CBCS SCHEME

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18IM52

Fifth Semester B.E. Degree Examination, Jan./Feb. 2021
Operation Research

Time: 3 hrs. Max. Marks: 100

Note: 1. Answer any FIVE full questions, choosing ONE full question from each module.
2. Use of Normal Distribution table is permitted.

Module-1

1 a. Define Operations Research. Explain the phases of Operations Research briefly. **(06 Marks)**

b. A company manufactures two types of belts 'A' and 'B'. The supply of leather is sufficient to make 800 belts per day (both types inclusive). The number of buckles available for type A and type B are 300 per day and 650 per day respectively. Each belt of type A requires twice as much time as required by belt B type, to manufacture. The company would be able to produce 1000 belts of type B per day, if only belt B is manufactured. Profit margin for Belt A is 0.4 per belt and 0.3 per belt for belt B. Determine the optimal mix. **(14 Marks)**

OR

2 a. Solve the following Linear Programming problem by Big-M method.

Minimize $z = 5x_1 + 3x_2$

Subject to : $2x_1 + 4x_2 \le 12$

$2x_1 + 2x_2 = 10$

$5x_1 + 2x_2 \ge 10$

where $x_1, x_2 \ge 0$ **(10 Marks)**

b. Obtain the dual for the following LPP:

Minimize $z = 3x_1 - 2x_2 + 4x_3$

Subject to : $3x_1 + 5x_2 + 4x_3 \ge 7$

$6x_1 + x_2 + 2x_3 \ge 4$

$7x_1 - 2x_2 - x_3 \le 10$

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

$4x_1 + 7x_2 - 2x_3 \ge 2$

where $x_1, x_2, x_3 \ge 0$ **(06 Marks)**

c. Define the following terms with a suitable example:
(i) Slack variable. (ii) Surplus variable **(04 Marks)**

Module-2

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 production capacities of these factories are 1000, 700 and 900 units per month respectively. The requirements from dealers are 900, 800, 500 and 400 units per month respectively. Returns per unit (excluding transportation costs) are Rs.8, Rs.7 and Rs.9 at the three factories unit transportation costs from factories to dealers are given below:

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

Determine the optimum solution to maximize total returns. **(10 Marks)**

b. Solve the following assignment problem:

	1	2	3	4	5
A	45	30	65	40	55
B	50	30	25	60	90
C	25	20	15	20	40
D	35	25	30	30	20
E	80	60	60	70	50

(10 Marks)

OR

4 a. A company has three plants A, B and C and three warehouses X, Y and Z. The number of units available at the plants is 60, 70 and 80 and the demand at X, Y and Z is 50, 80 and 80 respectively. Unit cost of transportation is given below:

		To X	Y	Z
From	A	8	7	3
	B	3	8	9
	C	11	3	5

Find the allocation so that the total transportation cost is minimum. **(10 Marks)**

b. Solve the following assignment problem for the given distance in kms:

	Cities	1	2	3	4	5	6
	A	12	10	15	22	18	8
	B	10	18	25	15	16	12
Cities	C	11	10	3	8	5	9
	D	6	14	10	13	13	12
	E	8	12	11	7	13	10

(10 Marks)

Module-3

5 a. Draw the network for the following project. Identify its critical path. Calculate the project duration and total float for each activity :

Activity	A	B	C	D	E	F	G	H	I	J
Predecessor	-	-	A	A	B, C	B, C	E	E	D, G	F, H, I
Time (weeks)	15	15	3	5	8	12	1	14	3	14

(10 Marks)

b. The three time estimates of a certain project are given below:

Activity	t_0	t_m	t_p
0 – 1	2	3	4
1 – 3	15	16	17
1 – 2	3	6	9
1 – 4	6	10	14
2 – 3	4	8	12
3 – 4	3	5	7
4 – 5	2	3	4

(i) Draw the network and find the critical path and duration of project.
(ii) If the scheduled time is 28 days, find the probability of completion of the project.

(10 Marks)

OR

6 a. A project consists of a series of tasks labeled A to I. With the following relationships (W < X, Y means X and Y cannot start until W is completed). Construct the network diagram having the following constraints :

A < D, E ; B, D < F ; C < G ; C < H; F, G < I

Find the optimum completion time, start time, finish time, in days for the project with duration of each activity given below:

Tasks	A	B	C	D	E	F	G	H	I
Duration (days)	23	8	20	16	24	18	19	4	10

(10 Marks)

b. Following table gives a list of jobs along with time estimates :

Job	t_0	t_m	t_p
1 – 2	3	6	15
1 – 6	2	5	14
2 – 3	6	12	30
2 – 4	2	5	8
3 – 5	5	11	17
4 – 5	3	6	15
6 – 7	3	9	27
5 – 8	1	4	7
7 – 8	4	19	28

(i) Draw the network and find its critical path and its project duration.

(ii) What is the probability that the project will not be completed by the due date of 38 days? **(10 Marks)**

Module-4

7 a. Explain briefly the Kendall's notations. **(04 Marks)**

b. Define the following terms :

(i) Balking

(ii) Collision **(04 Marks)**

c. A self service store employs one cashier at its counter. 9 customers arrive on an average every 5 minutes. While the cashier can serve 10 customers in 5 minutes. Assuming Poisson distribution for arrival rate and Exponential distribution for service rate, find

(i) Average number of customers in system.

(ii) Average number of customers in queue.

(iii) Average time a customer spends in system.

(iv) Average time a customer waits before being served. **(12 Marks)**

OR

8 a. Discuss the characteristics of a Queuing system. **(08 Marks)**

b. Arrival of machinists at a Tool crib is considered to be Poisson distribution at an average rate of 6 per hour. The length of the time the machinist must remain at the tool crib is exponentially distributed with an average time being 0.05 hours.

(i) What is the probability that the machinist arriving at the tool crib will have to wait?

(ii) What is the average number of machinists at tool crib?

(iii) What is the probability that there are 2 or more machinists at tool crib at any given point of time?

(iv) The company will install a second tool crib when convinced that a machinist would expect to spend atleast 6 minutes waiting and being served at tool crib. By how much the flow of machinist to the tool crib increase to justify the second tool crib. **(12 Marks)**

Module-5

9 a. Two players A and B are playing a game of tossing a coin simultaneously. Player A wins 1 unit of value when there are two heads, wins nothing when there are two tails and looses ½ unit of value when there is one head and one tail. Determine the pay off matrix, the best strategies for each player and value of the game. **(08 Marks)**

b. Solve the following game :

		Player B			
		I	II	III	IV
Player A	I	2	2	3	-1
	II	4	3	2	6

(12 Marks)

OR

10 a. Define the following terms:
(i) Payoff matrix (ii) Mixed strategy (iii) Pure strategy
(iv) Saddle point (v) Maximum principle **(10 Marks)**

b. Solve the following game using dominance principle:

		Player B			
		B_1	B_2	B_3	B_4
Player A	A_1	3	2	4	0
	A_2	2	4	3	4
	A_3	4	2	4	0
	A_4	0	4	0	8

(10 Marks)

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