MBA(D) (3ʳᵈ Semester) Examinations, June 2020 (DDE)
[Session: Jan 2019–Dec 2020]

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.

Group - A

Answer any six questions.   5×6=30

1. What are the glaring characteristics of Operations Research? Discuss, in brief.

2. A Mutual Fund company has Rs. 20 lakhs available for investment in Government bonds, blue chip stocks, speculative stocks and short-term bank deposits. The annual expected return and risk factors are given as follows:

Type of investment	Annual expected return	Risk factor (0 to 100)
Government bonds	14%	12
Blue chip stocks	19%	24
Speculative stocks	23%	48
Short-term deposits	12%	6

Mutual fund is required to keep at least Rs. 2 lakhs in short-term deposits and not to exceed an average risk factor of 42. Speculative stocks must be at most 20% of the total amount invested. How should Mutual Fund invest the funds so as to maximize its total expected annual return? Formulate this as a linear programming problem.

3. Construct the dual to the following primal problem:

Maximize $Z = 3x_1 + 5x_2$
Subject to
$$2x_1 + 6x_2 \le 50$$
$$3x_1 + 2x_2 \le 35$$
$$5x_1 - 3x_2 \le 10$$
$$x_2 \le 20$$
$$x_1, x_2 \ge 0$$

4. What is degeneracy in a transportation problem? How is it resolved?

5. Show the mathematical structure of an assignment problem.

6. Explain the significance of inventory control.

7. Construct a network for a project whose activities and their predecessor relationship are given in the following table:

Activity	A	B	C	D	E	F	G	H	I	J	K
Predecessor	-	-	-	A	B	B	C	D	E	H, I	F, G

8. In the context of theory of game, define the following terms:
   (a) Course of action, (b) Outcome, (c) Pay-off matrix, (d) Pure strategy, (e) Value of a game

Please Turn Over

Group -B

Answer any five questions. 10×5=50

9. Using simplex method solve the following LPP:

Maximize $Z = 4x_1 + 10x_2$

Subject to

$$2x_1 + x_2 \leq 50$$
$$2x_1 + 5x_2 \leq 100$$
$$2x_1 + 3x_2 \leq 90$$
$$x_1, x_2 \geq 0$$

10. (a) Explain Vogel's Approximation Method (VAM) of finding the initial feasible solution to a transportation problem.

(b) Find initial feasible solution for the following transportation problem using VAM. The table below shows unit transportation costs.

		To Warehouse			Supply
		W_1	W_2	W_3	
	P_1	6	8	4	14
From Plant	P_2	4	9	8	12
	P_3	1	2	6	5
Demand		6	10	15	31

11. Solve the following assignment problem which minimizes the total man hours. The time required for processing the job in hours is given in the following table:

		Men			
		A	B	C	D
	1	10	25	15	20
Jobs	2	15	30	5	15
	3	35	20	12	24
	4	17	25	24	20

Determine the minimum man-hours to complete the jobs.

12. A project schedule has the following characteristics as shown in the table below:

Activity	Name	Time	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

(i) Construct PERT network.

(ii) Compute T_E and T_L for each activity.

(iii) Find the critical path.

Please Turn Over

13. An R & D project has a list of tasks to be performed whose time estimates are given in the table below:

Table: Time Estimates for R & D Project

Activity	Activity Name	t_o	t_m	t_p
1-2	A	4	6	8
1-3	B	2	3	10
1-4	C	6	8	16
2-4	D	1	2	3
3-4	E	6	7	8
3-5	F	6	7	14
4-6	G	3	5	7
4-7	H	4	11	12
5-7	I	2	4	6
6-7	J	2	9	10

   (i)   Draw the project network.

   (ii) Find the critical path.

   (iii) Find the probability that the project is completed in 19 days. If the probability is less than 20%, find the probability of completing it in 24 days.

14. (a) Discuss the operating characteristics of a queue.

   (b) In relation to queuing theory, define the following terms:

       (i) Balking, (ii) Reneging, (iii) Jockeying

15. Write short notes on any two:

   (a) Applications of duality

   (b) Nash equilibrium

   (c) A priori criterion of decision-making

   (d) Monte Carlo simulation