Black Blend Formulation

The statement of the use case is on Mip Wise's website: mipwise.com/use-cases/black-blend.

The following diagram summarizes the data of the problem.

Decision Variables

- x_{ij} - Amount of raw grain procured from supplier $i = 1, 2, 3$ to be processed at facility $j = 1, 2$.

Constraints

- Capacity of Supplier 1:

$$x_{11} + x_{12} \leq 1000.$$

- Capacity of Supplier 2:

$$x_{21} + x_{22} \leq 3000.$$

- Capacity of Supplier 3:

$$x_{31} + x_{32} \leq 2000.$$

- Capacity of Facility 1:

$$x_{11} + x_{21} + x_{31} \leq 2500.$$

- Capacity of Facility 2:

$$x_{12} + x_{22} + x_{32} \leq 3000.$$

Objective

Observe that revenue, procurement cost, and processing cost are given by the following expressions:

$$\begin{aligned} revenue &= 0.8 \cdot 25 \cdot (x_{11} + x_{12} + x_{21} + x_{22} + x_{31} + x_{32}) \\ procurementCost &= 6 \cdot (x_{11} + x_{12}) + 7 \cdot (x_{21} + x_{22}) + 5 \cdot (x_{31} + x_{32}) \\ processingCost &= 10 \cdot (x_{11} + x_{21} + x_{31}) + 12 \cdot (x_{12} + x_{22} + x_{32}) \end{aligned}$$

Since the objective is to maximize the total profit, we have:

$$\max revenue - procurementCost - processingCost.$$

Final formulation

$$
\begin{aligned}
\max \quad & 4x_{11} + 2x_{12} + 3x_{21} + x_{22} + 5x_{31} + 3x_{32} \\
\text{s.t.} \quad & x_{11} + x_{12} \leq 1000, \\
& x_{21} + x_{22} \leq 3000, \\
& x_{31} + x_{32} \leq 2000, \\
& x_{11} + x_{21} + x_{31} \leq 2500, \\
& x_{12} + x_{22} + x_{32} \leq 3000, \\
& x_{11}, x_{21}, x_{31}, x_{12}, x_{22}, x_{32} \geq 0.
\end{aligned} \tag{1}
$$