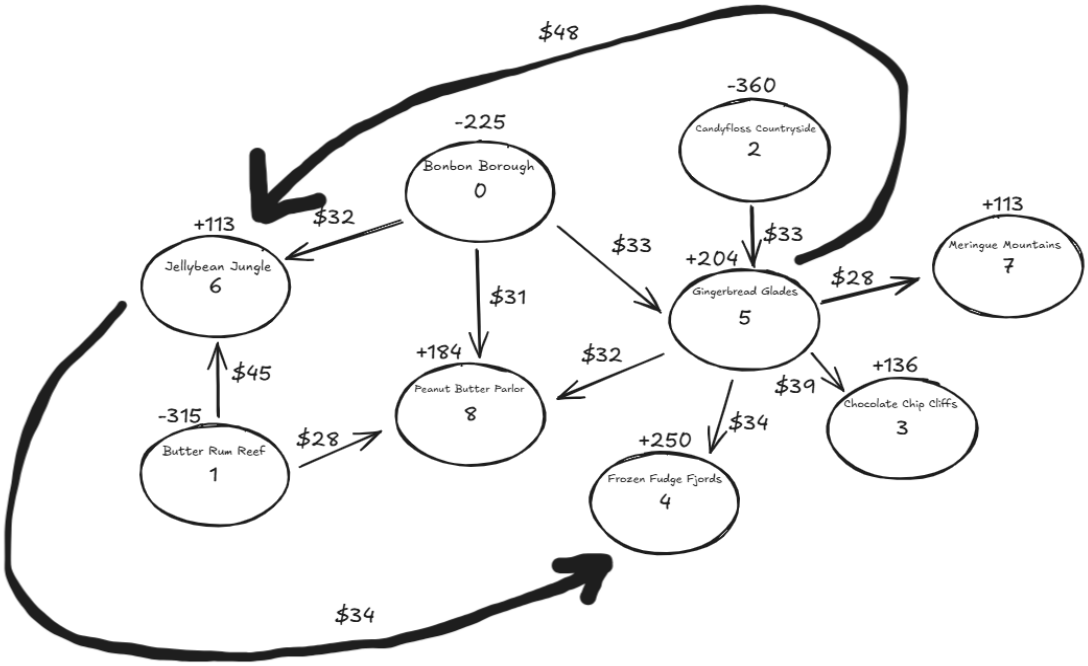
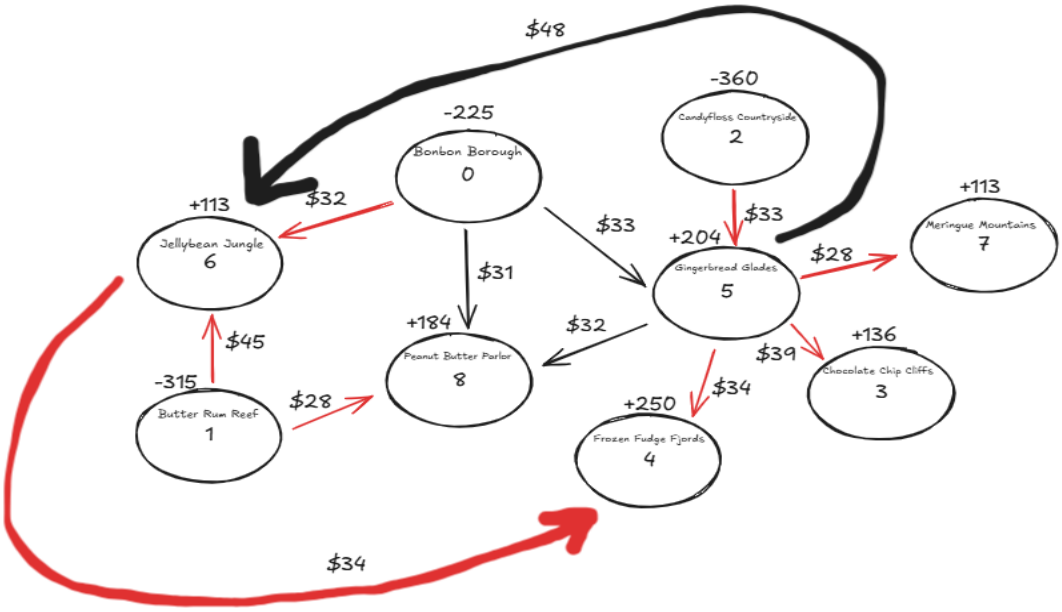
