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

A black screen with pink numbers

Description automatically generatedA network of lines and dots

Description automatically generated

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*

Objective Function:

The sum of the Ship and Unit Costs columns

=Sumproduct(B6:B20, G6:G20) The sum of the Ship and Unit Costs columns

Minimize:

33X₀₄ + 45X₁₄ + 42X₂₃ + 41X₂₆ + 37X₂₇ + 32X₃₆ + 34X₃₇ + 38X₄₃ + 35X₄₅ + 28X₄₇ + 48X₄₈ + 26X₅₈ + 44X₇₅ + 41X₈₆

Constraints:

The decision variable column (Ship) cannot be a negative number (negativity constraint)

B6:B20 [>=] 0

+

Supply and Demand must be less than or equal to Supply/Demand, this is a result of the balance-of-flow rules.

(Net Flow) [<=] (Supply/Demand)

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)*

A screenshot of a computer

Description automatically generated

*This model is a visual representation of minimizing the total transportation cost. With everything in place, according to the given information, we designate the “Ship” column as the decision variable that will change. Our objective function is the sum of the Ship and Unit Costs columns, calculating the total transportation cost. Using Excel solver to find the “Ship” column, we observe the optimized solution for the given shipments that will minimize the total cost we pay for transportation costs (based on costs per mile)*

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*
   1. This rule negates the possibility of mismatched supply and demand outcomes. Meaning, it makes sure that the supply for all sources matches the demand for all of the destinations.
2. *What happens when you change your model to make Total Supply > Total Demand (i.e. add 115 units to one of the sources)*

When I changed my model, to make Total Supply it became an even larger negative number, so now we have to change the constraints from less than/equal to, to greater than/equal to.

1. *What happens when you rerun your model?*

After rerunning the model, the first thing I noticed was the total transportation cost increased by $8,000. And the shipment values were adjusted as well to account for the excess demand.

1. *What do you need to change to make your model work again?*

The model technically works, as solver found a feasible solution, however, to make it more efficient we would want to revert back to our original values. Or in a hypothetical world work to see if supply/demand requirements could change and find a new optimal minimized value for this scenario.

1. *Make the changes and report on your findings.*
   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.*