

ISYE Homework #12

Question 18.1

Describe analytics models and data that could be used to make good recommendations to the power company.

Here are some questions to consider:

- The bottom-line question is which shutoffs should be done each month, given the capacity constraints. One consideration is that some of the capacity – the workers' time – is taken up by travel, so maybe the shutoffs can be scheduled in a way that increases the number of them that can be done.
- Not every shutoff is equal. Some shutoffs shouldn't be done at all, because if the power is left on, those people are likely to pay the bill eventually. How can you identify which shutoffs should or shouldn't be done? And among the ones to shut off, how should they be prioritized?

Think about the problem and your approach. Then talk about it with other learners, and share and combine your ideas. And then, put your approaches up on the discussion forum, and give feedback and suggestions to each other.

You can use the {given, use, to} format to guide the discussions: Given {data}, use {model} to {result}.

Have fun! Taking a real problem, and thinking through the modeling and data process to build a good solution framework, is my favorite part of analytics.

Step 1: Classify Customers by Payment Likelihood

Given:

- Customer payment history (number of late payments, balance amount, days since last payment)
- Account tenure
- Outstanding balance
- Responses to past payment reminders

Use:

- Logistic Regression

To:

- Predict the likelihood of payment before shutoff and classify customers as either non-payers or delayed payers.

Step 2: Cluster Customers by Location for Efficient Routing

Given:

- Customer addresses
- Predicted payment likelihoods from Step 1

Use:

- K-Means Clustering

To:

- Group customers into geographic clusters based on proximity and delinquency levels.

Given:

- Clustered customer data
- Distance between shutoff locations

Use:

- Dijkstra's Algorithm

To:

- Optimize travel routes within clusters and minimize worker travel time.

Step 3: Optimize Worker Schedules and Capacity

Given:

- Clustered shutoff groups
- Worker availability
- Travel times between locations
- Daily/hourly capacity of workers

Use:

- Optimization Model

To:

- Assign workers to maximize shutoffs within their shift limits and capacity.

Given:

- Real-time payment updates
- Worker schedules
- Customer address

Use:

- Dynamic Scheduling

To:

- Adjust shutoff schedules on-the-fly to reflect new customer data or unexpected changes in capacity.

Outcome:

This structured approach ensures that only high-priority customers are targeted for shutoffs. By minimizing travel time through efficient routing and optimizing worker schedules, the power company can maximize the number of shutoffs completed within operational constraints while reducing unnecessary disruptions.