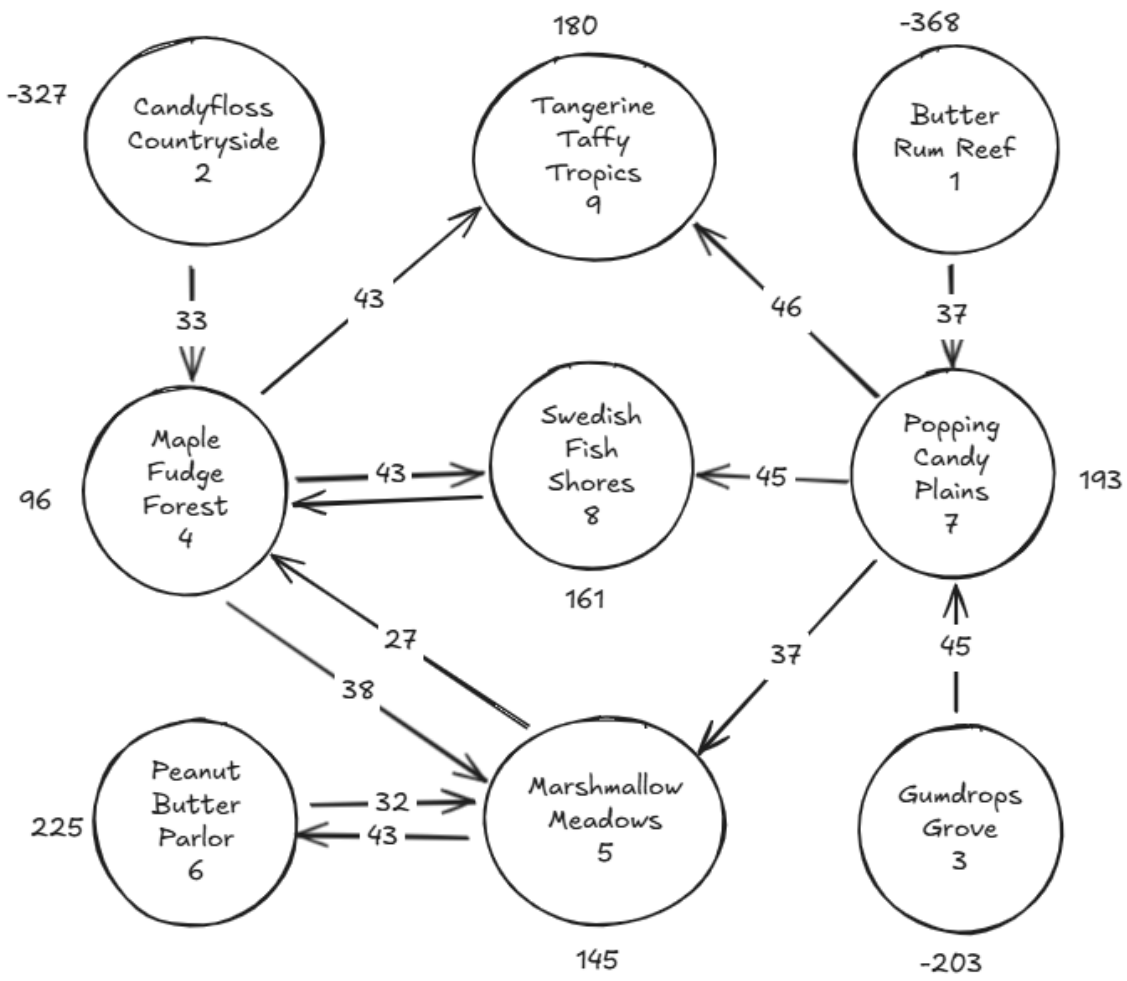
Module 06 – Transshipment Problem

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 = $37X_{17}+33\ X_{24}+45X_{37}+38X_{45}+43X_{48}+43X_{49}+27X_{54}+43X_{56}+32X_{65}+37X_{75}+45X_{78}+46X_{79}+44X_{84}$

