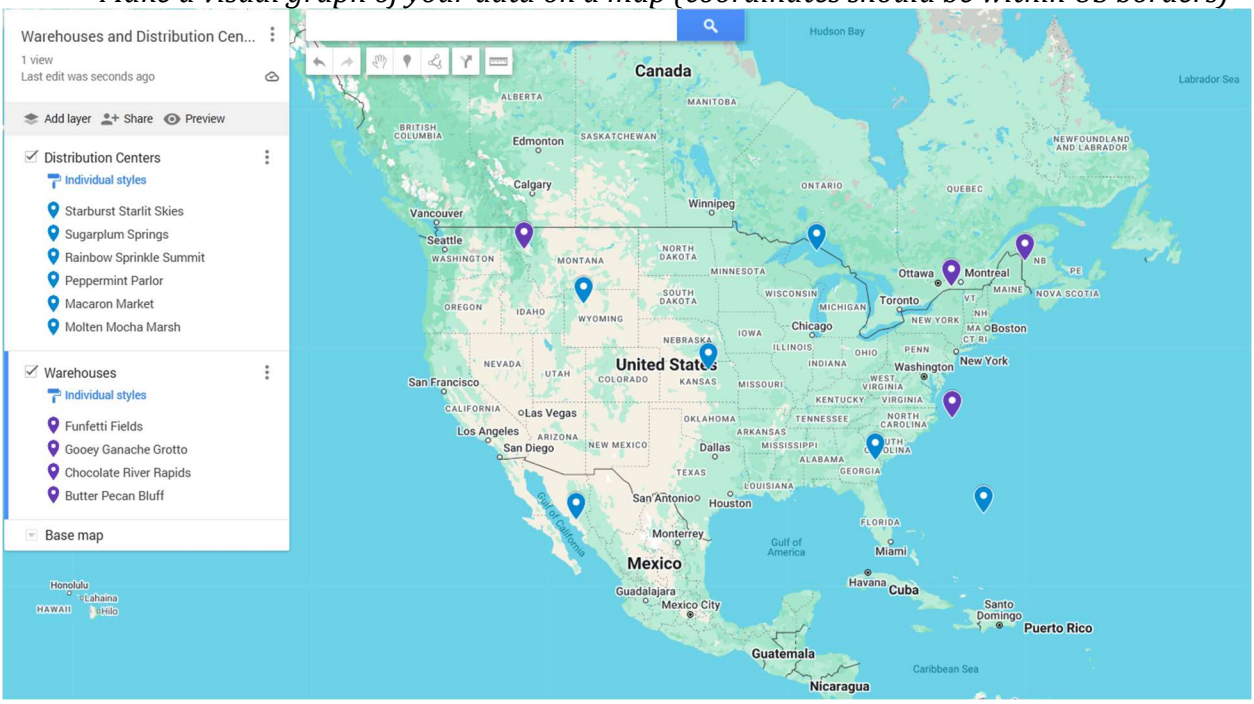
Module 09 – Fixed Charge Problem

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)*



Model Formulation

MIN: 27.76X11 + 62.86X12 + 48.42X13 + 24.94X14 + 25.70X15 + 9.19X16 + 15.06X21 + 20.04X22 + 20.00X23 + 53.22X24 + 28.90X25 + 36.01X26 + 20.42X31 + 22.68X32 + 28.56X33 + 61.78X34 + 37.46X35 + 44.57X36 + 24.62X41 + 10.48X42 + 10.62X43 + 43.84X44 + 26.68X45 + 43.19X46

Subject to:

X11 + X21 + X31 + X41 >= 776
X12 + X22 + X32 + X42 >= 503
X13 + X23 + X33 + X43 >= 668
X14 + X24 + X34 + X44 >= 712
X15 + X25 + X35 + X45 >= 951
X16 + X26 + X36 + X46 >= 800

Constraints:

SUM of Binary constraints <=2

Model Optimized for Min Costs to Supply DCs

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

WH vs DC	1	2	3	4	5	6
1	27.76	62.86	48.42	24.94	25.7	9.19
2	15.06	20.04	20	53.22	28.9	36.01
3	20.42	22.68	28.56	61.78	37.46	44.57
4	24.62	10.48	10.62	43.84	26.68	43.19

WH vs DC	1	2	3	4	5	6	Units Sent Per WH	Binary Constraint	Linking Constraint	Possible C	Actual Cost
1	0	0	0	712	951	800	2463	1	-1967	1802	1802
2	0	0	0	0	0	0	0	0	0	1568	0
3	0	0	0	0	0	0	0	0	0	2771	0
4	776	503	688	0	0	0	1967	1	-2463	1887	1887
Sum	776	503	688	712	951	800	Total Demand	2			
Total DC Demand	776	503	688	712	951	800	4430		Total Cost:		
									$ 84,922.10		

This model recommends utilizing warehouses 1 and 4 for optimal shipping to posts 1-6. The total cost minimized is shown as $84,922.10.

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?*

WH vs DC	1	2	3	4	5	6
1	27.76	62.86	48.42	24.94	25.7	9.19
2	15.06	20.04	20	53.22	28.9	36.01
3	20.42	22.68	28.56	61.78	37.46	44.57
4	24.62	10.48	10.62	43.84	26.68	43.19

WH vs DC	1	2	3	4	5	6	Units Sent Per WH	Binary Constraint	Linking Constraint	Possible C	Actual Cost
1	0	0	0	0	0	3.41E-13	3.41061E-13	0	3.41061E-13	1802	0
2	5.8E-12	0	0	0	0	0	5.79803E-12	0	5.79803E-12	1568	0
3	0	0	0	0	0	0	0	0	0	2771	0
4	776	503	688	712	951	800	4430	1	0	1887	1887
Sum	776	503	688	712	951	800	Total Demand	1			
Total DC Demand	776	503	688	712	951	800	4430		Total Cost:		
									$ 124,708.88		

The total cost of the distribution plan increases by nearly $40,000 up to $124,708.88.

2. *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?*

WH vs DC	1	2	3	4	5	6
1	27.76	62.86	48.42	24.94	25.7	9.19
2	15.06	20.04	20	53.22	28.9	36.01
3	20.42	22.68	28.56	61.78	37.46	44.57
4	24.62	10.48	10.62	43.84	26.68	43.19

WH vs DC	1	2	3	4	5	6
1	832.8	1885.8	1452.6	748.2	771	275.7
2	451.8	601.2	600	1596.6	867	1080.3
3	612.6	680.4	856.8	1853.4	1123.8	1337.1
4	738.6	314.4	318.6	1315.2	800.4	1295.7

WH vs DC	1	2	3	4	5	6	Units Sent Per WH
1	0	0	0	712	951	800	2463
2	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0
4	776	503	688	0	0	0	1967
Sum	776	503	688	712	951	800	Total Demand
Total DC Demand	**776**	**503**	**688**	**712**	**951**	**800**	4430

Binary Constraint	Linking Constraint	Possible C	Actual Cost
1	-1967	1802	1802
0	0	1568	0
0	0	2771	0
1	-2463	1887	1887
2			
	Total Cost:		
	$ 2,440,682.00		

The cost of balloons up to $2,440,682.00.