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10ME74

Seventh Semester B.E. Degree Examination, Jan./Feb. 2021
Operations Research

Time: 3 hrs. Max. Marks:100

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

PART – A

1 a. Briefly explain the scope of Operation Research. **(04 Marks)**

b. A toy company manufacturer manufactures two types of dolls a basic version-doll "A" and a deluxe version-doll "B". Each doll of type B takes twice as long to produce as one of the type A, and the company would have time to make a maximum of 2000 per day. The supply of plastic is sufficient to produce 1500 dolls per day (Both A and B combined). The deluxe version requires a fancy dress of which there are only 600 per day available. If the company makes a profit of Rs.3.00 and Rs.5.00 per doll respectively on doll A and doll B than how many of each doll should be produced per day in order to maximize the total profit. **(08 Marks)**

c. Solve the following LP problem graphically:

$Z_{max} = 8000x_1 + 7000x_2$

Subject to : $3x_1 + x_2 \le 66$

$x_1 + x_2 \le 45$

$x_1 \le 20$

$x_2 \le 40$

$x_1, x_2 \ge 0$ **(08 Marks)**

2 a. Find the dual of

$Z_{max} = 5x_1 - 6x_2 + 4x_3$

Subject to : $3x_1 + 4x_2 + 6x_3 \ge 9$

$x_1 + 3x_2 + 2x_3 \ge 5$

$-7x_1 + 2x_2 + x_3 \ge -10$

$x_1 - 2x_2 + 4x_3 \ge 4$

$x_1, x_2, x_3 \ge 0$ **(08 Marks)**

b. Solve the following LPP by using Big M method

$Z_{min} = 4x + y$

Subject to : $3x + y = 3$

$4x + 3y \ge 6$

$x + 2y \le 3$

$x, y \ge 0$ **(12 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.

3 a. There are three factories A, B and C which supply goods to four dealers D_1, D_2, D_3 and D_4. The production capacities of these factories are 1000, 700 and 900 units per month respectively. The requirements from the dealers are 900, 800, 500 and 400 units per month respectively. The per unit return (excluding transportation cost) are Rs.8.00, Rs.7.00 and Rs.9.00 at the three factories respectively. The following table gives the unit transportation costs from the factories to the dealers.

	D_1	D_2	D_3	D_4
A	2	2	2	4
B	3	5	3	2
C	4	3	2	1

Determine the optimum solution to maximize the total returns. **(12 Marks)**

b. Solve the travelling salesman problem in the matrix shown below

	A	B	C	D	E
A	∞	6	12	6	4
B	6	∞	10	5	4
C	8	7	∞	11	3
D	5	4	11	∞	5
E	5	2	7	8	∞

(08 Marks)

4 a. Briefly explain Gomory's cutting plane method of IPP. **(06 Marks)**

b. Find the optimum integer solution to the following LPP

$Z_{max} = x_1 + x_2$

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

$x_2 \le 2$

$x_1, x_2 \ge 0$ **(14 Marks)**

PART – B

5 a. List out the differences between PERT and CPM. **(06 Marks)**

b. A project schedule has the following characteristics

Activity	Time (min)	Activity	Time (min)
1-2	2	4-5	6
1-3	7	4-6	5
1-4	3	5-6	9
2-7	8	7-8	5
3-5	4	6-8	4

i) Draw the network

ii) Find the project duration time and critical path

iii) Find the E_s, E_f, L_s, L_f and total float. **(14 Marks)**

6 a. Explain the different types of service mechanisms in queuing. **(08 Marks)**

b. A post office has three windows providing the same service. It receives on an average 30 customers per hour. Arrivals are poisson distributed and service time is exponentially distributed. Each window serves as an average 12 customers per hour.

i) What is the probability that a customer will be served immediately?

ii) What is the probability that a customer will have to wait?

iii) What is the average member of customers in the system?

iv) What is the average total time a customer must spend in the post office? **(12 Marks)**

7 a. Explain clearly the following terms:
i) Pay off matrix ii) Saddle point iii) Pure strategy iv) Mixed strategy. **(04 Marks)**

b. Solve the game by using dominance principle

		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)

c. Reduce the following game to 3 × 2 by dominance principle and solve it by graphical method

	PLAYER "B"			
PLAYER "A"	B_1	B_2	B_3	B_4
A_1	19	6	7	5
A_2	7	3	14	6
A_3	12	8	18	4
A_4	8	7	13	-1

(06 Marks)

8 a. List out the assumptions made for sequencing problems. **(06 Marks)**

b. There are five jobs each of which must go through three machines A, B and C in the order ABC. Processing times (hour) are given in the following table. Determine the optimum sequence of the job that minimizes the total elapsed time. Also find the idle times of machine A, B and C. The matrix is given below.

Machines	JOBS				
	1	2	3	4	5
M/C A	8	10	6	7	11
M/C B	5	6	2	3	4
M/C C	4	9	8	6	5

(10 Marks)

c. Briefly explain
i) Total elapsed time
ii) Idle time on a machine. **(04 Marks)**

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