Jason Eveleth jeveleth
xwm

Project – I

1 Journey

Most of the time of this project was trying to figure out how to represent the constraints in a linear program. The break through was when I realized I try to model the underlying integer program, and then just replace the integers with continuous variables. After I did that, my first intuition seemed to match the leaderboards.

2 Decision Variables and Constraint Model

The problem constists of constraints on customers and facilities (which are represented as indices of their data). Each customer has a demand. Each customer has an allocation cost and distance to each facility. Each facility has an opening cost, and generation capacity. We also have constraints on the transportation: a maximum number of vehicles per facility and truck distance limit (which I encode implicitly as a max distance servable by each facility). Then the actual amount of distance each facility also has a cost.

I had 3 types of constraints, and 3 terms in my objective function.

I imagined the fully connected bipartite graph (between facilities and customers which edge weights according to allocation cost and distance). The way I thought about it was each customer has a certain amount of "flow" of their demand over the edges. These were the only decision variables, which were constrainted to between 0 and 1. This brings us to constraint (1) the sum of the flow out from every customer is 1. Next, we need to satisfy demand, (2) for each facility, the dot product of flow to customers and their demand must be less than the facility capacity. Finally we need to satisfy the transportation requirements. (3) For each facility, the dot product of flow to customers and distances must be less than the total distance a facility's trucks can go (`numMaxVehiclePerFacility*truckDistLimit`).

For the objective value, (1) I measured the cost of "opening" a facility. This is accomplished by multiplying the amount of capacity of each facility is used by the "cost per unit capacity", which is `openingCostF[f]/capacityF[f]` for facility `f`. (2) I measured the service cost: flow dotted with allocation costs. (3) I measured transportation costs: flow dotted with distances, divided by `truckDistLimit` (which we assume will give us the number of trucks used) times the `truckUsageCost`. My objective was the sum of these costs.

3 Info

I spent about 7 hours on this project.