ISyE4106 MIP

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1 Introduction

This model seeks to select suppliers for various materials in Steelcase's procurement process. Using data on cost, expected shipment delays, minimum supplier diversity, demand, and minimum order quantity, this model is a mixed integer program to minimize cost to procure material.

2 Parameters

$f_{i,j}$: Fixed cost of an order of material j from supplier i
$v_{i,j}$: Variable cost of an order of material j from supplier i
d_j : Cost of each late day for material j
$l_{i,j}$: $E[lateness]$ of material j by supplier i
m_j : Minimum order quantity for material j
n_j : Minimum supplier diversity for material j

3 Decision Variables

$x_{i,j}$: Units of material j from supplier i
$y_{i,j}$: Is supplier i an active supplier of material j, j $\in \{0,1\}$

4 Objective Function

$\min \sum_{j=1}^{J} \sum_{i=1}^{I} [f_{i,j} * y_{i,j} + v_{i,j} * x_{i,j} + d_j * l_{i,j} * x_{i,j}]$

5 Constraints

$\mathrm{x}_{i,j} \leq M y_{i,j}, \quad \forall i \in I, \forall j \in J \quad [Linearize binary constraint]$
$\sum_{i=1}^{I} x_{i,j} \geq m_j, \quad \forall j \in J \quad [\text{Demand}]$
$\sum_{i=1}^{I} y_{i,j} \geq n_j, \quad \forall j \in J \quad [\text{Material sourcing Diversity}]$
$\mathrm{x}_{i,j} \geq m_j * y_{i,j}, \quad \forall i \in I, \forall j \in J \quad [\text{Minimum Order Quantity}]$
$\mathrm{x}_{i,j} \geq 0, \quad \forall i \in I, \forall j \in J \quad [\text{Non-Negativity}]$

$$y_{i,j} \in {0,1}, \quad \forall i \in I, \forall j \in J \quad \text{[Binary Variable]}$$