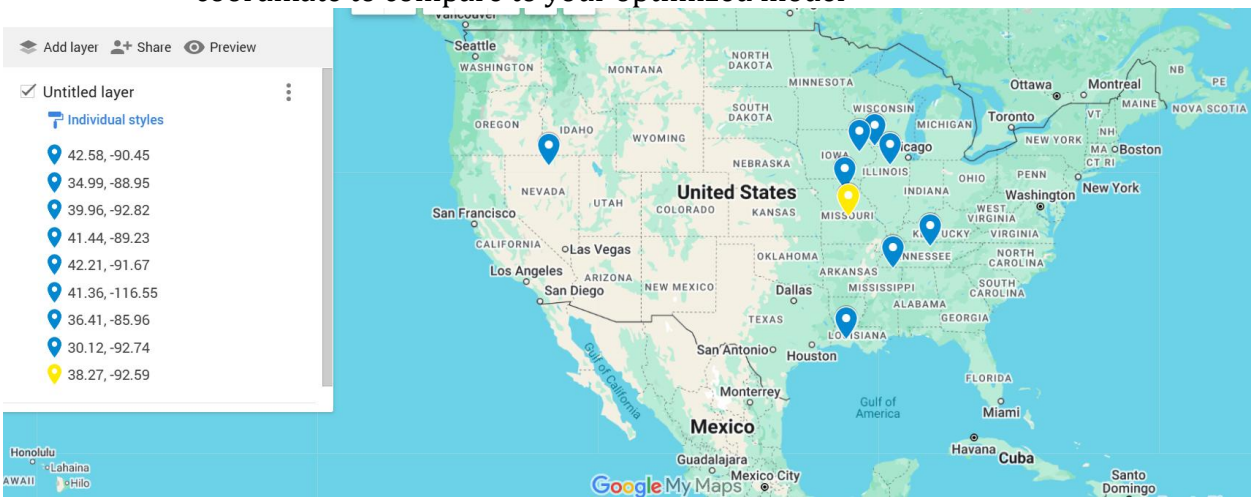
Module 12 – Location Graph

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
- Use your available data to determine a good starting coordinate for the DC
  - Should you use the average of the ranges of lat longs of the stores?
  - Should you use the coordinates of the store furthest away from the current DC?
  - Can you think of something better to use?
  - Whatever you use, please record the optimal function with your starting coordinate to compare to your optimized model



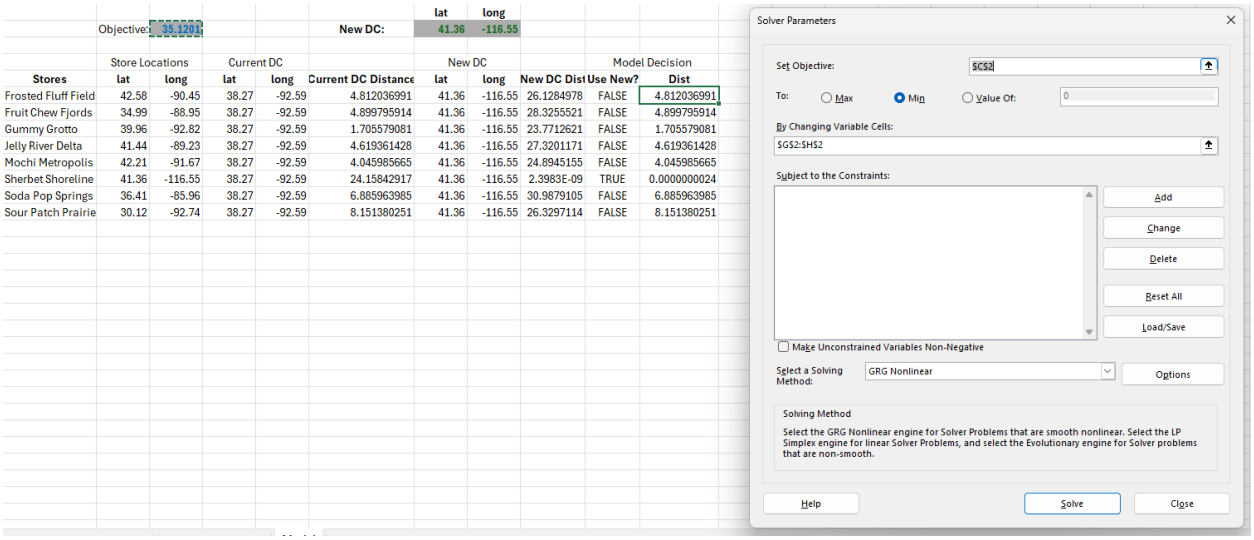
Used averages to find new DC coordinates. Average used was 38, 100.

