


VIT

Vellore Institute of Technology
(Deemed to be University under section 3 of the U.G. Act, 1956)

Final Assessment Test – November 2025

Course: CBS1008 - Operations Research

Class NBR(s): 4409 / 4412

Time: Three Hours

Slot: D1

Max. Marks: 100

- KEEPING MOBILE PHONE/ANY ELECTRONIC GADGETS, EVEN IN 'OFF' POSITION IS TREATED AS EXAM MALPRACTICE
- DON'T WRITE ANYTHING ON THE QUESTION PAPER

COs	CO Statements
CO1	Apply operations research techniques like L.P.P, scheduling and sequencing in industrial optimization problems.
CO2	Solve allocation problems using various OR methods.
CO3	Analyze various OR models like Inventory, Replacement, Queueing, Decision etc and apply them for optimization.
CO4	Understand the concepts of integer linear programming.
CO5	Gain knowledge on current topics and advanced techniques of Operations Research in a wide range of applications in industries.

BL – Blooms Taxonomy Level (1 – Remember, 2 – Understand, 3 – Apply, 4 – Analyse, 5 – Evaluate, 6 – Create)

Answer ALL Questions

(10 X 10 = 100 Marks)

1. An apple firm produces 2 products, canned apple and canned juice. The specific amounts of material, labour and equipment required to produce each product and the availability of each of these resources are shown in the table given below:

CO1 BL3

	Canned juice	Canned apple	Available resources
Labour	3	2.0	12.0
Equipment	1	2.3	6.9
Materials	1	1.4	4.9

Assuming one unit of canned juice and canned apple has profit margin \$ 2 and \$ 1 respectively. Formulate the linear programming problem and solve it by graphical method to get the maximum profit.

2. Solve the linear programming problem using simplex method

CO1 BL3

$$\text{Max } z = 3x_1 + 2x_2 + 5x_3$$

$$\text{Subject to } x_1 + 4x_2 \leq 420;$$

$$3x_1 + 2x_3 \leq 460;$$

$$x_1 + 2x_2 + x_3 \leq 430;$$

$$x_1, x_2, x_3 \geq 0.$$

3. Solve the following transportation problem

CO2 BL3

	Retail				Supply
Shop	R1	R2	R3	R4	
P1	21	16	25	13	11
P2	17	18	14	23	13
P3	32	27	18	41	19
Demand	6	10	12	15	

4. Solve the following assignment problem

CO2 BL3

	P	Q	R	S	T
A	8	4	2	6	1
B	0	9	5	5	4
C	3	8	9	2	6
D	4	3	1	0	3
E	9	5	8	9	5

5. Solve the following problem using dual simplex method

CO4 BL3

$$\text{Min } z = 4x_1 + 7x_2$$

Subject to

$$2x_1 + 3x_2 \geq 5; \quad x_1 + 7x_2 \geq 9; \quad x_1, x_2 \geq 0.$$

- 6.a) Solve the integer programming problem using branch and bound method

CO4 BL3

$$\text{Max } z = 2x_1 + 2x_2$$

Subject to

$$5x_1 + 3x_2 \leq 8; \quad x_1 + 2x_2 \leq 4; \quad x_1, x_2 \geq 0 \text{ and are integers.}$$

OR

- 6.b) Solve the integer programming problem using cutting plane method

CO4 BL3

$$\text{Max } z = x_1 + x_2$$

Subject to

$$3x_1 + 2x_2 \leq 5; \quad x_2 \leq 2; \quad x_1, x_2 \geq 0 \text{ and are integers.}$$

- 7.a) a) Solve the following goal programming problem using graphical method

CO3 BL3

$$\text{Min } z = d_1^- + d_1^+$$

Subject to

$$80x_1 + 40x_2 + d_1^- - d_1^+ = 800;$$

$$x_1 + x_2 \leq 10; \quad x_1, x_2, d_1^-, d_1^+ \geq 0.$$

OR

7.b) $\text{Min } z = P_1 d_1^- + P_2 (2d_2^- + d_3^-) + P_3 d_1^+$

CO3 BL3

Subject to

$$x_1 + x_2 + d_1^- - d_1^+ = 10;$$

$$x_1 + d_2^- = 6;$$

$$x_2 + d_3^- = 8;$$

$$x_1, x_2, d_1^-, d_1^+, d_2^- \geq 0.$$

8. Given the transition probability matrix is

CO3 BL3

$$P = \begin{matrix} & \begin{matrix} A & B & C \end{matrix} \\ \begin{matrix} A \\ B \\ C \end{matrix} & \begin{bmatrix} 0.7 & 0.2 & 0.1 \\ 0.5 & 0.4 & 0.1 \\ 0.6 & 0.2 & 0.2 \end{bmatrix} \end{matrix} \text{ and initial probability } q_0 = [0.6 \quad 0.3 \quad 0.1]$$

- Find the probability that a customer who is currently a brand A purchaser will purchase brand B after two time period.
- Find the probability that a customer who is currently a brand B purchaser will purchase brand A three periods from now.
- Find $P(X_3 = A)$.

9. Solve the following game using dominance property

CO5 BL3

$$\begin{matrix} & \begin{matrix} B1 & B2 & B3 \end{matrix} \\ \begin{matrix} A1 \\ A2 \\ A3 \end{matrix} & \begin{bmatrix} 1 & 7 & 2 \\ 6 & 2 & 7 \\ 6 & 1 & 6 \end{bmatrix} \end{matrix}$$

10. Solve the following game graphically

CO5 BL3

$$\begin{matrix} & \text{Player } B \\ \text{Player } A & \begin{bmatrix} 1 & 3 & 11 \\ 8 & 5 & 2 \end{bmatrix} \end{matrix}$$

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