Module 12 – Location Graph

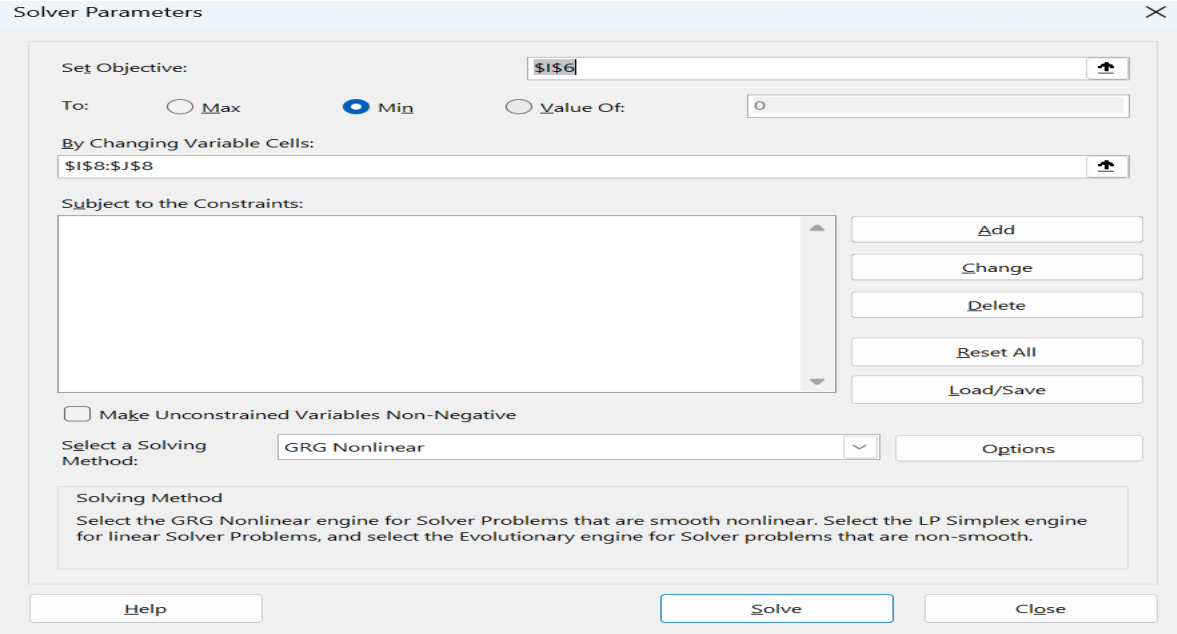
Exploratory Data Analysis

- Use your available data to determine a good starting coordinate for the DC

Objective	53.20208802	
	Lat	Long
New Dist	36.60976059	-95.6398

We have chosen to use these new coordinates for our new location as it is optimized to travel a minimal distance between each of the 8 locations.

Model Formulation



MIN: "SUM(distance)" / "IF ("Use New?" , "IF ("Use New?" , "New DC dist." , "Current DC dist.")"
Objective Function: Sum(distances)
Constraints: none, possible Variable Cells > 0

