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*

Min:

37X\_{04}+37X\_{13}+33X\_{26}+28X\_{35}+49X\_{43}+33X\_{47}+25X\_{46}+33X\_{48}+40X\_{56}+48X\_{65}+26X\_{67}+48X\_{64}+45X\_{73}+33X\_{48}

Constrains:

-X04>=-313

-X13>= -352

-X26>= 233

-X35>= 191

-X43-X46-X47-X48+X14+X64>=176

X35+X65-X56 >= 205

X26+X46+X56-X64-X65-X67 >= 117

-X73+X67+X47>=147

X48>=164

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 screenshot of a computer

  AI-generated content may be incorrect.*
* *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)*

A diagram of a network

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.*

*Follow these steps to complete this section:*

1. *Describe the necessity of the Balance-of-Flow for this problem type*

The balance of the flow principle tells us that the total supply is equal to the total demand in the transportation or network of the problem. If the balance is not maintained in the model it may become infeasible do to the learning unoptimized solution and the inability to allocate the properly. In my problem each of the nine nodes have either a supply, demand, or act as an intermediary. Meaning that all inflows sums and outflow sums must match to ensure proper distribution

1. *What happens when you change your model to make Total Supply > Total Demand (i.e. add 115 units to one of the sources)*

*The model doesn’t work because the balance of flow. Meaning the supply and the demand don’t match.*

1. *What happens when you rerun your model?*
2. *What do you need to change to make your model work again?*
3. *Make the changes and report on your findings.* *To make the transportation model work again, several adjustments are necessary. First, the XLOOKUP functions must be verified to ensure they correctly fetch cost per mile, node mappings, and other essential data without inconsistencies. Additionally, the SUMIF functions used to calculate inflows and outflows should be checked for accuracy, ensuring they reference the correct columns and ranges within the dataset. Another critical fix involves the net flow calculation, which should be computed as Inflows - Outflows while avoiding circular references and incorrect linkages. Moreover, the supply and demand balances need to be verified, ensuring that the total supply from warehouses matches the total demand from retail locations. If there is any imbalance, shipment allocations must be adjusted accordingly. Once these changes are implemented, it is essential to confirm that the total transportation cost calculation using SUMPRODUCT accurately reflects the optimized cost. After making the necessary corrections, a review of the model should be conducted to ensure all errors are resolved and the transportation network functions as intended.*
   1. *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.*