**Optimizing Warehouse Locations for Efficient Nationwide Distribution**

If we plan to establish a company and need to determine the optimal location for a warehouse between two cities based on demand, how do we precisely decide where to place the warehouse?  
  
As commonly known, cities are pinpointed on the globe using latitude and longitude coordinates, and individuals worldwide typically employ the basic Pythagorean theorem to calculate distances between two locations. However, this method has limitations, particularly in larger areas where distances are extensive. To overcome this challenge and accurately determine distances between cities, Solver can be employed to identify the optimal warehouse location. This process aims to minimize shipping distances for all shipments, offering a more precise solution in scenarios where traditional methods fall short.

The data employed in both the scenarios is generic.

The objective is to identify the **most efficient location** for a warehouse, aiming to **minimize** shipping distances for all shipments nationwide.

A table with numbers and a number on it

Description automatically generated  
  
The goal here is to minimize the Total Distance by finding the best location for warehouse 1.   
The "X" in the table represents the distance from the warehouse to each respective city.

So, to get the result for this type of case we are going to run Solver in Excel.   
Keeping the goal in solver by minimizing the total distance. And what exactly we are going to change is B2:C2.

The solution we get is 36.81N, 92.48 W.

A table with numbers and a number of miles

Description automatically generated

Utilizing maps on any website provides location information pinpointed to an area within **Missouri**.  
  
In a similar manner, we can now simultaneously identify the locations of two warehouses. However, the data we will use will differ as we need additional information to retrieve the specific locations.

The sole additions comprise two distance calculations (city to warehouse 1 and city to warehouse 2). In this instance, the assumption is that each city will be supplied from the warehouse that is in close proximity. The primary goal remains to **minimize** the overall distance.

A table with numbers and letters

Description automatically generated

The "X" in the table represents the distance from the warehouse to each respective city.

So, to get the result for this type of case we are going to run Solver in Excel again.   
Keeping the goal in solver by minimizing the total distance. And what exactly we are going to change is B2:C3.

In a unique approach, we'll deviate from using GRG Nonlinear, as it may not yield the optimal outcome and might result in identical latitude and longitude for both warehouses. Instead, we'll employ GRG Nonlinear with multiple optima, specifically with a default population size of 100 (indicating 100 runs). The constraints set for this optimization include ensuring that the latitudes of both warehouses are greater than or equal to zero, less than 90 (avoiding the North Pole), and the longitudes are greater than or equal to zero but less than or equal to 150 (excluding areas beyond Hawaii).

The solution we get is:

|  |  |  |
| --- | --- | --- |
|  | **Latitude** | **Longitude** |
| **Warehouse 1** | 34.93187 | 117.7915884 |
| **Warehouse 2** | 38.16407 | 84.02897632 |

Utilizing maps on any website offers location details precisely highlighting an area in **California** and another one in **Kentucky**.