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



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.

MIN transportation cost:

21X_1 + 20X_2+16X_3+9X_4+18X_5+8X_6 +21X_7+22X_8+ 18X_9+ 22X_10+8X_11+ 24Z_12+22X_13+ 16X_14+ 12X_15+ 19X_16+ 24X_17+ 22X_18+24X_19+ 5X_20+ 15X_21+24X_22+ 13X_23+6X_24

MIN Non-eco transportation: $1X_1+1X_2+0X_3+1X_4+1X_5+1X_6+1X_7+1X_8+1X_9+1X_10+1X_11+1X_12+1X_13+1X_14+1X_15+1X_16+1X_17+1X_18+1X_19+1X_20+1X_21+1X_22+1X_23+1X_24$

MIN congestion levels

70X_1+ 104X_2+88X_3+ 102X_4+93X_5+ 88X_6+ 85X_7+ 70X_8+ 98X_9+ 72X_10+ 94X_11+92X_12+ 36X_ 13+ 82X_14+ 91X_15+ 89X_16+93X_17+ 25X_18+ 93X_19+ 88X_20+ 102X_21+ 107X_22+ 85X_23+96X_24

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

	2 3 6 1 5 5 5 5 7 2 4 6 6 7 7 3 4 5 5 7 3 4 5 5 5 7 3 4 5 5 7 3 5 7 5 7	-102 -102 -102 -103 -104 -105 -105 -115 -115 -115 -115 -115 -115	5 5 7 7 7 7 7 7 9 9 9 9 9 9 9 9 9 9 9 9	0 -115,9 85,76 -102,5 99,03 -102,5 113,29 99,03 85,76 99,87 -115,9 99,87 -115,9 99,87 -115,9 99,87 -115,9 99,87 -115,9 113,29	37.5 37.5 37.5 44.15 44.15 30.69 30.69 30.69 39.31 39.31 39.31 39.31 39.32 30.02 30.02 30.02	Long y2	44.15 30.69 31.24 37.5 30.02 37.5 39.31 30.02 44.15 30.69 30.02 37.88 44.15 39.31	Eco Friendlin Desel Rail Air Freight Slow Steaming (Desel Rail Desel Rail Cargo Ships (He Slow Steaming (Slow Steaming (Slow Steaming (Slow Steaming (Rectrified Rail Slow Steaming (Rec		Congestion L 1 7 7 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	0 4 4 5 5 5 5 5 5 5 5 7 8 9 9 9 9 9 9	1 2 1 3 1 6 1 1 1 1 1 1 1 5 1 1 6 1 1 2 1 1 3 1 1 5 7 0 7 1 2 2 1	To 2 Jellybean Jungle 3 Pudding Peaks 6 Tangerine Taffy Tropics 1 Dutter Pecan Bluff 5 Sprinkle Street 1 Butter Pecan Bluff 4 Snickerdoode Stopes 5 Sprinkle Street 6 Tangerine Taffy Tropics 2 Jellybean Jungle 3 Pudding Peaks 5 Wipped Wonderland	Unit Cost Euc. 21 20 16 9 18 8 21 22 18 22 18 22 4 24 22 16	7.15 15.03 17.87 7.15 14.15 15.03 9.01 16.88 30.15 14.27 9.01 17.02 10.81
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			Objectives	Tot	als	Target		Deviation	% Beviation	Weight	Weighted deviation %				
			Min Cost		235,368.23	\$	227,746.00	\$ 7,622.23		3%	1 3	<u> </u>			
			Min non-eco friendir	ness \$	8,455.11	\$	8,189.00	\$ 266.11		3%	13	4			
			Min Congestion	2	1,308,424.40	*	,266,052.00	\$ 42,372.40		3%	3				
			Objective												
			Minimax		3%										
Totals	S	Target				Deviati	on	% De	eviation		Weight		Weighted de	eviation %	
\$	235,368.2	3 \$		22	7,746.00	\$	7,622	.23		3%			1		3%
\$	8,455.1	1 \$			8,189.00	\$	266	.11		3%			1		3%
\$	1,308,424.4	\$		1,26	6,052.00	\$	42,372	.40		3%			1		3%
	\$	\$ 8,455.11	\$ 235,368.23 \$ \$ 8,455.11 \$	Totals Target \$ 235,368.23 \$ \$ 8,455.11 \$	Totals Target \$ 235,368.23 \$ 22 \$ 8,455.11 \$	Totals Target \$ 235,368.23 \$ 227,746.00 \$ 8,455.11 \$ 8,189.00	Totals Target Deviati \$ 235,368.23 \$ 227,746.00 \$ \$ 8,455.11 \$ 8,189.00 \$	Totals Target Deviation	Totals Target Deviation % Deviation \$ 235,368.23 \$ 227,746.00 \$ 7,622.23 \$ 8,455.11 \$ 8,189.00 \$ 266.11	Totals Target Deviation % Deviation \$ 235,368.23 \$ 227,746.00 \$ 7,622.23 \$ 8,455.11 \$ 8,189.00 \$ 266.11	Totals Target Deviation % Deviation \$ 235,368.23 \$ 227,746.00 \$ 7,622.23 3% \$ 8,455.11 \$ 8,189.00 \$ 266.11 3%	Totals Target Deviation % Deviation Weight \$ 235,368.23 \$ 227,746.00 \$ 7,622.23 3% \$ 8,455.11 \$ 8,189.00 \$ 266.11 3%	Totals Target Deviation % Deviation Weight \$ 235,368.23 \$ 227,746.00 \$ 7,622.23 3% \$ 8,455.11 \$ 8,189.00 \$ 266.11 3%	Totals Target Deviation % Deviation Weight Weighted do \$ 235,368,23 \$ 227,746.00 \$ 7,622.23 3% 1 \$ 8,455.11 \$ 8,189.00 \$ 266.11 3% 1	Totals Target Deviation % Deviation Weight Weighted deviation % \$ 235,368.23 \$ 227,746.00 \$ 7,622.23 3% 1 \$ 8,455.11 \$ 8,189.00 \$ 266.11 3% 1

The model indicates which decision variables we should utilize to meet our objective functions. Objective function is hard to explain... 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.

Objectives	Tota	als	Target		Devi	ation	% Deviation		Weight	٧	Veighted deviation %
Min Cost	\$	236,972.96	\$	227,746.00	\$	9,226.96		4%		1	4%
Min non-eco friendliness	non-eco friendliness \$ 8,225.86		\$ 8,189.00		\$ 36.86		0%		9		4%
Min Congestion	\$	1,288,709.26	\$	1,266,052.00	\$	22,657.26		2%		1	2%
Objective											
Minimax		4%									
Objectives Totals		Tar	rget		Deviation	% Deviation		Weight		Weighted deviation %	
Min Cost \$ 235,36		\$ 235,368	.23 \$	227,746	.00	\$ 7,622.	23	3	%	Ę	17%
Min non-eco friendliness		\$ 8,455	.11 \$	\$ 8,189		\$ 266.	.11 3		1%	5	16%
Min Congestion		\$ 1,308,424	.40 \$	1,266,052	.00	\$ 42,372.	40	3	%	Ę	17%
Objective											
Minimax			17%								

The approach I decided to do this approach more differently, I decided to apply equal weights to minimizing cost, non-eco friendliness, min congestion. As it reminded me of a balanced scorecard, when we are selecting weights to evaluate our suppliers. This approach gave me a higher percentage..