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:*

* *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/Word

A diagram of a network

AI-generated content may be incorrect.

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AI-generated content may be incorrect.

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.*

Node 1:

Node 2:

Node 3:

Node 4:

Node 5:

Node 6:

Node 7:

l Optimized for Maximal Flow

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

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Units of Flow | Links | | | | Upper Bound |
| To | | From | |
| 96 | 0 | Candy Cane Canyon | 1 | Chocolate River Rapids | 368 |
| 173 | 0 | Candy Cane Canyon | 2 | Creme Brulee Cliffs | 173 |
| 0 | 0 | Candy Cane Canyon | 3 | Fizzwhiz Fjord | 206 |
| 0 | 1 | Chocolate River Rapids | 3 | Fizzwhiz Fjord | 282 |
| 0 | 1 | Chocolate River Rapids | 4 | Jelly River Delta | 75 |
| 96 | 1 | Chocolate River Rapids | 5 | Mochi Metropolis | 283 |
| 199 | 2 | Creme Brulee Cliffs | 6 | Molasses Marsh | 199 |
| 0 | 3 | Fizzwhiz Fjord | 4 | Jelly River Delta | 181 |
| 0 | 4 | Jelly River Delta | 7 | Whipped Wonderland | 283 |
| 0 | 5 | Mochi Metropolis | 7 | Whipped Wonderland | 222 |
| 26 | 5 | Mochi Metropolis | 2 | Creme Brulee Cliffs | 236 |
| 70 | 5 | Mochi Metropolis | 6 | Molasses Marsh | 70 |
| 0 | 6 | Molasses Marsh | 7 | Whipped Wonderland | 133 |
| 0 | 6 | Molasses Marsh | 4 | Jelly River Delta | 149 |
| 269 | 6 | Molasses Marsh | 0 | Candy Cane Canyon | 9999 |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  |  |  |  |  | Supply / Demand |
| Nodes | | Inflow | Outflow | Net Flow |
| 0 | Candy Cane Canyon | 269 | 269 | 0 | 0 |
| 1 | Chocolate River Rapids | 96 | 96 | 0 | 0 |
| 2 | Creme Brulee Cliffs | 199 | 199 | 0 | 0 |
| 3 | Fizzwhiz Fjord | 0 | 0 | 0 | 0 |
| 4 | Jelly River Delta | 0 | 0 | 0 | 0 |
| 5 | Mochi Metropolis | 96 | 96 | 0 | 0 |
| 6 | Molasses Marsh | 269 | 269 | 0 | 0 |
| 7 | Whipped Wonderland | 0 | 0 | 0 | 0 |

Model with Stipulation

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

*Let’s demonstrate the “Flow Aggregation” special consideration that was discussed in the textbook and the Follow Along – Model Formulation video. Please follow these steps:*

* *Identify an edge that is not used with your current solution* 
  + *If by chance all your edges are in use, then apply the next step to an under-utilized edge*
* *Add a lower bound (LB) constraint to that edge (i.e. there must be a non-zero flow to the edge)*
  + *The LB should be 10% of the capacity of that edge (i.e. if the unused edge supports 500 unit flow, then we should had a LB of 50 units through that edge)*
* *Discuss the changes to the optimal solution with this change and how it impacts the model formulation*