$-X_{17} \geq -368$
$-X_{24} \geq -327$
$-X_{37} \geq -203$
$+X_{54}+X_{84}+X_{24}-X_{45}-X_{48}-X_{49} \geq 96$
$+X_{45}+X_{65}+X_{75}-X_{54}-X_{56} \geq 145$
$+X_{56}-X_{65} \geq 225$
$+X_{17}+X_{37}-X_{75}-X_{78}-X_{79} \geq 193$
$+X_{48}+X_{78}-X_{84} \geq 161$
$+X_{49}+X_{79} \geq 180$

Model Optimized for Minimal Transportation Cost

Implement your formulation into Excel and be sure to make it neat. This section should include:

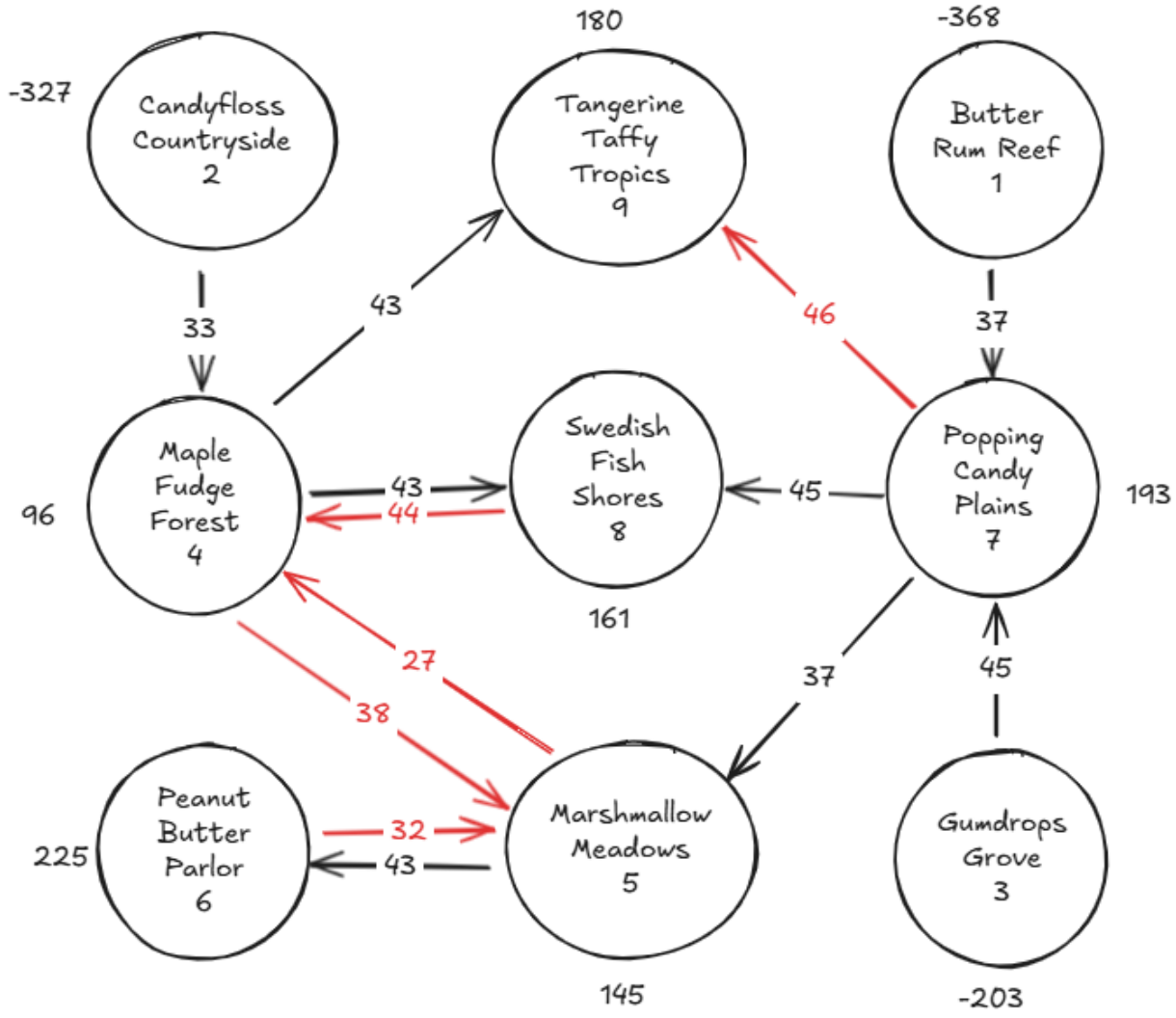
- *A screenshot of your optimized final model (formatted nicely, of course)*
- *A text explanation of what your model is recommending*
- *Update your graph from the EDA section to bold/color the links being used (and show how much is going through that link)*

