

BBA 5th Semester (Honours) Examination, 2022 (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 do you understand by OR models?
- (b) What is meant by the term 'feasible region'?
- (c) Define 'linear programming'.
- (d) Give one example of an assignment problem.
- (e) What is meant by an unbalanced transportation problem?
- (f) What do you understand by 'zero-sum' in the context of game theory?
- (g) How can an artificial variable be removed during solution of an LPP?
- (h) In a linear programming problem, what does a redundant constraint imply?
- (i) How is the Hungarian method applied in an assignment problem for obtaining a solution if the matrix is rectangular?
- (j) Is it necessary that a game should always possess a saddle point? Explain.
- (k) In Decision Theory, what is meant by 'Expected Opportunity Loss'?
- (l) List out the steps of a decision-making process.
- (m) In network analysis, explain the term 'critical path'.
- (n) What is float? What are the different types of floats?
- (o) 'PERT takes care of uncertain durations' — How far is this statement correct?

2. (a) Solve the following LPP:

$$\begin{aligned} \text{Minimize} &= 2x_1 + 9x_2 + x_3 \\ \text{subject to} & \quad x_1 + 4x_2 + 2x_3 \geq 5 \\ & \quad 3x_1 + x_2 + 2x_3 \geq 4 \\ & \quad x_1, x_2, x_3 \geq 0 \end{aligned}$$

(b) Briefly explain the role of linear programming in managerial decision-making. 7+5=12

3. (a) Use the graphical method to solve the following LP problem:

$$\text{Minimize } Z = 20x_1 + 10x_2$$

$$\text{subject to } x_1 + 2x_2 \leq 40$$

$$3x_1 + x_2 \geq 30$$

$$4x_1 + 3x_2 \geq 60$$

$$\text{and } x_1, x_2 \geq 0$$

- (b) Explain the concept of infeasibility. How can it be detected in the simplex method? 7+5=12

4. (a) Write down the general mathematical statement of the transportation problem.

- (b) A dairy firm has three plants located in a state. The dairy milk production at each plant is as follows:

Plant 1 : 6 million litres, Plant 2 : 1 million litres and Plant 3 : 10 million litres.

Each day, the firm must fulfil the needs of its four distribution centres. The minimum requirement of each centre is as follows:

Distribution Centre 1 : 7 million litres

Distribution Centre 2 : 5 million litres

Distribution Centre 3 : 3 million litres

Distribution Centre 4 : 2 million litres

Cost (in hundred of rupees) of shipping one million litres from each plant to each distribution centre is given in the following table:

		Distribution Centres			
		D ₁	D ₂	D ₃	D ₄
Plant	P ₁	2	3	11	7
	P ₂	1	0	6	1
	P ₃	5	8	15	9

Find the initial basic feasible solution for the given problem by using following methods:

- North-West corner rule
- Least cost method
- Vogel's approximation method.

3+9=12

5. (a) How does an assignment problem differ from a transportation problem?
- (b) A department of a company has five employees with five jobs to be performed. The time (in hours) that each man takes to perform each job is given in the following effectiveness matrix:

		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?

4+8=12

6. (a) Explain the concept of two-person zero-sum game, giving a suitable example.
- (b) Distinguish between pure strategies and mixed strategies.
- (c) In relation to the theory of games, explain the following terms:
- Payoff
 - Dominance
- 6+2+4=12
7. (a) Explain and illustrate the Laplace principle of decision-making under uncertainty.
- (b) A steel making company is concerned with the possibility of a strike. It will cost an extra Rs. 20,000 to acquire an adequate stockpile. If there is a strike and the company has not stockpiled, management estimates an additional expense of Rs. 60,000 on account of lost sales. Should the company stockpile or not if it is to use
- Optimistic criterion
 - Savage criterion
 - Hurwicz criterion for $\alpha = 0.4$
 - Laplace criterion
- 4+8=12
8. (a) Distinguish between PERT and CPM in network analysis.
- (b) What are the different types of Floats? Describe, with the help of an example, how can you compute them.
- 5+7=12

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=12

10. Write short notes on:

- (a) Special cases of LPP
- (b) Rules of dominance in game theory

8+4=12