MBA(D) 3rd Semester Examination, June 2019 (DDE)

[Sessions: (Jan 2017–Dec 2018) & (Jan 2016–Dec 2017)]

Subject: Operations Research

Paper: MBD-301

Time: 3 Hours **Full Marks: 80**

The figures in the margin indicate full marks.
Candidates are required to give their answers in their own words as far as practicable.

Answer any five *questions.*

1. (a) Enumerate, with brief description, the applications of linear programming problem (LPP) in business decision-making.

(b) A diet conscious housewife wishes to ensure certain minimum intake of vitamins A, B and C for the family. The minimum daily needs of the vitamins A, B and C for the family are 60, 40 and 32 units, respectively. For the supply of these vitamins the housewife relies on two fresh foods F_1 and F_2. One unit of F_1 contains 14, 10 and 4 units of vitamins A, B and C respectively. One unit of F_2 contains 4, 8 and 16 units of the three vitamins respectively. F_1 costs Rs. 3 per unit and F_2 Rs. 2 per unit. The problem is how many units of each food the housewife should buy every day to keep her food bill as low as possible. Formulate it as a linear programming problem to minimize the total cost. 8+8=16

2. (a) Use simplex method to solve the following LP problem:

Minimize $z = 5x_1 + 3x_2$

Subject to the constraints

$$2x_1 + 4x_2 \leq 12$$
$$2x_1 + 2x_2 = 10$$
$$5x_1 + 2x_2 \geq 10$$

and $x_1, x_2 \geq 0$

(b) Write a dual LPP for the following primal:

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

Subject to

$$2x_1 - x_2 + x_3 \geq 4$$
$$x_1 + x_2 + 2x_3 \leq 8$$
$$x_1 - x_2 \geq 2$$
$$x_1, x_2, x_3 \geq 0$$

10+6=16

3. Solve the following transportation problem: 16

	D_1	D_2	D_3	D_4	D_5	Supply
S_1	4	7	3	8	2	4
S_2	1	4	7	3	8	7
S_3	7	2	4	7	7	9
S_4	4	8	2	4	7	2
Demand	8	3	7	2	2	

4. (a) Write down the mathematical model of the assignment problem.

(b) What do you mean by 'Unbalanced Assignment Problems'? How do you solve such problems?

(c) A department has five employees with five jobs to be performed. The time (in hours) each man will take to perform each job is given in the effectiveness matrix below:

		Employees				
		I	II	III	IV	V
Jobs	A	10	5	13	15	16
	B	3	9	18	13	6
	C	10	7	2	2	2
	D	7	11	9	7	12
	E	7	9	10	4	12

How should the jobs be allocated, one per employee, so as to minimize the total man-hours? 3+5+8=16

5. (a) A project schedule has the following characteristics as shown in the table below:

(i) Construct the project network.

(ii) Compute Earliest Expected Time (T_E) and Latest Allowable Time (T_L) for each activity.

(iii) Find the critical path.

Project Schedule

Activity	Name	Time (days)	Activity	Name	Time (days)
1-2	A	4	5-6	G	4
1-3	B	1	5-7	H	8
2-4	C	1	6-8	I	1
3-4	D	1	7-8	J	2
3-5	E	6	8-10	K	5
4-9	F	5	9-10	L	7

(b) Compare and contrast between CPM and PERT. 10+6=16

6. (a) Explain total, independent and free floats in network analysis.

(b) A small project has seven activities. The relevant data about these activities is given below:

Activity	Dependence	Normal Duration (Days)	Crash Duration (Days)	Normal Cost (Rs.)	Crash Cost (Rs.)
A	----	7	5	500	900
B	A	4	2	400	600
C	A	5	5	500	500
D	A	6	4	800	1,000
E	B, C	7	4	700	1,000
F	C, D	5	2	800	1,400
G	E, F	6	4	800	1,600

6+10=16

7. (a) What is a game in game theory? What do you understand by 'zero-sum' in this context?

(b) Define (i) Competitive game (ii) Payoff matrix (iii) Saddle point (iv) Optimal strategy.

(c) Define pure strategy and mixed strategy and explain the difference between them. 4+8+4=16

8. Write short notes on *any two*: 8×2=16

(a) Decision making under certainty, uncertainty and risk

(b) Degeneracy in transportation problem

(c) Operating characteristics of a queue

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