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B. E. (Fifth Semester) Examination, April-May 2021

(New Scheme)

(Mech., Production and Automobile Engg. Branch)

OPERATIONS RESEARCH

Time Allowed : Three hours

Maximum Marks : 80

Minimum Pass Marks : 28

Note : *Answer all the questions. Each question has four parts. Part (a) is compulsory. Answer any two from Part (b), (c) and (d). Graph sheets are permitted. Normal probability distribution tables are permitted.*

1. (a) What is meant by infeasible solution? 2

(b) Explain : 9

(i) Characteristic features of O.R.

(ii) Scope of O.R.

(iii) Advantages of O.R.

(c) Solve the following LPP with graphical method

Maximize : $60z_1 + 50x_2$

Subject to : $2x_1 + 4x_2 \leq 80$

$3x_1 + 2x_2 \leq 60$

$x_1 \leq 16$

$x_2 \leq 18$

$x_1 \geq 0 \quad x_2 \geq 0$ 9

(d) Solve the following LPP with Simplex method

Maximize $Z = 10x_1 + 30x_2$

Subject to $4x_1 + 6x_2 \leq 12$

$8x_1 + 4x_2 \leq 16$

$x_1 \geq 0, \quad x_2 \geq 0$ 9

2. (a) What is meant by degenaracy in transportation

problem. 2

(b) Solve the following transportation problem with VAM. Transporation cost is given as Rs/item. 9

Plant ↓	Customers → C_1	C_2	C_3	C_4	C_5	Available
P_1	4	2	3	2	6	8
P_2	5	4	5	2	1	12
P_3	6	5	4	7	7	14
Demand	4	4	6	8	8	

(c) A company has 5 sales managers, and marketing the products in 4 cities. As per the past sales, the expected sales in lakhs of units is given in the following table. Assign one city to one manager. Compute the maximum sales that can be obtained. 9

	CityA	City B	City C	City D
Manager 1	14	9	17	13
2	6	10	12	14
3	10	12	18	12
4	19	14	16	18
5	18	16	12	10

(d) Solve the following marketing salesman problem. Find optimal route to minimise the distance. 9

$C_{12} = 20$ $C_{13} = 4$ $C_{14} = 10$ $C_{23} = 5$ $C_{34} = 6$

$C_{25} = 10$ $C_{35} = 6$ $C_{45} = 20$ consider $C_{ij} = C_{ji}$ in kms. If C_{ij} is not given that path is not available.

3. (a) What is the difference between CPM and PERT. 2

(b) In a single server waiting line arrival of customers follows Poisson probability distribution with mean arrival rate 20 customers per hours. Service time follows exponential probability distribution with the mean service time as 2 minutes per customer. Consider infinite population source, FIFO discipline, compute : 9

(i) Utilisation of server.

(ii) Probability that server is idle.

(iii) Average length of Queue.

(iv) Average time a customer spents in the system.

(v) Probability of finding two customers in the system.

(c) (i) Explain Kendall's notation to represent the characteristics of queuing system. 4

(ii) Discuss about customer behaviour in the queuing system. 5

(d) A new project consists of a activities. Time estimates are given below. 9

Activities	Time Estimates (days)
1 - 2	2 - 5 -14
1 - 6	2 - 5 - 8
2 - 3	5 - 11 - 29
2 - 4	1 - 4 - 7
3 - 5	5 - 11 - 17
4 - 5	2 - 5 - 14
5 - 8	2 - 2 - 8
6 - 7	3 - 9 - 27
7 - 8	7 - 13 - 31

(i) Draw project network diagram

(ii) Find the critical path

(iii) What is the probability to compute the project in 33 days?

4. (a) What is meant by Montecarlo simulation? 2

(b) Solve the following pass off matrix using graphical method. Find the value of the game, probabilities of strategies for A and B players. 9

		Player B	
		b_1	b_2
Player A	a_1	-6	7
	a_2	4	-5
	a_3	-1	-2
	a_4	-2	5
	a_5	7	-6

(c) Solve the following pay off matrix using the dominance rules. Find the value of the game and probabilities of strategies for A and B players. 9

		Player B			
		b_1	b_2	b_3	b_4
Player A	a_1	12	4	8	16
	a_2	4	-2	2	24
	a_3	4	6	6	18
	a_4	3	-1	6	10

(d) A company has a production plan of

manufacturing 150 bikes per day. But due to shortage of material, machine breakdowns and quality problems production of bikes follows the following probability distribution. 9

Production Per day	146	147	148	149	150	151	152	153
Probability	0.13	0.12	0.14	0.11	0.10	0.20	0.12	0.08

The assembled bikes are transported in a cargo with a capacity to carry 150 bikes. Use the following random numbers to simulate 10 days production.

89, 65, 18, 26, 09, 78, 36, 95, 58, 23

Find :

(i) Average number of bikes waiting.

(ii) Average number of empty spaces in two cargo.