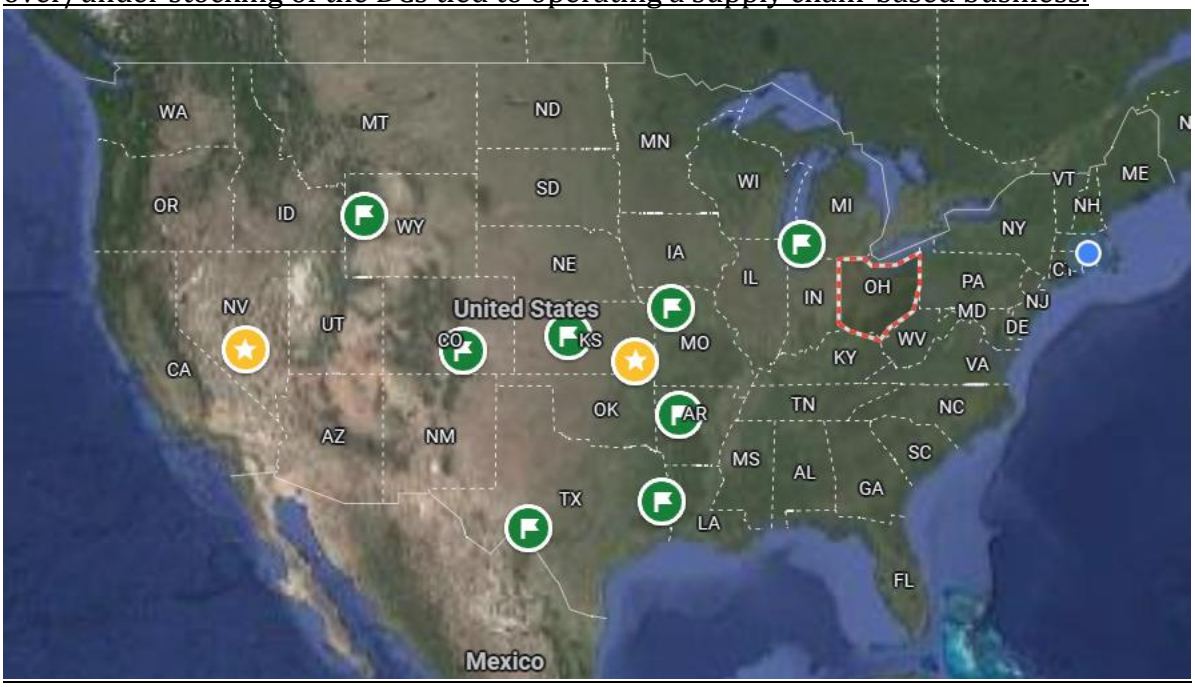
Model Optimized for Distance Reduction from DC to Store

Store Name	Latitude	Longitude	Last Ye	Expected YOY Change				Distribution Center Name	Latitude	Longitude
Choco Volcano	39.98	-93.71	1326	0.11				Pudding Peaks	37.09	-116.33
Cocoa Bean Crater	42.52	-86.79	2154	-0.08						
Gingerbread Glades	43.65	-110.04	1154	0.07						
Gumdrops Grove	31.66	-94.21	1219	0.08						
Honeycomb Highlands	38.23	-104.8	1708	0.06			Objective	53.20208802		
Jelly River Delta	30.46	-101.28	1896	-0.07				Lat	Long	
Mallow Melt Mountains	38.82	-99.2	1263	0.11			New Dist	36.60976059	-95.6398	
Peanut Butter Parlor	35.5	-93.29	1695	-0.07						

	STORE LOCATION		CORRENT DC			NEW DC			Model Decision	
Store Name	Lat	Long	Lat	Long	Current DC	Lat	Long	New DC Dist	Use New?	Dist
Choco Volcano	39.98	-93.71	37.09	-116.33	22.80387	36.6098	-95.6398	3.883629317	TRUE	3.88363
Cocoa Bean Crater	42.52	-86.79	37.09	-116.33	30.034921	36.6098	-95.6398	10.64187914	TRUE	10.6419
Gingerbread Glades	43.65	-110.04	37.09	-116.33	9.0883277	36.6098	-95.6398	16.02907409	FALSE	9.08833
Gumdrops Grove	31.66	-94.21	37.09	-116.33	22.776727	36.6098	-95.6398	5.152126726	TRUE	5.15213
Honeycomb Highlands	38.23	-104.8	37.09	-116.33	11.58622	36.6098	-95.6398	9.302405517	TRUE	9.30241
Jelly River Delta	30.46	-101.28	37.09	-116.33	16.44565	36.6098	-95.6398	8.344555197	TRUE	8.34456
Mallow Melt Mountains	38.82	-99.2	37.09	-116.33	17.217137	36.6098	-95.6398	4.190501429	TRUE	4.1905
Peanut Butter Parlor	35.5	-93.29	37.09	-116.33	23.094798	36.6098	-95.6398	2.598663011	TRUE	2.59866
	Averages	37.6025	-97.92							

The following model recommends that to minimize the total distance in the transporting products and the distribution of units between the Distribution Center and 8 Stores, certain steps must be taken. Following the data listed above, they must place their new DC at the Latitude & Longitude of 36.61, -95.64. By doing so, they will increase the business' efficiency to replenish their inventory each time they are about to run out (or near 0). In doing so, they will optimize total distance traveled between locations by gaining the most

efficiency out of the miles typically traveled. As a result, this considers each variable of the function. Following this model, the business can prevent unnecessary bottlenecks and over/under stocking of the DCs tied to operating a supply chain-based business.



