# Module 02 – Transportation Modeling

**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:*
- *The locations involved in the analysis (id -> name) and specify if they are a source or a destination*

| Location id | S or D | Name | Capacity | Demand |
|---|---|---|---|---|
| Sfe345cb | Source | Caramel Corn Caverns | 151 | |
| Scc1f4cf | Source | Candy Cane Canyon | 123 | |
| S89052cd | Source | Fruit Chew Fjords | 117 | |
| S2c3e08f | Source | Cotton Candy Clouds | 166 | |
| | | | | |
| Da7cec12 | Destination | Pudding Peaks | | 102 |
| Da3f394d | Destination | Melty Mint Mountains | | 104 |
| D6ca4f41 | Destination | Marzipan Metropolis | | 95 |
| D6236e72 | Destination | Whipped Wonderland | | 103 |
| D3c0b041 | Destination | Meringue Mountains | | 92 |
| D3a8be26 | Destination | Sour Patch Prairie | | 93 |

- *A table of the average cost between source and destination (for the sake of this assignment, we are dealing with sugar-miles similar to the bushel-mile example from the textbook)*

| Average of per Row Labels | Column Labels D3a8be26 | D3c0b041 | D6236e72 | D6ca4f41 | Da3f394d | Da7cec12 | (blank) | Grand Total |
|---|---|---|---|---|---|---|---|---|
| S2c3e08f | 0.13 | 0.15 | 0.05 | 0.08 | 0.18 | 0.11 | | 0.12 |
| S89052cd | 0.15 | 0.08 | 0.15 | 0.12 | 0.19 | 0.17 | | 0.14 |
| Scc1f4cf | 0.19 | 0.11 | 0.07 | 0.18 | 0.12 | 0.10 | | 0.13 |
| Sfe345cb | 0.11 | 0.12 | 0.13 | 0.11 | 0.18 | 0.08 | | 0.12 |
| (blank) | | | | | | | | |
| Grand Total | 0.14 | 0.12 | 0.10 | 0.13 | 0.17 | 0.11 | | 0.13 |

**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*

Decision variables:

Cotton Candy Clouds= $X_1$

Fruit Chew Fjords= $X_2$

Candy Cane Canyon= $X_3$

Caramel Corn Caverns= $X_4$

Sour Patch Prairie= $X_5$

Meringue Mountains= $X_6$
Whipped Wonderland= $X_7$
Marzipan Metropolis= $X_8$
Melty Mint Mountains= $X_9$
Pudding Peaks= $X_{10}$

MAX=
X15+X16+X17+X18+X19+X110+X25+X26+X27+X28+X29+X210+X35+X36+X37+X38+X39
+X310+X45+X46+X47+X48+X49+X410

Capacity Constraints
$X_{15}+X_{16}+X_{17}+X_{18}+X_{19}+X_{110}<=166$
$X_{25}+X_{26}+X_{27}+X_{28}+X_{29}+X_{210}<=117$
$X_{35}+X_{36}+X_{37}+X_{38}+X_{39}+X_{310}<=123$
$X_{45}+X_{46}+X_{47}+X_{48}+X_{49}+X_{410}<=151$

Demand Constraints
$X_{101}+X_{102}+X_{103}+X_{104}=102$
$X_{91}+X_{92}+X_{93}+X_{94}=104$
$X_{81}+X_{82}+X_{83}+X_{84}=95$
$X_{71}+X_{72}+X_{73}+X_{74}=103$
$X_{61}+X_{62}+X_{63}+X_{64}=92$
$X_{51}+X_{52}+X_{53}+X_{54}=93$

## Model Optimized for Profit

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

| Average of per Row Labels | Column Labels D3a8be26 | D3c0b041 | D6236e72 | D6ca4f41 | Da3f394d | Da7cec12 | (blank) | Grand Total |
|---|---|---|---|---|---|---|---|---|
| S2c3e08f | 0.13 | 0.15 | 0.05 | 0.08 | 0.18 | 0.11 | | 0.12 |
| S89052cd | 0.15 | 0.08 | 0.15 | 0.12 | 0.19 | 0.17 | | 0.14 |
| Scc1f4cf | 0.19 | 0.11 | 0.07 | 0.18 | 0.12 | 0.10 | | 0.13 |
| Sfe345cb | 0.11 | 0.12 | 0.13 | 0.11 | 0.18 | 0.08 | | 0.12 |
| (blank) | | | | | | | | |
| Grand Total | 0.14 | 0.12 | 0.10 | 0.13 | 0.17 | 0.11 | | 0.13 |

| | Sour Patch Prairie | Meringue Mountains | Whipped Wonderland | Marzipan Metropolis | Melty Mint Mountains | Pudding Peaks | sent | Capacity |
|---|---|---|---|---|---|---|---|---|
| Cotton Candy Clouds | 33.0000 | 92.0000 | 0.0000 | 0.0000 | 41.0000 | 0.0000 | 166.0000 | 166 |
| Fruit Chew Fjords | 0.0000 | 0.0000 | 15.0000 | 0.0000 | 0.0000 | 102.0000 | 117.0000 | 117 |
| Candy Cane Canyon | 60.0000 | 0.0000 | 0.0000 | 63.0000 | 0.0000 | 0.0000 | 123.0000 | 123 |
| Caramel Corn Caverns | 0.0000 | 0.0000 | 88.0000 | 0.0000 | 63.0000 | 0.0000 | 151.0000 | 151 |
| Received | 93.0000 | 92.0000 | 103.0000 | 63.0000 | 104.0000 | 102.0000 | | |
| Demand | 93 | 92 | 103 | 95 | 104 | 102 | | |
| | | | | | | | | |
| Objective | 90.58000134 | | | | | | | |

This model shows that the minimum cost of shipping and receiving candy for my shop is 90.58$. Cotton candy clouds supply 33 to sour path prairie, 92 to meringue mountains, and 41 to melty mint mountains. Fruit chew fjords supply 15 to whipped wonderland and 102 to pudding peaks. Candy Cane Canyon only supplies to Sour Patch Prairie and Marzipan Metropolis.

**Model with Stipulation**

*Please copy the tab of your original model before continuing with the next part to avoid messing up your original solution. What happens if you add an additional constraint to the model such that all demand **MUST** be met. Is the solution still feasible? If not, please explain why.*

No, the solution is no longer feasible, you get an error. This happens because there isn't enough candy to satisfy all the demands of all the destinations. There is not enough capacity to meet the demand of all the candy shops.