Indian Statistical Institute
SQC & OR Unit Bangalore
MS-QMS (Semester I): Operations Research I
End Semester: 2025-26
Time: 3 Hours Date: /12/2025

Answer all the questions and you can score 50 marks. The marks are given in parentheses. A scientific calculator is allowed.

Q1. You are given the task of minimizing the cost of conducting two activities. Each activity has three types of benefits. However, a minimum level of service is required for each of these benefits. The data is below.

Benefits	Per unit benefit Activity 1	Per unit benefit Activity 2	Minimum Acceptable Level
1	5	3	60
2	2	2	30
3	7	9	126
Unit Cost	60	50	

Formulate a linear programming model for this problem. [5]

Q2. A public service facility is facing problems due to the high transportation expenses associated with delivering daily orders to its retail centers spread throughout the city. It operates from three locations, denoted as L1, L2, and L3, and supplies to three retail centers, labeled R1, R2, and R3. The transportation cost per unit from each location to each retail center is summarized in the following table.

	R_1	R_2	R_3	**Supply (units)**
L_1	12	10	10	65
L_2	20	25	20	80
L_3	15	20	35	75
Demand (units)	70	100	50	

Find the optimal solution to the transportation problem. [10]

Q3.A manager must assign four executives to four different jobs. The manager knows the exact skill requirements of each job and the efficiency of each executive. Using this information, the manager has created the following table, which lists the estimated number of hours each executive would need to fully complete each job. The goal is to minimize the total time required to finish all jobs by assigning the executives in the most efficient way.

Executives/Jobs	E_1	E_2	E_3	E_4
J_1	15	12	16	13
J_2	12	18	17	21
J_3	15	22	12	13
J_4	14	15	14	17

Find the optimal assignment and the optimal assignment cost. Can you solve this problem using transportation algorithms? [10]

Q4.Write the dual of the following LPP and then solve the dual problem:

$$\begin{aligned}
&\text{Maximize } Z = 3x - 2y + 4z \\
&\text{subject to:} \\
&\quad 2x + 4y - z \geq 2, \\
&\quad 4x - 4y \leq 3, \\
&\quad 2x + 3y \leq 7, \\
&\quad x, y, z \geq 0.
\end{aligned}$$

Describe all the steps clearly and write the primal optimal solution. [10]

Q5. Solve the following LPP with the help of the Revised Simplex method:

$$\begin{aligned}
&\text{Maximize } Z = 3x + 4y \\
&\text{subject to:} \\
&\quad 4x + 3y \leq 48, \\
&\quad 2x + 3y \leq 36, \\
&\quad x, y \geq 0
\end{aligned}$$

Describe all the steps clearly. [10]

Q6. Write down the differences between transportation and assignment problems. [5]