Week 4 Assignment

1. Two generators (G1 and G2) are competing to supply a 60MW load. The bidding information of the two generators is shown in Table 1 for G1 and in Table 2 for G2. The minimum and maximum capacities for G1 are 15MW and 65MW, respectively. The minimum and maximum capacities for G2 are 10MW and 80MW, respectively.

Assume each unit has a no-load cost. No-load cost for G1 is $100. No-load cost for G2 is $200.

Table 1. G1 Bidding Information

Quantity (MW)	Price ($/MWh)
20	20
30	25
15	30

Table 2. G2 Bidding Information

Quantity (MW)	Price ($/MWh)
15	**28**
40	26
25	32

Please find the minimum cost to supply the load and the accepted quantities for G1 and G2. You are required to formulate the problem using mixed-integer linear programming.

Submission

- **Complete MILP formulation (variables, objective function, constraints, bounds)**
- **Optimal solutions (commitment of units, accepted quantities, cost to supply the load)**

Hints

- It's possible that only one unit is needed to supply the load.
- If a unit is committed, a no-load cost will be incurred.
- Cost curve for G1 is convex when it's committed. Cost curve for G2 is non-convex when it's committed.

2. Find the mixed-integer linear programming formulation and the optimal solutions for $\max\{\max\{x_1 + x_2, 3x_1 - 2x_2\}\}$

subject to $0 \le x_1, x_2 \le 5$

3. Solve the following problems using Benders decomposition.

$$
\begin{aligned}
&\textit{Min } 20x_1 + 24x_2 + 10x_3 + 6y \\
&\textit{S.t.} \quad x_1 + 2x_2 + x_3 + 2y \geq 15 \\
&\qquad 4x_1 + 4x_2 + x_3 + y \geq 18 \\
&\qquad x_1, x_2, x_3 \geq 0,\ y \in \{0,1,2,\ldots,10\}
\end{aligned}
$$

$$
\begin{aligned}
&\textit{Min } x + y \\
&\textit{S.t.} \quad 2x - y \leq 3 \\
&\qquad x \geq 0,\ y \in \{-5,-4,\ldots,3,4\}
\end{aligned}
$$