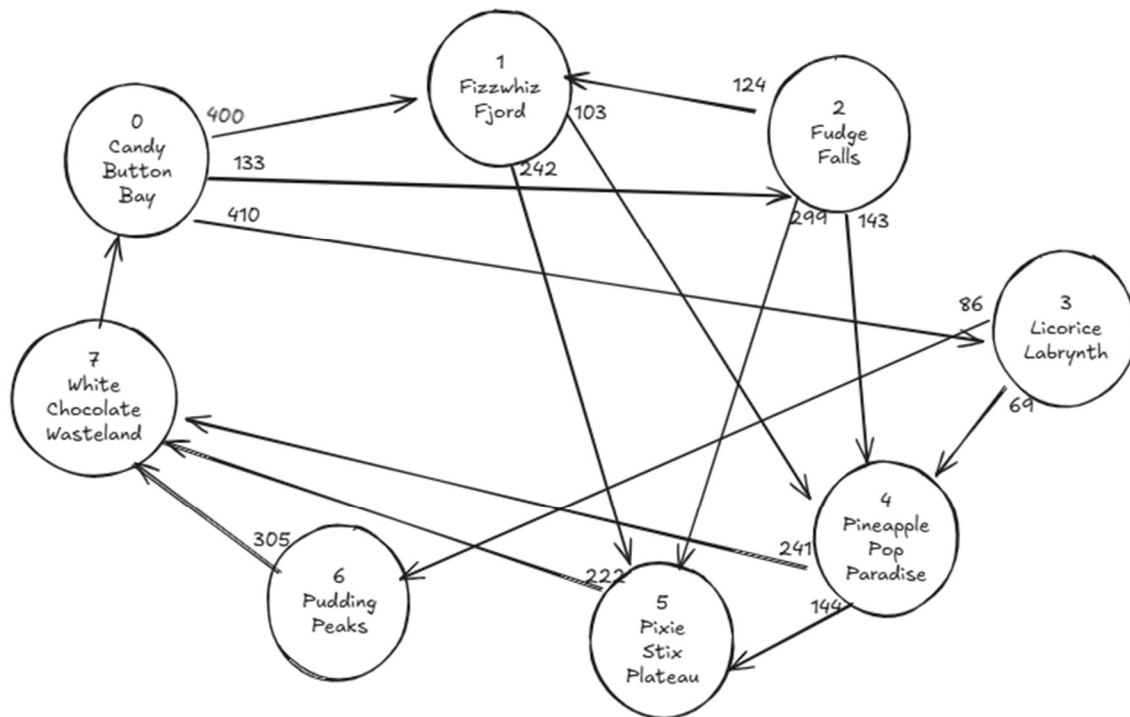


# Module 07 – Maximal Flow

## 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:



## 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.

**MAX:**  $X_{70}$

### Constraints:

$$X_{70} - X_{01} - X_{02} - X_{03} = 0$$

$$X_{01} + X_{21} - X_{14} - X_{15} = 0$$

$$X_{02} - X_{21} - X_{24} - X_{25} = 0$$

$$X_{03} - X_{34} - X_{36} = 0$$

$$X_{14} + X_{24} + X_{34} - X_{45} - X_{47} = 0$$

$$X_{15} + X_{25} + X_{45} - X_{57} = 0$$

$$X_{36} - X_{67} = 0$$

$$X_{47} + X_{57} + X_{67} - X_{70} = 0$$

**With the following bounds on the decision variables:**

**X01 <= 400**

**X02 <= 133**

**X03 <= 410**

**X14 <= 103**

**X15 <= 242**

**X21 <= 124**

**X24 <= 143**

**X25 <= 299**

**X34 <= 69**

**X36 <= 86**

**X47 <= 241**

**X45 <= 144**

**X57 <= 222**

**X77 <= 305**

**X70 <= 9999999**

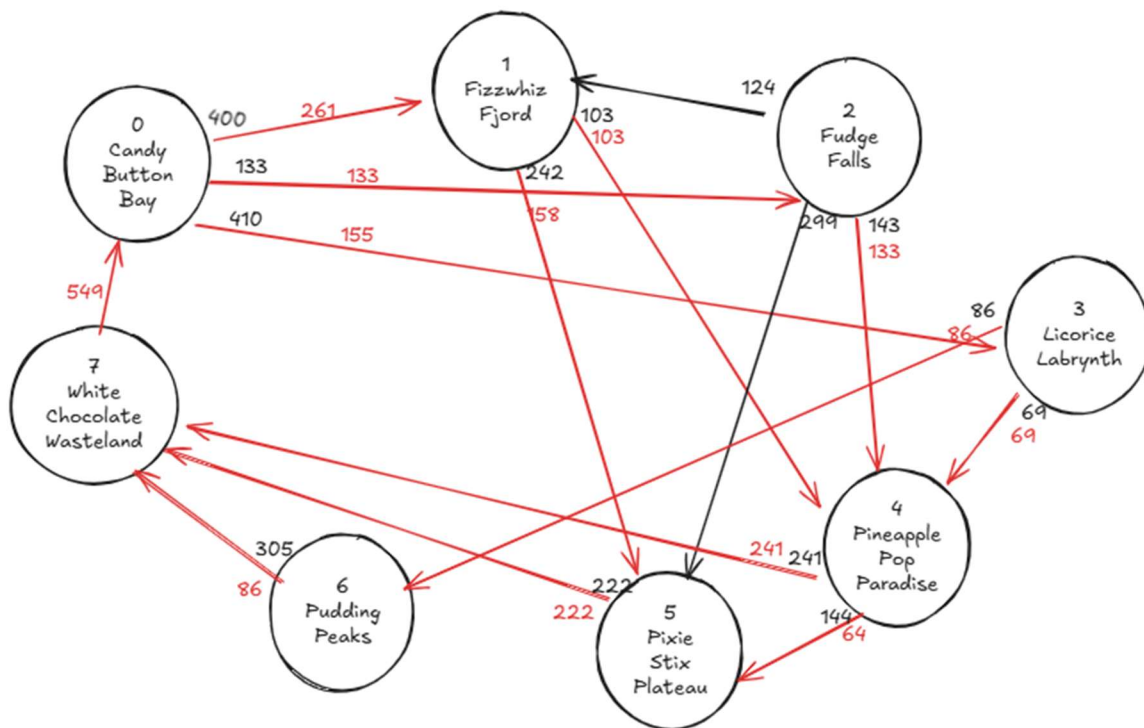
## Model Optimized for Maximal Flow

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

Maximal Flow -> 549									
Units of Flow	Links		Upper Bound	Nodes					Supply / Demand
	From	To			Inflow	Outflow	Net Flow		
261	0 Candy Button Bay	1 Fizzwhiz Fjord	400	0	Candy Button Bay	549	549	0	0