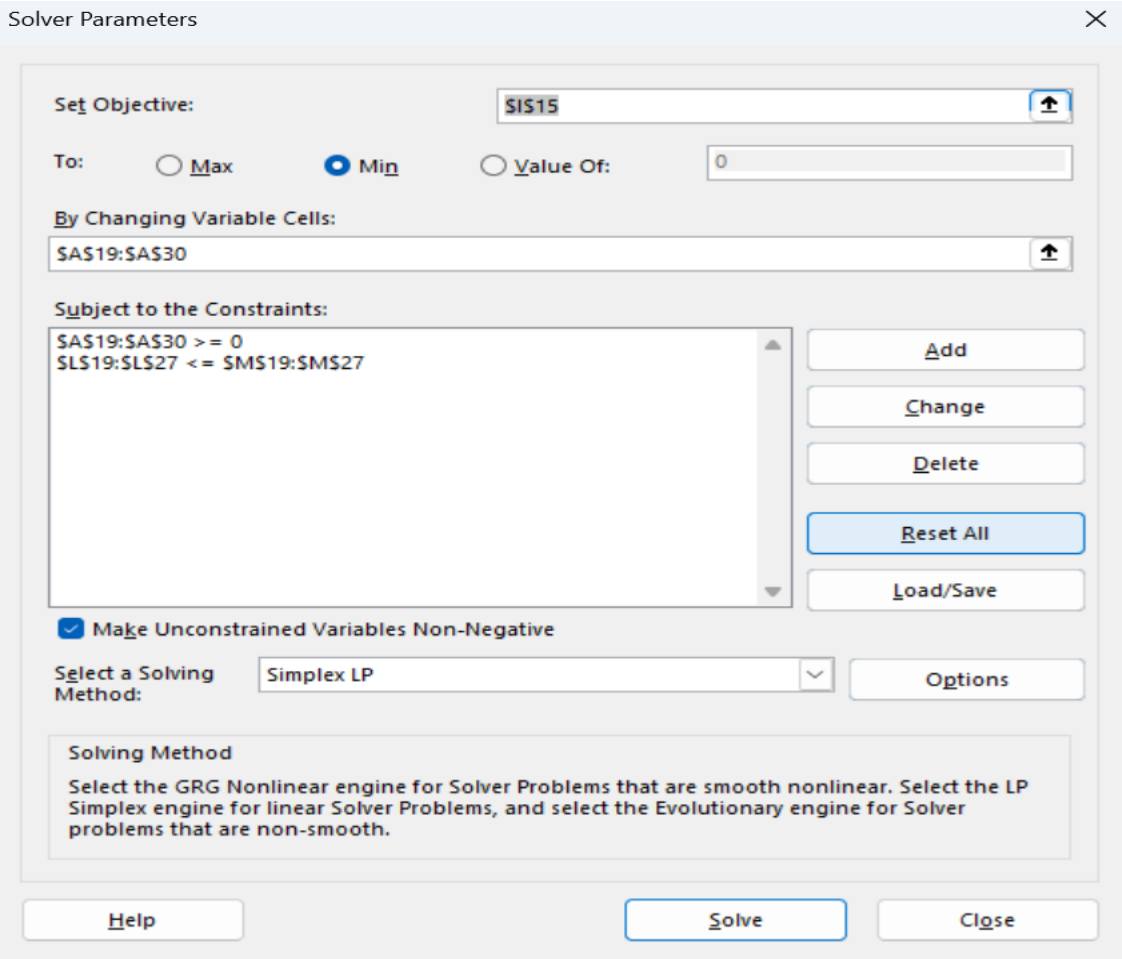
Module 06 – Transshipment Problem

