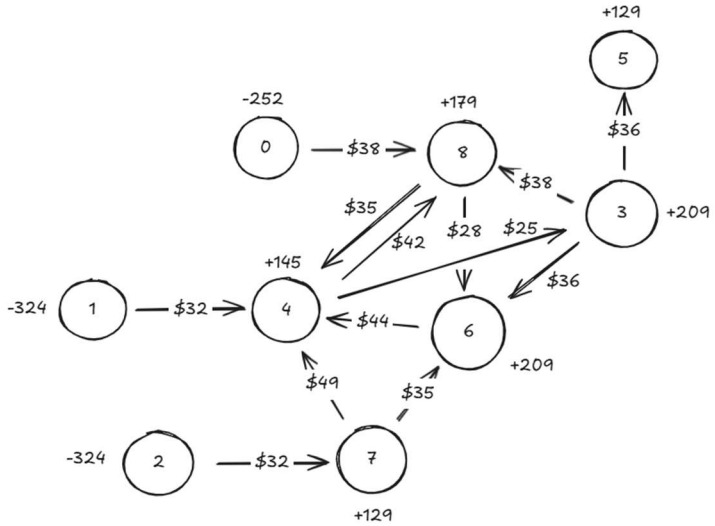
Module 06 – Transshipment Problem

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:

- *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.
Hint: This one differs a bit from the sample problem in terms of Balance-of-Flow

Constraints:

-X_08<=-252
-X_14<=-324
-X_27<=-324
-X_35-X_36-X_38+X_43<=+209
X_43-X_48+X_14+X_64+X_74<=+145
X_35<=+129
-X_64+X_36+X_76+X_86<=209
_X_74-X_76+X_27<=129
-X_84-X_86+X_08+X_38_X_48<=179
X_ij>=0

Objective function:
+X_08+X_14+X_27+X_35+X_36+X_38+X_43+X_48+X_64+X_74+X_76+X_84+X_86

Decision variables are all locations:
-X_0-X_1-X_2+X_3+X_4+X_5+X_6+X_7+X_8

Model Optimized for Minimal Transportation Cost
Implement your formulation into Excel and be sure to make it neat. This section should include:

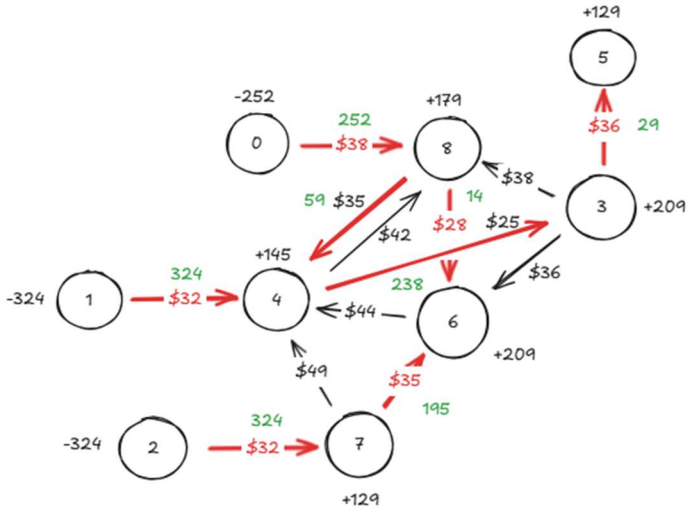
- *A screenshot of your optimized final model (formatted nicely, of course)*
- *A text explanation of what your model is recommending*
- *Update your graph from the EDA section to bold/color the links being used (and show how much is going through that link)*

Total Transportation Cost -> $ 46,588.00

Ship	From	To	Unit Cost
252	0	8	$ 38
324	1	4	$ 32
324	2	7	$ 32
29	3	5	$ 36
0	3	6	$ 36
0	3	8	$ 38
238	4	3	$ 25
0	4	8	$ 42
0	6	4	$ 44
0	7	4	$ 49
195	7	6	$ 35
59	8	4	$ 35
14	8	6	$ 28

Nodes	Inflow	Outflow	Netflow	Supply/Demand
0	0	252	-252	-252
1	0	324	-324	-324
2	0	324	-324	-324
3	238	29	209	209
4	383	238	145	145
5	29	0	29	129
6	209	0	209	209
7	324	195	129	129
8	252	73	179	179

My model is recommending sending 252 units from node 0 to 8, 324 units from node 1 to 4, 324 units from note 2 to 7, 29 from 3 to 5, 238 from 4 to 3, 195 from 7 to 6, 59 from 8 to 4, and 14 from 8 to 6. This will minimize total transportation costs to $46,588.



Model with Stipulation

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

Follow these steps to complete this section:

1. *Describe the necessity of the Balance-of-Flow for this problem type*
2. *What happens when you change your model to make Total Supply > Total Demand (i.e. add 115 units to one of the sources)*
3. *What happens when you rerun your model?*
4. *What do you need to change to make your model work again?*
5. *Make the changes and report on your findings.*
    a. *PS there is a small chance that the source you added 115 to may make your model infeasible. If so, add the 115 units to a different source.*

1. Balance of flow is necessary to ensure that all locations have the necessary supply while attempting to meet demand and keep transportation costs to a minimum.
2. When you change the model to make total supply more than demand it changes the transportation costs and makes an error when trying to find a solution.
3. When you rerun the model, it cannot come up with an optimal solution.
4. You would need to change the constraints depending on how much you make the supply. Change from less than or equal to greater than or equal to.
5. I made sure demand was higher than supply like my original model and it worked again.