

Module 12 – Location Graph

Exploratory Data Analysis



Using the average of the stores' latitudes and longitudes (36.84, -104.88) offers a balanced and centralized starting point for the new DC, placing it roughly at the geographic center of all store locations (indicated by the purple pin on the map).



Model Formulation

Decision Variables:

- Let x = latitude of the new DC
- Let y = longitude of the new DC

MIN

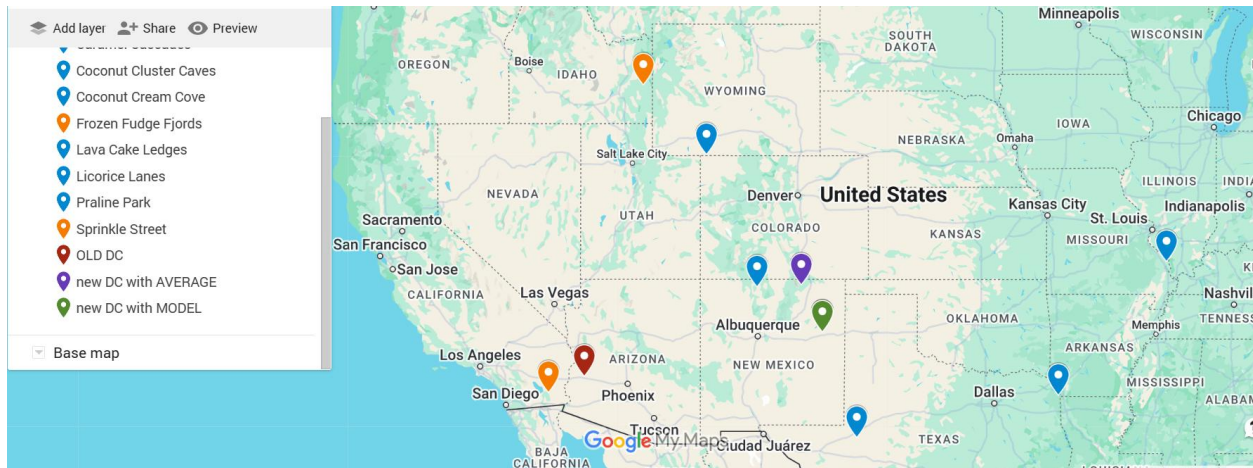
$$\begin{aligned} & \left((37.6-X)^2 + (-89.67-Y)^2 \right)^{1/2} + \left((41.05-X)^2 + (-108.86-Y)^2 \right)^{1/2} + \left((31.56-X)^2 + (-102.59-Y)^2 \right)^{1/2} \\ & + \left((43.21-X)^2 + (-111.48-Y)^2 \right)^{1/2} + \left((36.79-X)^2 + (-106.76-Y)^2 \right)^{1/2} \\ & + \left((33.08-X)^2 + (-94.17-Y)^2 \right)^{1/2} + \left((35.24-X)^2 + (-104.02-Y)^2 \right)^{1/2} \\ & + \left((33.19-X)^2 + (-115.46-Y)^2 \right)^{1/2} \end{aligned}$$

Model Optimized for Distance Reduction from DC to Store

Model

	Objective	50.70465				lat	long				
					New DC:	35.23996	-104.02				
	Store Location		Current DC			New DC		Model Decision			
Stores	lat	long	lat	long	Current DC Distance	lat	long	New DC Dist	Use New?	Dist	
Caramel Cascades	37.6	-89.67	33.71	-113.94	24.5797681	35.23996	-104.02	14.54275442	TRUE	14.54275442	
Coconut Cluster Caves	41.05	-108.86	33.71	-113.94	8.926477469	35.23996	-104.02	7.561899914	TRUE	7.561899914	
Coconut Cream Cove	31.56	-102.59	33.71	-113.94	11.55183968	35.23996	-104.02	3.94803317	TRUE	3.94803317	
Frozen Fudge Fjords	43.21	-111.48	33.71	-113.94	9.813337862	35.23996	-104.02	10.91665687	FALSE	9.813337862	
Lava Cake Ledges	36.79	-106.76	33.71	-113.94	7.812733197	35.23996	-104.02	3.148067003	TRUE	3.148067003	
Licorice Lanes	33.08	-94.17	33.71	-113.94	19.78003539	35.23996	-104.02	10.08402425	TRUE	10.08402425	
Praline Park	35.24	-104.02	33.71	-113.94	10.03729545	35.23996	-104.02	4.25961E-05	TRUE	4.25961E-05	
Sprinkle Street	33.19	-115.46	33.71	-113.94	1.60648685	35.23996	-104.02	11.62223736	FALSE	1.60648685	

Updated Map



Explanation

The model recommends establishing a new distribution center at coordinates (35.24, -104.02) (green pin on the map). This location closely aligns with the coordinate average of all store locations, which was (36.84, -104.88) (purple pin).

Compared to the current DC, the new location significantly reduces the total distance to most stores—improving proximity to six out of eight. The only exceptions are Frozen Fudge Fjords and Sprinkle Street, which remain closer to the original DC. Despite this, the overall reduction in total travel distance—from 94.11 (sum of current DC distances) to 50.70—demonstrates a clear gain in efficiency.

By relocating the DC to this more central location, the company can enhance logistical performance, streamline distribution routes, reduce transportation costs, and improve delivery responsiveness across the network.

Model with Stipulation

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

*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.*

[illegible]

The updated model selects a new DC location at 36.76, -106.55, optimizing based on both distance and store demand by minimizing the total of Distance \times Next Year Demand. This change prioritizes stores with higher demand, ensuring they are closer to a DC to reduce transportation costs and improve service efficiency. In Solver, the objective function was updated to minimize the sum of distance multiplied by demand, while keeping the decision variables as the new DC's latitude and longitude. This adjustment led to a more balanced and cost-effective distribution network.