Problem 1. 5 Marks

Consider the problem Consider the following linear program

$$\begin{array}{lllllll} \max\ z = & 14x_1 & + & 7x_2 & & \\ \text{subject to} & 2x_1 & + & 5x_2 & \leq & 14 \\ & 5x_1 & + & 2x_2 & \leq & 14 \\ & x_1 \geq 0 & & x_2 \geq 0 & & \end{array}$$

1. Solve the problem graphically.
2. Identify any multiple solutions in the problem if there are any.
3. Assume that the right hand side of constraint 2 is allowed to change to $14 + s$. Find the range of s that retains the optimal solution found by the Simplex method unchanged.

Problem 2. 5 Marks

Consider the following transportation problem

	1	2	3	4	Supply
1	10	2	20	11	15
2	12	7	9	20	25
3	4	14	16	18	10
Demand	5	15	15	15	

1. Find an initial solution using the North West corner method.
2. Find the optimal solution.

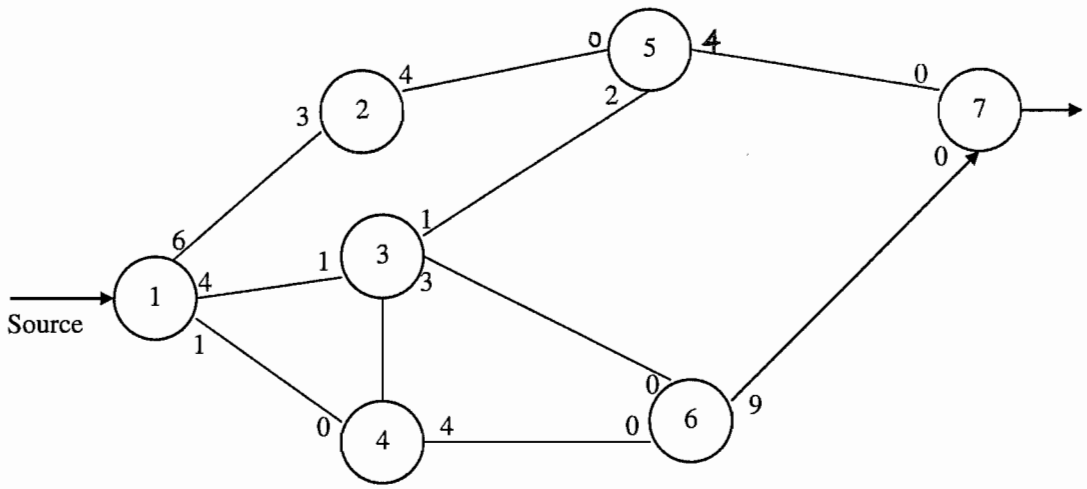
Problem 3. 5 Marks

Solve the assignment problem given the following costs matrix

2	3	5	1	4
−1	1	3	6	2
−2	4	3	5	0
1	3	4	1	4
7	1	2	1	2