133	0 Candy Button Bay	2 Fudge Falls	133	1	Fizzwhiz Fjord	261	261	0	0
155	0 Candy Button Bay	3 Licorice Labyrinth	410	2	Fudge Falls	133	133	0	0
103	1 Fizzwhiz Fjord	4 Pineapple Pop Paradise	103	3	Licorice Labyrinth	155	155	0	0
158	1 Fizzwhiz Fjord	5 Pixie Stix Plateau	242	4	Pineapple Pop Paradise	305	305	0	0
0	2 Fudge Falls	1 Fizzwhiz Fjord	124	5	Pixie Stix Plateau	222	222	0	0
133	2 Fudge Falls	4 Pineapple Pop Paradise	143	6	Pudding Peaks	86	86	0	0
0	2 Fudge Falls	5 Pixie Stix Plateau	299	7	White Chocolate Wasteland	549	549	0	0
69	3 Licorice Labyrinth	4 Pineapple Pop Paradise	69						
86	3 Licorice Labyrinth	6 Pudding Peaks	86						
241	4 Pineapple Pop Paradise	7 White Chocolate Wasteland	241						
64	4 Pineapple Pop Paradise	5 Pixie Stix Plateau	144						
222	5 Pixie Stix Plateau	7 White Chocolate Wasteland	222						
86	6 Pudding Peaks	7 White Chocolate Wasteland	305						
549	7 White Chocolate Wasteland	0 Candy Button Bay	9999999						

This Model shows the maximum flow of the Chocolate River. Bottlenecks arise where the units of flow are equal to its upper bound... this can limit the total flow from this particular station.