Model Formulation

Try to 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. Hint: Linking constraints aren't needed since we are using Nonlinear GRG but refer to the associated PowerPoint in your data if you need help.

Objective Function: Sum of the distance from each warehouse to the DC between both the old and new location.

Decision Variables: Latitude and Longitude of the new DC based on average used



						lat	long			
	Objective:	35.1201			New DC:	41.36	-116.55			
	Store Locations		Current DC			New DC			Model Decision	
Stores	lat	long	lat	long	Current DC Distance	lat	long	New DC Dist	Use New?	Dist
Frosted Fluff Field	42.58	-90.45	38.27	-92.59	4.812036991	41.36	-116.55	26.1284978	FALSE	4.812036991
Fruit Chew Fjords	34.99	-88.95	38.27	-92.59	4.899795914	41.36	-116.55	28.3255521	FALSE	4.899795914
Gummy Grotto	39.96	-92.82	38.27	-92.59	1.705579081	41.36	-116.55	23.7712621	FALSE	1.705579081
Jelly River Delta	41.44	-89.23	38.27	-92.59	4.619361428	41.36	-116.55	27.3201171	FALSE	4.619361428
Mochi Metropolis	42.21	-91.67	38.27	-92.59	4.045985665	41.36	-116.55	24.8945155	FALSE	4.045985665
Sherbet Shoreline	41.36	-116.55	38.27	-92.59	24.15842917	41.36	-116.55	2.3983E-09	TRUE	0.0000000024
Soda Pop Springs	36.41	-85.96	38.27	-92.59	6.885963985	41.36	-116.55	30.9879105	FALSE	6.885963985
Sour Patch Prairie	30.12	-92.74	38.27	-92.59	8.151380251	41.36	-116.55	26.3297114	FALSE	8.151380251

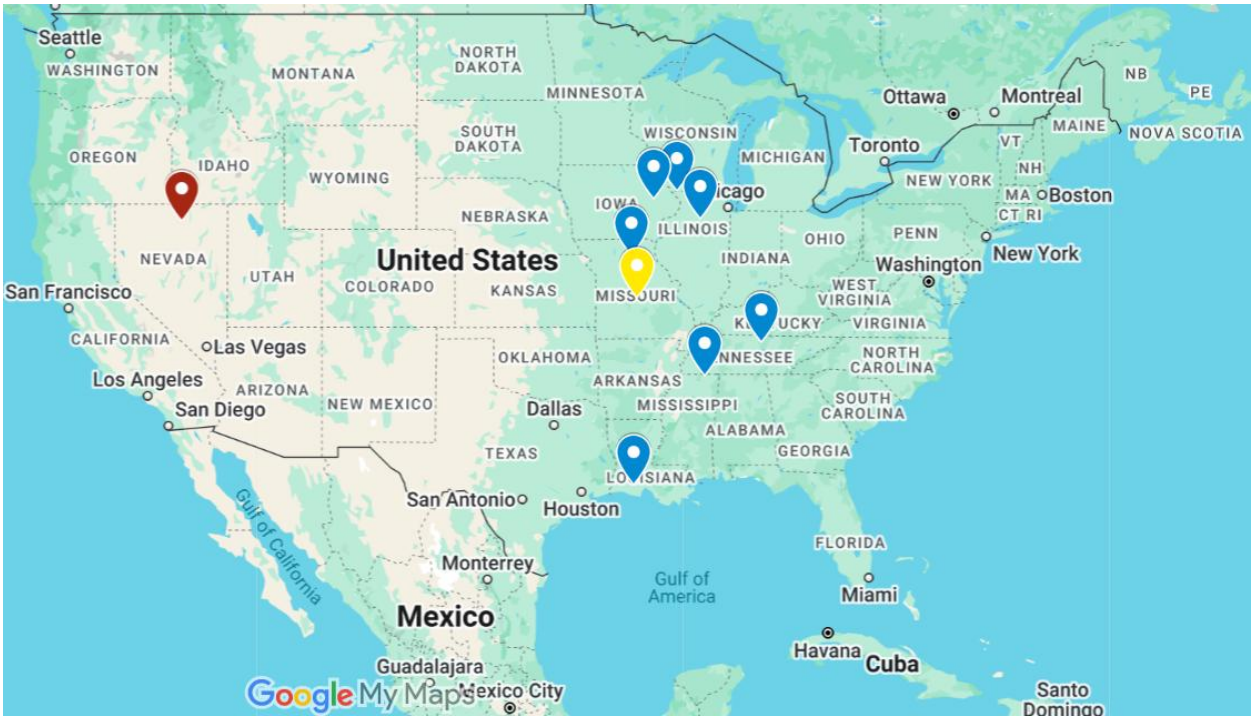
Model Optimized for Distance Reduction from DC to Store