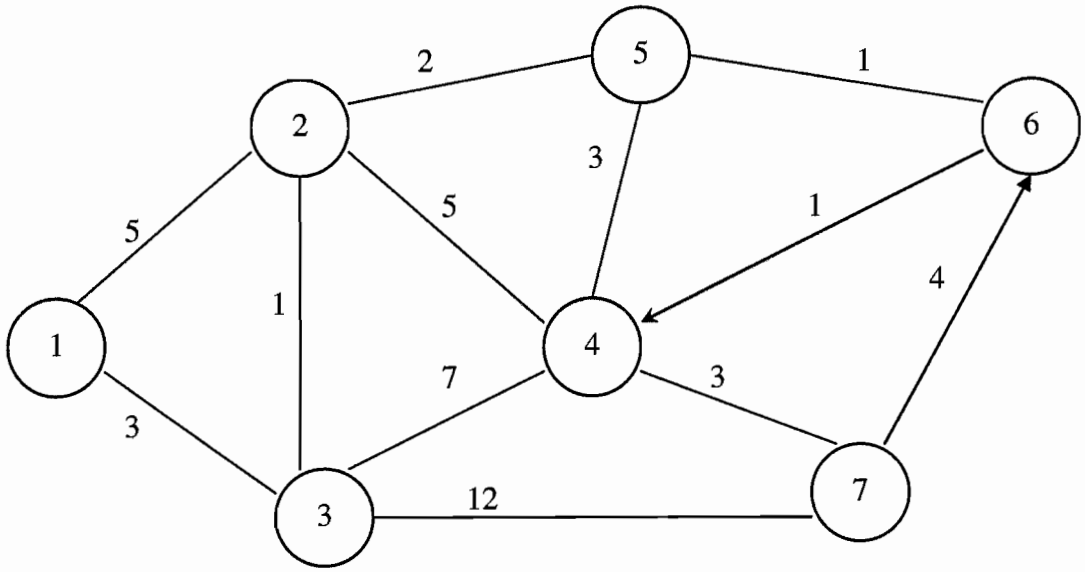
Problem 4 5 Marks

Find the maximal flow from the source to the sink of the network below, and the corresponding minimal cut. Verify that the maximal flow is equal to the capacity of this cut



Problem 5. 5 Marks

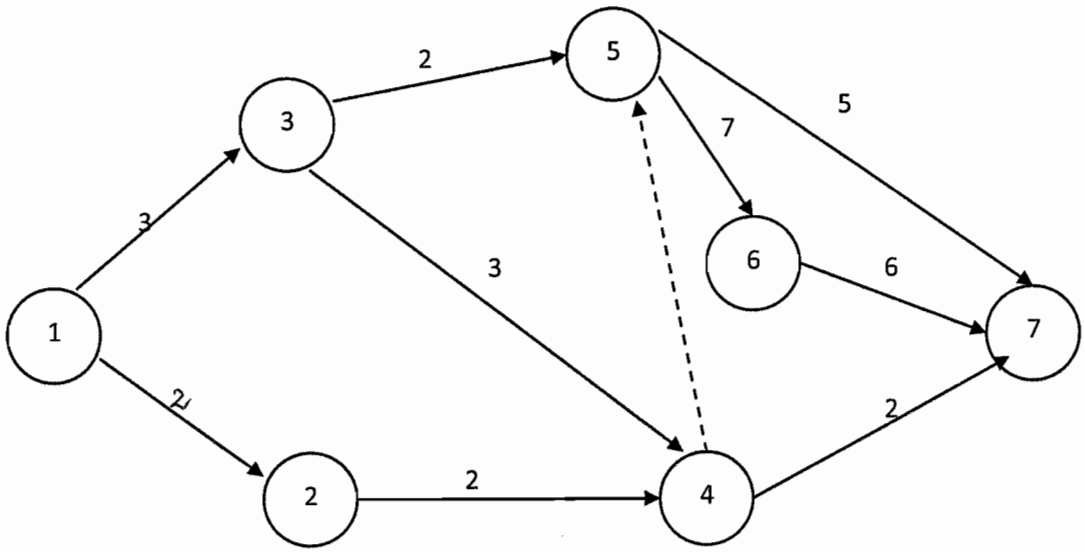
Use Dijkstra Algorithm to find the shortest path from



1. Node 1 to node 7,
2. Node 1 to node 4.

Problem 6. 5 Marks

Determine the critical path for the project network



Problem 7. 5 Marks

Use Branch and Bound method to solve the problem

$$
\begin{array}{lrcrcl}
\max\ z & = & x_1 & + & x_2 & \\
\text{subject to} & & 4x_1 & + & 10x_2 & \geq\ 12 \\
& & 10x_1 & + & 4x_2 & \geq\ 12 \\
& & x_1 & , & x_2 & \geq\ 0 \text{ and integer}
\end{array}
$$

Problem 8. 5 Marks

Use Dynamic programming to solve the problem

$$\begin{array}{lrcrcrcl} \max\ z & = & 5x_1 & + & 6x_2 & + & x_3 & \\ \text{subject to} & & 3x_1 & + & 4x_2 & + & 2x_3 & \leq\ 5 \\ & & x_i = 0, 1,\ i = 1, \cdots, 3 & & & & & \end{array}$$