Update your graph from the EDA section to bold/color the links being used (and show how much is going through that link)

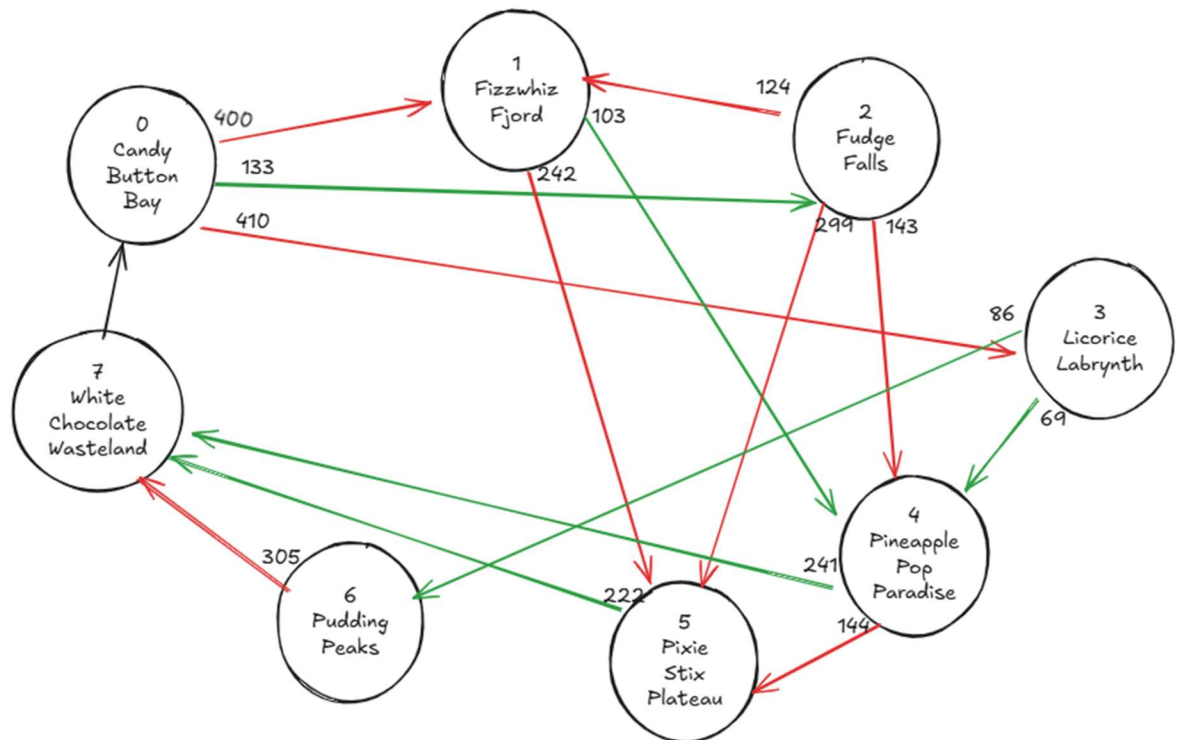


## Model with Stipulation

Please copy the tab of your original model before continuing with the next part to avoid messing up your original solution.

	Nodes	Units of Passthrough
0	Candy Button Bay	549
1	Fizzwhiz Fjord	261
2	Fudge Falls	133
3	Licorice Labyrinth	155
4	Pineapple Pop Paradise	305
5	Pixie Stix Plateau	222
6	Pudding Peaks	86
7	White Chocolate Wasteland	549

*Units of passthrough per node*



**To achieve the optimal solution, capacity should be expanded for edges that are in the “red” to reduce bottlenecks in the pipeline.**