Assignment 3

Sri Seshadri

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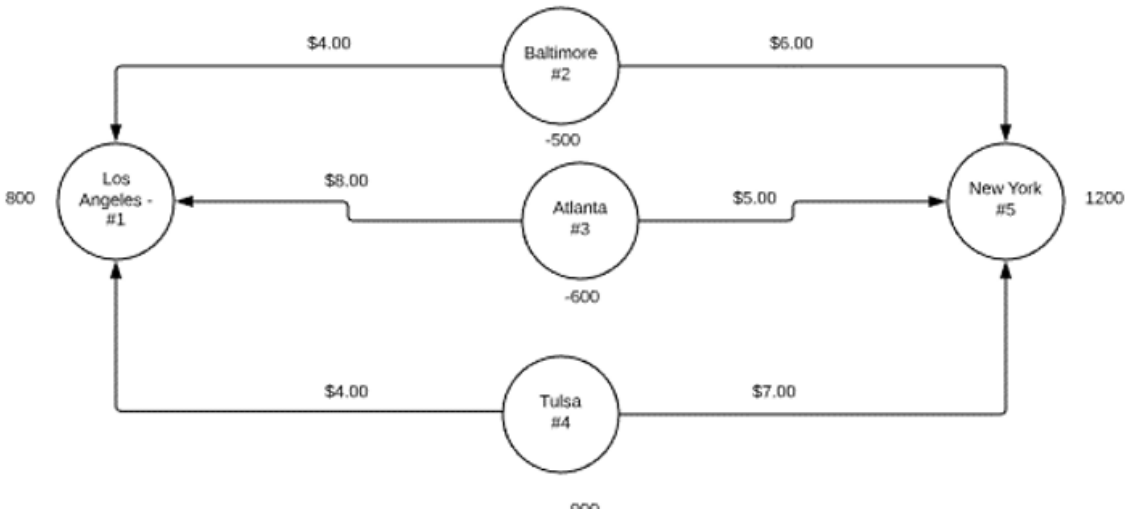
Problem 1

Here there are two scenarios that will be inspected using Integer Linear Programming (ILP) to model total cost. Scenario 1 - plant in Baltimore, Scenario 2 - plant in Seattle.

Scenario 1

Formulation:

The model is formulated as a network flow model as shown in the figure below, where nodes 1 through 5 are Los Angeles, Baltimore, Atlanta, Tulsa and New York respectively



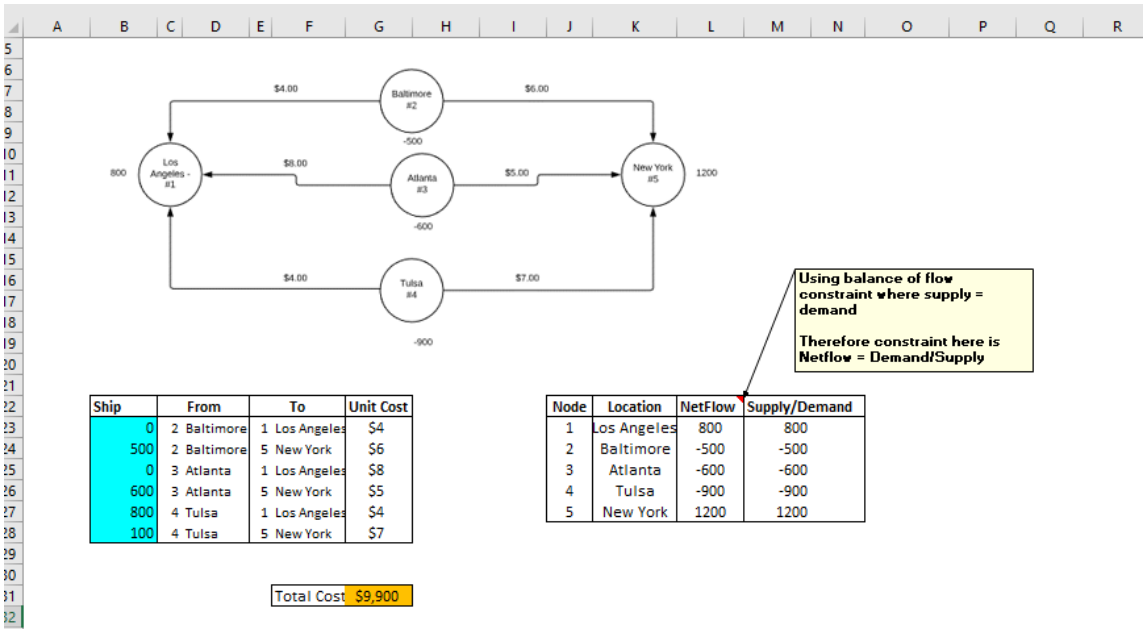
Decision variables:

Let X_{ij} be the flow from node i to j where $i \in \{2, 3, 4\}$ and $j \in \{1, 5\}$

X_{ij} are the decision variables.

Other variables

Let C_{ij} be the cost variable for distribution of toys between X_ij Let D_i be the supply at i and D_j be the demand at j. D_i is denoted with a negative number and the D_j as positive number for modeling as a network flow problem.



