Optimal Water Distribution Network

Variables

City Nodes and Attributes

- City Nodes: A compilation of nodes that depict different areas within the city, each possessing unique attributes.
- Distance from a water source or main distribution point is inversely related to proximity, with smaller values indicating closer distance.
- The level of adequacy of the current infrastructure in the area for the installation of new water distribution systems can be assessed on a scale of 1 to 10.
- The population density is utilized to prioritize areas with high needs.

Priority Score

- The priority score is an essential metric utilized to assess the significance of individual regions. It is usually computed by considering factors such as population density, proximity, and infrastructure preparedness. A higher priority score signifies a greater need for water distribution in that area.

Edges and Costs

- Connections are established between nodes that symbolize potential pathways for laying pipes. Each link is equipped with.
- The cost of installing a pipeline along this path must be minimized to ensure cost-effective expansion.

Constraints

Budget Constraint

- Implementation: Track the total cost during the greedy selection and stop adding new edges when the budget is reached.

Pipe Capacity and Flow Constraints

- Each pipe in the network has a maximum flow capacity that shouldn’t be exceeded. This ensures the network can handle the demand without overloading pipes.

Population Density Threshold

- Prioritize only high-density areas (e.g., areas above a certain population density threshold) to focus on regions where the water demand is greatest.
- Implementation: Filter nodes based on population density before adding them to the priority queue.

Minimum Infrastructure Readiness

- Only consider areas with adequate infrastructure readiness (e.g., above a threshold) to avoid placing water infrastructure where it’s challenging to install and maintain.
- Implementation: Exclude nodes below the infrastructure readiness threshold.