	5 – 8	7 – 9	8 – 9
Duration:	10	8	8	16	7	7	12	10

Jobs:	9 – 10	10 - 11
Duration:	8	5

(i) Draw the network.
(ii) Estimate EST, EFT, LST and LFT
(iii) Critical Path and Duration. **(10 Marks)**

b. Given below in the list of jobs and their duration and cost:

Jobs	Normal		Crash	
	Time (days)	Cost (Rs.)	Time (days)	Cost (Rs.)
1 – 2	8	100	6	200
1 – 3	4	150	2	350
2 – 4	2	50	1	90
3 – 4	5	100	1	200

Indirect cost is Rs.100/day. Crash the activity and find optimum project duration and cost. **(10 Marks)**

6 a. Explain the following:
(i) Queuing systems and Queue discipline.
(ii) Customer's behavior and service mechanism. **(05 Marks)**

b. What is Utilization factor or Traffic Intensity? Explain the implication of increase in service time. **(05 Marks)**

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

7 a. Explain the theory of Dominance. **(04 Marks)**

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

		Player – B	
		B_1	B_2
Player - A	A1	1	– 3
	A2	3	5
	A3	– 1	6
	A4	4	1
	A5	2	2
	A6	–5	0

(08 Marks)

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

8 a. Explain sequencing using Johnson's rule of 'n' jobs to process on 3 machines. **(04 Marks)**

b. Find the optimal sequence for the following jobs and idle times of machines. (time in minutes).

Jobs →	1	2	3	4	5	6
Machine M_1	15	22	13	12	16	16
Machine M_2	25	24	17	22	15	18

(08 Marks)

c. Find the optimum time for the following jobs to be processed on 5 machines using graphical method.

Job1	Sequence:	A	C	D	E	B
	Time:	4	2	6	5	2

Job2	Sequence:	C	A	D	B	E
	Time:	8	3	4	2	2

(08 Marks)

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