Module 10 – MOLP

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:*

* *Choose a visualization method (expect 7 nodes and ~24 arcs):*
  + *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
  + *Make a visual graph of your data like what we saw for the sample problem*
    - <https://excalidraw.com>
    - <https://mermaid.live>
    - <https://dreampuf.github.io/GraphvizOnline>
    - Powerpoint

A map of the united states

AI-generated content may be incorrect.

Model Formulation

*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. For this problem, I am only asking that you perform the model formulation for the MOLP model.*

Model Optimized for Equally Weighted Objectives

*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 to indicate which arcs are used*

X1j≤9759

X2j≤1455

X3j≤1762

X4j≤1214

X5j≤1982

X6j≤1559

X7j≤1787

Xi2​≥1455

Xi3≥1762

Xi4≥1214

Xi5≥1982

Xi6≥1559

Xi7≥1787

Total Transportation Cost

MIN =5X12+21X17+15X21+17X25+10X26+22X27+23X31+11X34+6X35+17X36+19X41+6X42+19X45+19X47+24X53+14X56+12X61+7X62+10X63+17X65+23X72+23X73+5X74+8X76

Total Congestion

MIN =0X12+1X17+1X21+1X25+1X26+1X27+1X31+1X34+1X35+1X36+1X41+1X42+1X45+1X47+1X53+1X56+1X61+1X62+1X63+0X65+1X72+0X73+1X74+1X76

Total Eco-Friendly

MIN =1X12+0X17+1X21+1X25+0X26+1X27+1X31+0X34+1X35+1X36+1X41+1X42+1X45+1X47+1X53+1X56+1X61+1X62+1X63+0X65+1X72+1X73+1X74+1X76

Total Distance

MIN =17X12+3X17+17X21+27X25+31X26+19X27+9X31+13X34+19X35+21X36+4X41+21X42+6X45+4X47+19X53+5X56+14X61+31X62+21X63+5X65+19X72+10X73+4X74+12X76

A screenshot of a computer

AI-generated content may be incorrect.

Model with Stipulation

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

*Alter the weights of each objective to add weight to match what matters most to you. Perhaps run a few different scenarios to see how the routes change depending on the weights. When you find a weight mix and solution that satisfies you, please write a justification on why you chose the final model/weights and about how a configured model like yours can be used for scenario planning.*

In the model with stipulation changed the weights for each objective to focus more on what really matters in the situation. I gave congestion the most weight at 50% because avoiding delays and making sure deliveries are on time is really important. Distance got 30% since it helps lower fuel use and is better for the environment, and cost was given 20% because we wanted to leave room to choose better or faster routes even if they cost a bit more. This setup helps us plan for different situations by letting us try out different weights and see how the best shipping routes change. It’s useful for thinking ahead and making smart decisions in the supply chain when things like money, time, or rules chang