

**BBA 5th Semester (Honours) Examination, 2023 (CBCS)****Subject : Operations Research****Course : BBA-5.2****Time: 4 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 Question No. 1 and any five questions from the rest.***1. Answer any ten questions:****2×10=20**

- (a) What is a model?
- (b) What do you understand by linear programming?
- (c) What is meant by a feasible region?
- (d) A PERT network has 9 activities on its critical path. The standard deviation of each activity on the critical path is 3. What is the standard deviation of the critical path?
- (e) In a transportation problem with 4 supply points and 5 demand points, how many (i) number of constraints, (ii) number of equations are required in its formulation?
- (f) What is a Basic Feasible Solution in a transportation problem?
- (g) What do you understand by unbalanced assignment problem?
- (h) What do you understand by 'Zero-sum' in the context of game theory?
- (i) What do you mean by 'loop' in a transportation problem?
- (j) What is a redundant constraint?
- (k) State the Dominance Rule in Game theory.
- (l) What is meant by Expected Value of Perfect Information (EVPI)?
- (m) What are the essential characteristics of a decision model?
- (n) In the context of Game theory, explain the term 'Saddle Point'.
- (o) In relation to PERT/CPM, explain the term 'Event Slack'.

**2. Solve the following LPP by simplex method:****12**

$$\begin{array}{ll} \text{Maximize} & Z = 3x_1 + 4x_2 + 7x_3 \\ \text{Subject to} & x_1 + x_2 + x_3 \leq 10 \\ & 4x_1 - x_2 - x_3 \geq 15 \\ & x_1 + x_2 + x_3 = 7 \\ & x_1, x_2 \geq 0, x_3 \text{ unrestricted in sign.} \end{array}$$

3. (a) Find the optimum solution to the following transportation problem in which the cells contain the transportation costs in rupees.

		Warehouses					Available
		W <sub>1</sub>	W <sub>2</sub>	W <sub>3</sub>	W <sub>4</sub>	W <sub>5</sub>	
Factories	F <sub>1</sub>	7	6	4	5	9	40
	F <sub>2</sub>	8	5	6	7	8	30
	F <sub>3</sub>	6	8	9	6	5	20
	F <sub>4</sub>	5	7	7	8	6	10
Required		30	30	15	20	5	100 total

- (b) Write down the general mathematical statement of the transportation problem. 9+3

4. (a) Write down the general mathematical model of an assignment problem.  
 (b) A department has five employees with five jobs to be performed. The time (in hours) each employee will take to perform each job is given in the 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+9

5. (a) What are the steps required in solving LPPs by graphical method? Discuss, in brief, with the help of an illustration.  
 (b) Briefly explain the following special cases of LPP solution:  
 (i) Unbounded solution  
 (ii) Infeasible solution 8+4

6. (a) Solve the game whose pay off matrix is given below:

Player A	Player B			
	B <sub>1</sub>	B <sub>2</sub>	B <sub>3</sub>	B <sub>4</sub>
A <sub>1</sub>	3	2	4	0
A <sub>2</sub>	3	4	2	4
A <sub>3</sub>	4	2	4	0
A <sub>4</sub>	0	4	0	8

- (b) Explain 'Maximin' and 'Minimax' principles in Game Theory. 8+4

7. A newspaper boy is thinking of selling a special one-time edition of a sports magazine to his regular newspaper customers. Based on his knowledge of the customers, he believes that he can sell between 9 to 12 copies. The magazines can be purchased at Rs. 8 and can be sold for Rs. 12 each. Magazines that are not sold can be returned to the publisher for a refund of 50%.

(a) Construct the decision matrix for the above problem indicating possible monetary consequences.

(b) Determine the best decision from the stand point of

(i) Maximin criteria

(ii) Hurwicz  $\alpha$ -criteria assuming  $\alpha = 0.40$

(iii) Minimax regret criteria.

6+6

8. (a) Explain the following terms in PERT/CPM:

(i) Earliest times

(ii) Total activity time

(b) A small project is composed of 7 activities whose time estimates are listed in the table below:

Activities	A	B	C	D	E	F	G
Optimistic time	1	1	2	1	2	2	3
Pessimistic time	7	7	8	1	14	8	15
Most likely time	1	4	2	1	5	5	6

(i) Draw the project network.

(ii) Find the expected duration and variance for each activity. What is the expected project length?

4+8

9. The following are the details of estimated times of activities of a certain project.

Activity	A	B	C	D	E	F
Immediate predecessor	—	A	A	B,C	—	E
Estimated time (weeks)	2	3	4	6	2	8

(a) Find the critical path and the expected time of the project.

(b) Calculate the earliest start time and earliest finish time for each activity.

(c) Calculate the slack of each activity.

4+4+4

10. Write short notes on any two:

6×2=12

(a) Vogel's Approximation Method (VAM)

(b) CPM and PERT — comparison and contrast

(c) Methodology of OR

(d) Decision making under uncertainty