Exploratory Data Analysis





Model Formulation



MIN: $+33X_{05} + 32X_{06} + 31X_{08} + 45X_{16} + 28X_{18} + 33X_{25} + 39X_{53} + 34X_{54} + 48X_{56} + 28X_{57} + 32X_{58} + 34X_{64}$ } total shipping cost

Subject to:

$-X_{05} - X_{06} - X_{08} \leq -225$ } flow constraint for node 0
$-X_{16} - X_{18} \leq -315$ } flow constraint for node 1
$-X_{25} \leq -360$ } flow constraint for node 2
$-X_{53} \leq +136$ } flow constraint for node 3
$+X_{54} + X_{64} \leq +250$ } flow constraint for node 4
$+X_{05} + X_{25} - X_{53} - X_{54} - X_{56} - X_{57} - X_{57} \leq +204$ } flow constraint for node 5
$+X_{06} + X_{16} + X_{56} + X_{64} \leq +113$ } flow constraint for node 6
$+X_{57} \leq +113$ } flow constraint for node 7
$+X_{08} + X_{18} + X_{58} \leq +184$ } flow constraint for node 8
$X_{ij} \geq 0$ for all i and j } nonnegativity conditions

Model Optimized for Minimal Transportation Cost

Location Id	Nodes	Supply/Demand	Location
0	Bonbon Borough	225	warehouse
1	Butter Rum Reef	315	warehouse
2	Candyfloss Countryside	360	warehouse
3	Chocolate Chip Cliffs	136	retail
4	Frozen Fudge Fjords	250	retail
5	Gingerbread Glades	204	retail
6	Jellybean Jungle	113	retail
7	Meringue Mountains	113	retail
8	Peanut Butter Parlor	184	retail
		Totals	
		900	warehouse
		1000	retail

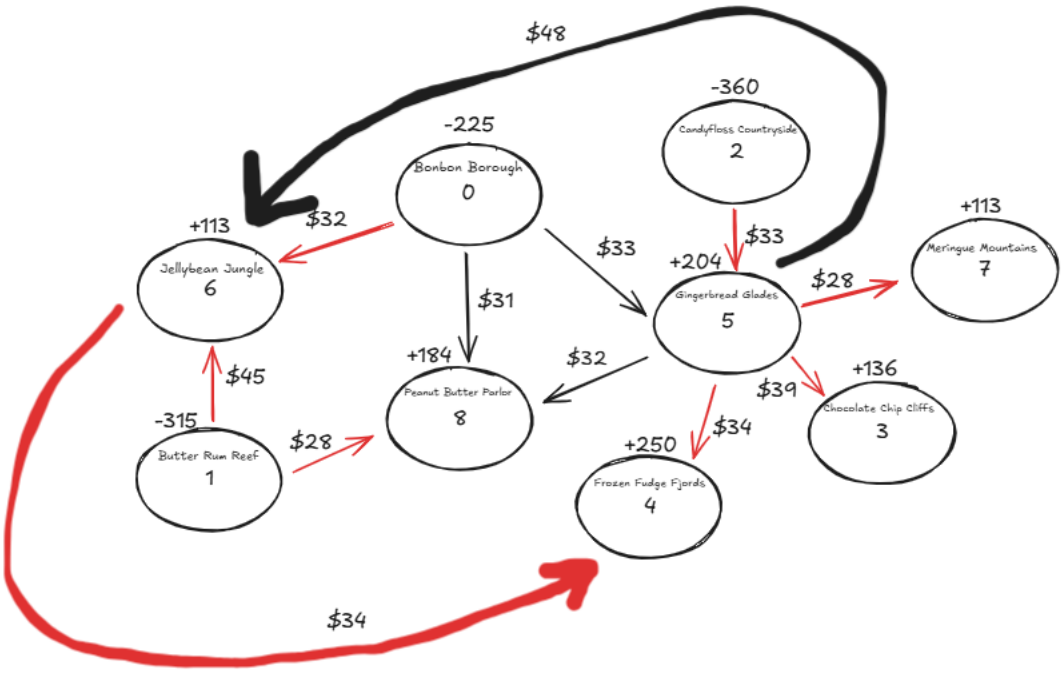
From	To	Unit Cost
0	5	$ 33
0	6	$ 32
0	8	$ 31
1	6	$ 45
1	8	$ 28
2	5	$ 33
5	3	$ 39
5	4	$ 34
5	6	$ 48
5	7	$ 28
5	8	$ 32
6	4	$ 34
Total Transportation Cost ->		$ 43,195.00

