

# 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

ID	Name	Source or Destination
Sa976849	Buttercream Beach	Source
S6f5cad9	Chocolate River Rapids	Source
S54b59bb	Churro Chamber	Source
S44fa573	Butterscotch Bluffs	Source
Dac7fd09	Maple Fudge Forest	Destination
Da9dbda0	Malted Milk Manor	Destination
D759aba7	Peanut Butter Parlor	Destination
D60bded9	White Chocolate Wasteland	Destination
D4cf8ef3	Licorice Lanes	Destination
D407253c	Peppermint Peninsula	Destination

- 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 Cost Per Unit		Column Labels							
Row Labels		D407253c	D4cf8ef3	D60bded9	D759aba7	Da9dbda0	Dac7fd09	Grand Total	
S44fa573	\$	0.14	\$ 0.12	\$ 0.06	\$ 0.12	\$ 0.16	\$ 0.12	\$	0.12
S54b59bb	\$	0.11	\$ 0.12	\$ 0.14	\$ 0.12	\$ 0.07	\$ 0.15	\$	0.12
S6f5cad9	\$	0.09	\$ 0.09	\$ 0.07	\$ 0.11	\$ 0.10	\$ 0.11	\$	0.10
Sa976849	\$	0.16	\$ 0.14	\$ 0.11	\$ 0.10	\$ 0.07	\$ 0.15	\$	0.12
Grand Total	\$	0.13	\$ 0.12	\$ 0.10	\$ 0.11	\$ 0.10	\$ 0.13	\$	0.11

## 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

$X_1$  = Butterscotch Bluffs

$X_2$  = Churro Chamber

$X_3$  = Chocolate River Rapids

$X_4$  = Buttercream Beach

$X_5$  = Peppermint Peninsula

$X_6$  = Licorice Lanes

$X_7$  = White Chocolate Wasteland

$X_8$  = Peanut Butter Parlor

$X_9$  = Malted Milk Manor

$X_{10} = \textit{Maple Fudge Forest}$

$$\begin{aligned} & \text{Max: } 0.14 \times X_{11} + 0.12 \times X_{12} + 0.06 \times X_{13} + 0.12 \times X_{14} + 0.16 \times X_{15} + 0.12 \times X_{16} + \\ & 0.11 \times X_{21} + 0.12 \times X_{22} + 0.14 \times X_{23} + 0.12 \times X_{24} + 0.07 \times X_{25} + 0.15 \times X_{26} + \\ & 0.09 \times X_{31} + 0.09 \times X_{32} + 0.07 \times X_{33} + 0.11 \times X_{34} + 0.10 \times X_{35} + 0.11 \times X_{36} + \\ & 0.16 \times X_{41} + 0.14 \times X_{42} + 0.11 \times X_{43} + 0.10 \times X_{44} + 0.07 \times X_{45} + 0.15 \times X_{46} \end{aligned}$$

## Capacity Constraints

$$\begin{array}{rcl} X_{15} + X_{16} + X_{17} + X_{18} + X_{19} + X_{110} & \leq & 110 \\ X_{25} + X_{26} + X_{27} + X_{28} + X_{29} + X_{210} & \leq & 113 \\ X_{35} + X_{36} + X_{37} + X_{38} + X_{39} + X_{310} & \leq & 140 \\ X_{45} + X_{46} + X_{47} + X_{48} + X_{49} + X_{410} & \leq & 136 \end{array}$$

## Demand Constraints

$$\begin{aligned} X_{51} + X_{52} + X_{53} + X_{54} &\leq 89 \\ X_{61} + X_{62} + X_{63} + X_{64} &\leq 86 \\ X_{71} + X_{72} + X_{73} + X_{74} &\leq 83 \\ X_{81} + X_{82} + X_{83} + X_{84} &\leq 95 \\ X_{91} + X_{92} + X_{93} + X_{94} &\leq 83 \\ X_{101} + X_{102} + X_{103} + X_{104} &\leq 84 \end{aligned}$$

## Model Optimized for Profit

*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)*

[illegible]

- *A text explanation of what your model is recommending*

My model shows that overall, the minimum cost for the shipping and receiving of my candy shop is 44.86. Butterscotch Bluffs supplies 83 to white chocolate wasteland and 27 to maple fudge forest. Churro Chamber supplies mostly to Peppermint Peninsula and a little to Malted Milk Manor. Chocolate River Rapids supplies to 3 destinations which are Peppermint Peninsula, Licorice Lanes, and Maple Fudge Forest. Finally, Buttercream Beach

supplies to both Peanut Butter Parlor and Malted Milk Manor. Buttercream Beach is also the only shipper to Peanut Butter Parlor.

### **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.*

- You would get an error
- If demand needs to be met it gives you an error because there isn't enough material to satisfy all the demands of all the destinations. There isn't enough capacity to meet all the demand that each destinations needs. The demand is greater than the capacity so it would be infeasible.