Ship	From		To		Unit Cost
368	1	Butter Rum Reef	7	Popping Candy Plains	$37.00
327	2	Candyfloss Countryside	4	Maple Fudge Forest	$33.00
203	3	Gumdrops Grove	7	Popping Candy Plains	$45.00
0	4	Maple Fudge Forest	5	Marshmallow Meadows	$38.00
51	4	Maple Fudge Forest	8	Swedish Fish Shores	$43.00
180	4	Maple Fudge Forest	9	Tangerine Taffy Tropics	$43.00
0	5	Marshmallow Meadows	4	Maple Fudge Forest	$27.00
123	5	Marshmallow Meadows	6	Peanut Butter Parlor	$43.00
0	6	Peanut Butter Parlor	5	Marshmallow Meadows	$32.00
268	7	Popping Candy Plains	5	Marshmallow Meadows	$37.00
110	7	Popping Candy Plains	8	Swedish Fish Shores	$45.00
0	7	Popping Candy Plains	9	Tangerine Taffy Tropics	$46.00
0	8	Swedish Fish Shores	4	Maple Fudge Forest	$44.00

	Location	Inflow	Outflow	Netflow	Supply/Demand
1	Butter Rum Reef	0	368	-368	-368
2	Candyfloss Countryside	0	327	-327	-327
3	Gumdrops Grove	0	203	-203	-203
4	Maple Fudge Forest	327	231	96	96
5	Marshmallow Meadows	268	123	145	145
6	Peanut Butter Parlor	123	0	123	225
7	Popping Candy Plains	571	378	193	193
8	Swedish Fish Shores	161	0	161	161
9	Tangerine Taffy Tropics	180	0	180	180

Total Transportation Cost	
$	63,630.00

The model recommends using all links except for 4→5, 5→4, 6→5, 7→9, 8→4. With this solution not all demand for location 6 is met but cost is kept at a minimum.



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*

Because we need to be aware that demand is greater than supply. This tells us the relationship between NetFlow and Supply/Demand

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?*

The cost rises to about $13000 but all demand is met.

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

It Worked

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.*

Ship	From		To		Unit Cost
368	1	Butter Rum Reef	7	Popping Candy Plains	$37.00
327	2	Candyfloss Countryside	4	Maple Fudge Forest	$33.00
305	3	Gumdrops Grove	7	Popping Candy Plains	$45.00
0	4	Maple Fudge Forest	5	Marshmallow Meadows	$38.00
51	4	Maple Fudge Forest	8	Swedish Fish Shores	$43.00
180	4	Maple Fudge Forest	9	Tangerine Taffy Tropics	$43.00
0	5	Marshmallow Meadows	4	Maple Fudge Forest	$27.00
225	5	Marshmallow Meadows	6	Peanut Butter Parlor	$43.00
0	6	Peanut Butter Parlor	5	Marshmallow Meadows	$32.00
370	7	Popping Candy Plains	5	Marshmallow Meadows	$37.00
110	7	Popping Candy Plains	8	Swedish Fish Shores	$45.00
0	7	Popping Candy Plains	9	Tangerine Taffy Tropics	$46.00
0	8	Swedish Fish Shores	4	Maple Fudge Forest	$44.00

	Location	Inflow	Outflow	Netflow	Supply/Demand
1	Butter Rum Reef	0	368	-368	-368
2	Candyfloss Countryside	0	327	-327	-327
3	Gumdrops Grove	0	305	-305	-318
4	Maple Fudge Forest	327	231	96	96
5	Marshmallow Meadows	370	225	145	145
6	Peanut Butter Parlor	225	0	225	225
7	Popping Candy Plains	673	480	193	193
8	Swedish Fish Shores	161	0	161	161
9	Tangerine Taffy Tropics	180	0	180	180

Total Transportation Cost	
$	76,380.00