Module 09 – Fixed Charge Problem

Exploratory Data Analysis

*In this section, you should perform some data analysis on the data provided to you. Please format your findings in a visually pleasing way and please be sure to include these cuts:*

* *Make a visual graph of your data on a map (coordinates should be within US borders)*
  + <https://mymaps.google.com/>
  + Find a map with latitude/longitude and place them approximately
  + Any alternative that gives the same effect

A map of the united states

AI-generated content may be incorrect.

Model Formulation

*Write the formulation of the model into here prior to implementing it in your Excel model. Be explicit with the definition of the decision variables, objective function, and constraints.*

Min: 34.54\*X11+34.35\*X12+10.42\*X13+19.9\*X14+34.32\*X15+12.36\*X16 +38.19\*X21+37.42\*X22+3.01000000000001\*X23+24.65\*X24+37.39\*X25+18.95\*X26 +50.88\*X31+50.69\*X32+13.74\*X33+36.24\*X34+50.66\*X35+28.7\*X36+22.62\*X41+10.05\*X42+39.72\*X43+17.22\*X44+10.68\*X45+24.76\*X46+1526Y1+ 2189Y2+ 1846Y3+ 1035Y4

DC 1: X11 + X21+ X31+X41<=980

DC 2: X12+X22+ X32+ X42<=844

DC 3: X13+ X23+ X33+ X43<=648

DC 4: X14+X24+X34+X44<=993

DC 5: X15+X25+X35+X45<=937

DC 6: X16+X26+X36+X46<=857

Linking constraints:

X1+25Y1 >= 0

X2+23Y2>=0

X3+17Y3>=0

X4+17Y4>=0

Model Optimized for Min Costs to Supply DCs

*Implement your formulation into Excel and be sure to make it neat. This section should include:*

* *A screenshot of your optimized final model (formatted nicely, of course)*
* *A text explanation of what your model is recommending*

A screenshot of a spreadsheet

AI-generated content may be incorrect.

This model recommends using Warehouse 1 and Warehouse 4 to fulfill the total demand of 5,259 units across six distribution centers. Warehouse 1 supplies DCs 3 and 6, while Warehouse 4 covers the remaining DCs. This configuration minimizes total costs, with transportation costing 75,101.1 and setup costs totaling 2,561, resulting in an overall objective value of 77,662.1. The solution balances setup and shipping costs to meet demand efficiently

Model with Stipulation

*Please copy the tab of your original model before continuing with the next part to avoid messing up your original solution.*

*Please perform 2 out of the 3 scenarios below with a short text description on what changed:*

1. *Instead of only being able to open 2 warehouses, what happens to our objective function when we only can open 1 warehouse?*

The objective function increase. With 2 warehouses the objective function is 77,662.1$ while with 1 warehouse it is 105749.3$ This could be because of the transportation cost increasing.

1. *Right now, we have $1 per unit shipped over the distance between the warehouse and the DC. What happens to our objective function when we increase this to $30? Does your DC assignment change at all?*

My costs was originally 77,662.1$ and increased to 2,255,594$. It increase by a lot, but the DC assignment did not change at all.

1. *For distance between each location, we used Manhattan distance but what happens to our model if we use Euclidean distance instead? Did the change impact the model at all? Do you feel this is a better distance metric to use in this scenario?*