Ship	From		To		Unit Cost
0	0	Bonbon Borough	5	Gingerbread Glades	$ 33
225	0	Bonbon Borough	6	Jellybean Jungle	$ 32
0	0	Bonbon Borough	8	Peanut Butter Parlor	$ 31
131	1	Butter Rum Reef	6	Jellybean Jungle	$ 45
184	1	Butter Rum Reef	8	Peanut Butter Parlor	$ 28
360	2	Candyfloss Countryside	5	Gingerbread Glades	$ 33
36	5	Gingerbread Glades	3	Chocolate Chip Cliffs	$ 39
7	5	Gingerbread Glades	4	Frozen Fudge Fjords	$ 34
0	5	Gingerbread Glades	6	Jellybean Jungle	$ 48
113	5	Gingerbread Glades	7	Meringue Mountains	$ 28
0	5	Gingerbread Glades	8	Peanut Butter Parlor	$ 32
243	6	Jellybean Jungle	4	Frozen Fudge Fjords	$ 34

	Nodes	Inflow	Outflow	Net Flow	Supply/Demand
0	Bonbon Borough	0	225	-225	-225
1	Butter Rum Reef	0	315	-315	-315
2	Candyfloss Countryside	0	360	-360	-360
3	Chocolate Chip Cliffs	36	0	36	136
4	Frozen Fudge Fjords	250	0	250	250
5	Gingerbread Glades	360	156	204	204
6	Jellybean Jungle	356	243	113	113
7	Meringue Mountains	113	0	113	113
8	Peanut Butter Parlor	184	0	184	184

Nodes		Inflow	Outflow	Net Flow	Supply/Demand
1	Newark	0	200	-200	-200

<u>The following model recommends that to minimize the Total Transportation Cost between the distribution centers and the wholesalers (warehouse & retail locations), they must ship efficiently between the 12 locations. Following the data graph listed above, they must ship 0, 225, 0, 131, 184, 360, 36, 7, 0, 113, 0, & 243 to the Nodes 0 through 8. By doing so, the Net Flow between the locations will equal the supply available as listed in the right portion of the screenshot.</u>



Model with Stipulation

1. Balance-of-Flow is a necessity for this problem type as it ensures efficient operations through aligning production, inventory, and distribution with demand fluctuations, minimizing disruptions, and excess costs. Overall, it optimizes inventory levels, which in turn reduces lead times and minimizes costs.
2. When making Total Supply > Total Demand & adding 115 to one of the sources, the Total Supply/Demand changes however, the inputs of Inflow & Outflow as well as the Net Flow output do not change because the Data Solver has not been run yet to recognize the data alteration. Furthermore, the solver does not change the Shipping values.
3. When rerunning the model, the solution provided does not properly follow the desired constraints. As a result, it can be concluded that there must be a change in the formulas or the Solver itself.
4. To fix the model, the Total Demand must change to reflect the increase in Total Supply. In doing so, we must go into Data Solver and change the Net Flow ≥ Total Supply/Demand. This should fix the model and provide a feasible solution.
5. When rerunning the model and fixing the constraint issues, the data becomes slightly more concentrated on where the product should be sent. Otherwise, the data seems to be similar, or in some cases exactly, to before. Additionally, the Total Transportation Cost rose from $43,195 to $44,598 to combat the rise in the product amount.