Model with Stipulation

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.*
2. *Provide a text explanation of what your model is recommending now with this change.*
3. *Explain the changes to your Solver/Model.*

Store Name	Latitude	Longitude	Last Ye	Expected YOY Change
Choco Volcano	39.98	-93.71	1326	0.11
Cocoa Bean Crater	42.52	-86.79	2154	-0.08
Gingerbread Glades	43.65	-110.04	1154	0.07
Gumdrops Grove	31.66	-94.21	1219	0.08
Honeycomb Highlands	38.23	-104.8	1708	0.06
Jelly River Delta	30.46	-101.28	1896	-0.07
Mallow Melt Mountains	38.82	-99.2	1263	0.11
Peanut Butter Parlor	35.5	-93.29	1695	-0.07

	Distribution Center Name	Latitude	Longitude
	Pudding Peaks	37.09	-116.33
Objective	86198.17332		
	Lat	Long	
New Dist	36.58886141	-95.3205	

	STORE LOCATION		CORRENT DC			NEW DC			Model Decision		STIPULATION	
Store Name	Lat	Long	Lat	Long	Current DC	Lat	Long	New DC Dist	Use New?	Dist	DEMAND	DEMAND STIP
Choco Volcano	39.98	-93.71	37.09	-116.33	22.80387	36.5889	-95.3205	3.754131221	TRUE	3.75413	1326.13	4978.466036
Cocoa Bean Crater	42.52	-86.79	37.09	-116.33	30.034921	36.5889	-95.3205	10.38978712	TRUE	10.3898	2154.35	22383.23789
Gingerbread Glades	43.65	-110.04	37.09	-116.33	9.0883277	36.5889	-95.3205	16.32555152	FALSE	9.08833	1154.21	10489.83869
Gumdrops Grove	31.66	-94.21	37.09	-116.33	22.776727	36.5889	-95.3205	5.052411735	TRUE	5.05241	1218.52	6156.464747
Honeycomb Highlands	38.23	-104.8	37.09	-116.33	11.58622	36.5889	-95.3205	9.620521433	TRUE	9.62052	1707.55	16427.52137
Jelly River Delta	30.46	-101.28	37.09	-116.33	16.44565	36.5889	-95.3205	8.548607685	TRUE	8.54861	1895.7	16205.59559
Mallow Melt Mountains	38.82	-99.2	37.09	-116.33	17.217137	36.5889	-95.3205	4.475329251	TRUE	4.47533	1263.06	5652.609364
Peanut Butter Parlor	35.5	-93.29	37.09	-116.33	23.094798	36.5889	-95.3205	2.304020748	TRUE	2.30402	1694.62	3904.43964

By including an alternative point in demand, the business can establish a new distribution center on account of distance and load. Thus, efficiency will be maintained between the 8 locations and 2 DCs across the country. As a result, businesses can ensure that over/under

stocking is avoided, and bottlenecks are foreseeably avoided. Through this principle, businesses can offer flexibility and reliability in knowing when they will periodically have shipment orders coming into the two DCs. Additionally, it adds an element of protection to knowing that all the 8 locations don't need to receive products from just one DC. Furthermore, product demand can become easier to track. Thus, the practices of future forecasting and planning will be optimized. Overall, the inclusion of a second distribution center provides operational flexibility. This is done through optimizing production scheduling and preventing rushed or disruptive adjustments in shipping practices to meet sudden demand for spikes or valleys.

The changes to the model were very minimal in numbers but change the final location by many miles. Also new categories were added to account for the newest demand and demand stipulation. The minimized objective function is changed to sum the "Demand Stipulation".