Ship	From	To	Unit Cost
0	2 Baltimore	1 Los Angeles	$4
500	2 Baltimore	5 New York	$6
0	3 Atlanta	1 Los Angeles	$8
600	3 Atlanta	5 New York	$5
800	4 Tulsa	1 Los Angeles	$4
100	4 Tulsa	5 New York	$7

Node	Location	NetFlow	Supply/Demand
1	Los Angeles	800	800
2	Baltimore	-500	-500
3	Atlanta	-600	-600
4	Tulsa	-900	-900
5	New York	1200	1200

Figure 1: Problem 1 ASPE formulation

Objective function

$Min\ TotalCost = X_{ij}C_{ij}$

Constraints:

Since the supply equals the demand ($\sum_i D_i + \sum_j D_j = 0$), the model will be constrained as $Inflow - Outflow = Supply\ or\ Demand$.

The constraints in explicit form are:

$X_{21} + X_{31} + X_{41} - 0 = D_1$ where $D_1 = 800$ $X_{25} + X_{35} + X_{45} - 0 = D_5$ where $D_5 = 1200$

$0 - X_{21} - X_{25} = D_2$ Where $D_2 = -500$ $0 - X_{31} - X_{35} = D_3$ Where $D_3 = -600$ $0 - X_{41} - X_{45} = D_4$ Where $D_2 = -900$

$X_{ij} >= 0$ and X_{ij} are integers

ASME Modeling

Figures 1 and 2 show the model set up in ASPE

Scenario 1 Results

The Total cost for a plant in Baltimore was $9900

Scenario 2

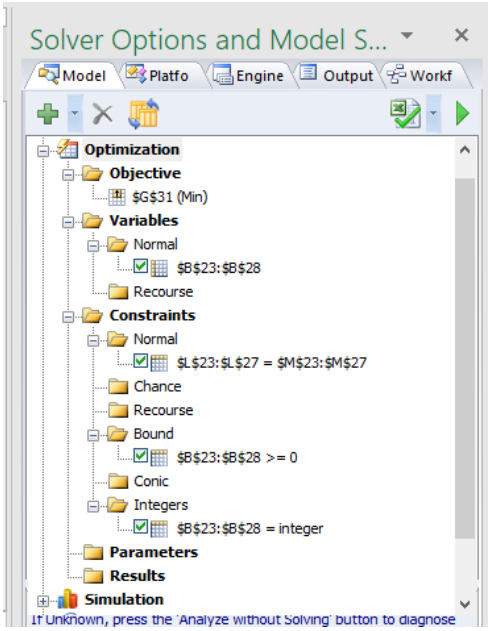
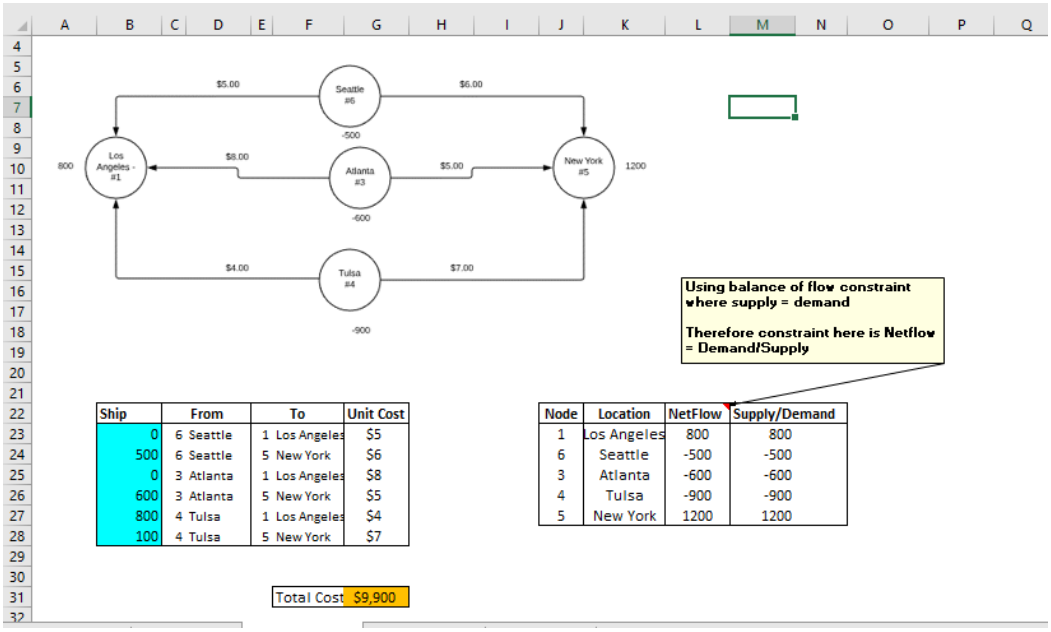


Figure 2: Problem 1 ASPE Model setup



Ship	From	To	Unit Cost
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Node	Location	NetFlow	Supply/Demand
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6	Seattle	-500	-500
3	Atlanta	-600	-600
4	Tulsa	-900	-900
5	New York	1200	1200

Figure 3: Problem 1 ASPE formulation