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*
- *Update your graph from the EDA section by adding in your new DC and add indicators of which Stores are serviced by which DC*

						lat	long			
	Objective:	35.1201			New DC:	41.36	-116.55			
	Store Locations		Current DC			New DC			Model Decision	
Stores	lat	long	lat	long	Current DC Distance	lat	long	New DC Dist	Use New?	Dist
Frosted Fluff Field	42.58	-90.45	38.27	-92.59	4.812036991	41.36	-116.55	26.12849785	FALSE	4.812036991
Fruit Chew Fjords	34.99	-88.95	38.27	-92.59	4.899795914	41.36	-116.55	28.32555207	FALSE	4.899795914
Gummy Grotto	39.96	-92.82	38.27	-92.59	1.705579081	41.36	-116.55	23.77126206	FALSE	1.705579081
Jelly River Delta	41.44	-89.23	38.27	-92.59	4.619361428	41.36	-116.55	27.32011713	FALSE	4.619361428
Mochi Metropolis	42.21	-91.67	38.27	-92.59	4.045985665	41.36	-116.55	24.89451546	FALSE	4.045985665
Sherbet Shoreline	41.36	-116.55	38.27	-92.59	24.15842917	41.36	-116.55	2.39834E-09	TRUE	0.0000000024
Soda Pop Springs	36.41	-85.96	38.27	-92.59	6.885963985	41.36	-116.55	30.98791054	FALSE	6.885963985
Sour Patch Prairie	30.12	-92.74	38.27	-92.59	8.151380251	41.36	-116.55	26.32971135	FALSE	8.151380251

My model is recommending that the coordinates of the new DC are 41.36, -116.55 and will be used by Sherbet Shoreline.



Model with Stipulation

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

You should notice that while distance is minimized between each store and each DC, there is a discrepancy between how much demand is serviced between each DC (i.e. one DC may service a lot more demand than others). Please:

1. *Choose one:*
    a. *Implement a change that picks a location for the new DC to distance **AND** load. You can do this by multiplying distance by demand if a store is serviced by a particular DC.*
    b. *Instead of just summing the distance, also add the difference between demand serviced between each DC (i.e. if the old DC serves stores with 8000 total demand and the new DC does 3000 then the difference would be 5000). Be sure to not remove the sum of distance too, it should be both. You may want to add weights and such but not necessary*
2. *Provide a text explanation on what your model is recommending now with this change.*
3. *Explain the changes to your Solver/Model.*

My model is recommending a new DC closer to the rest of the warehouses between Chicago and Tennessee to fulfill more of the demand. This was an expected change as having a singular warehouse on the west coast does not make sense when accounting for demand and the fact that most warehouses are closer to the east coast.