CBCS SCHEME

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15ME81

Eighth Semester B.E. Degree Examination, Dec.2019/Jan.2020
Operations Research

Time: 3 hrs. Max. Marks: 80

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

1 a. State various phases of operations research and explain in brief any one of them. **(06 Marks)**

b. Four products are processed successively on two machines. The machining times in hours per unit of each product are given below:

Machine	Time per unit (hr.)			
	Product 1	Product 2	Product 3	Product 4
1	2	3	4	2
2	3	2	1	2

The total cost of producing one unit of each product is based directly on machine time. Cost per hour for machines 1 and 2 are Rs.10 and Rs.5 respectively. The total hours available for machines 1 and 2 are 500 and 380. If the sale price per unit for products 1, 2, 3 and 4 are Rs.65, 70, 55 and 45 respectively, formulate as LPP to maximize total net profit. **(10 Marks)**

OR

2 a. Define Optimum solution, Feasible zone, redundant constraint. **(06 Marks)**

b. Feasible zone ABCDEA, identified by a set of constraints of a LPP having 2 decision variables x, y has A ≡ (1, 0); B ≡ (1, 2); C ≡ (2, 3), D ≡ (4, 1); E ≡ (2, 0). If a new constraint $x \leq 2y$ is added, identify the new feasible zone (show on graph). State redundant constraints. Find maximum and minimum value of Z if Z = 3x + 5y for new feasible zone. **(10 Marks)**

Module-2

3 a. Define Slack variable, Surplus variable and Artificial variable. **(06 Marks)**

b. For the LPP,

Maximize $Z = 2x_1 - 5x_2 + 10x_3$

Subject to $x_1 + 2x_2 + 2x_3 \leq 90$

$x_1, x_2, x_3 \geq 0$

i) Find all basic solutions and obtain optimum solution.

ii) Find the optimum solution by simplex.

iii) Write the dual for the given LPP. **(10 Marks)**

OR

4 Solve the following LPP

Maximize $Z = x_1 + 2x_2 + 3x_3$

Subject to $x_1 - x_2 + x_3 \geq 4$

$x_1 + x_2 + 2x_3 \leq 8$

$x_1 - x_3 \geq 2$

$x_1, x_2, x_3 \geq 0$ **(16 Marks)**

Module-3

5 a. Write a brief note on 'Degeneracy in Transportation Problem'. **(06 Marks)**

b. As the total demand is more than the total supply, it is not possible to meet the demand of every destination of the transportation problem given below:

		Destination A	B	C	
Source	1	5	1	7	10
	2	6	4	6	80
	3	3	2	5	15
		75	20	50	

The penalty cost per unit of unsatisfied demand are Rs.5, 3 and 2 for destinations A, B and C respectively.

i) Formulate the problem to minimize the total (transportation plus penalty) cost.

ii) Obtain basic feasible solution by VAM.

iii) Test the basic feasible solution for optimality. **(10 Marks)**

OR

6 a. State the common and distinguishing features of Transportation Problem and Assignment Problem. **(06 Marks)**

b. Solve the following assignment problem:

	I	II	III	IV	V
A	11	17	8	16	20
B	9	7	12	6	15
C	13	16	15	12	16
D	21	24	17	28	26
E	14	10	12	11	13

(10 Marks)

Module-4

7 a. Define Network, Event, Dummy activity. **(06 Marks)**

b. For the network shown in Fig.Q7(b), the three time estimates for the activities are given along the arrows. Determine the critical path. What is the probability that the project will be completed in 20 days?

Z	0.45	0.47	0.48	0.49	0.50
$\Psi(z)$	0.6736	0.6808	0.6844	0.6879	0.6915

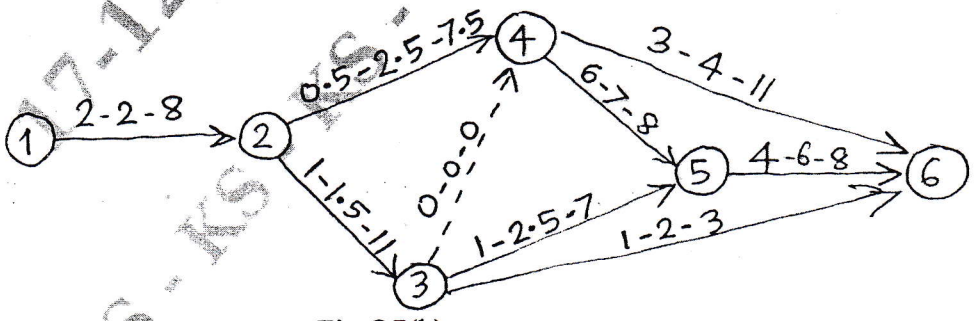

Fig.Q7(b) **(10 Marks)**

OR

8 a. State and explain in brief Kendall's notation for representing queing models. **(06 Marks)**

b. A self service store employs one cashier at its counter. Nine customers arrive on an average every 5 minutes while the cashier can serve 10 customers in 5 minutes. Assuming Poisson distribution for arrival and exponential distribution for service, find

i) Average number of customers in the system
ii) Average number of customers in the queue
iii) Average time a customer spends in the system
iv) Average time a customer waits before being served. **(10 Marks)**

Module-5

9 a. Define Saddle point, Zero Sum game, Game Value. **(06 Marks)**

b. Reduce the game to either m × 2 or 2 × n by dominance, and then solve graphically.

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

(10 Marks)

OR

10 a. State assumptions made while applying Johnson's rule to 'n jobs on 2 machines'. **(06 Marks)**

b. Use graphical method to minimize the time required to process the following jobs on the machines. For each machine specify the job which should be done first. Also calculate the total elapsed time.

Job 1	Sequence	A	B	C	D	E
	Time (hr)	6	8	4	12	4
Job2	Sequence	B	C	A	D	E
	Time (hr)	10	8	6	4	12

(10 Marks)

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