Decision Analytics for Business and Policy

Request for Proposal: Points of Dispense

Due Dates: Proposal Nov 10, Report Dec 1 **Submission:** Canvas

Project Scope.

To prepare for large public health emergencies, the Allegheny County is prioritizing the list of Points of Dispense (PODs) to open, which are used to distribute essential supplies and medicines to the public during such emergencies. **Your goal for this project is to formulate a facility location model, and optimally select a list of PODs from the candidate sites. You need to compare two different formulations: minimizing the total/weighted travel distance of the population, and minimizing the maximum travel distance for anyone.** This problem is similar to the shelter design question in the homework, but requires significantly more calibration for data, for example, on the estimation of travel distance between each household to each candidate POD site. Furthermore, you should come up with a few different scenarios (local outbreak within a few zip codes, versus more global outbreak throughout the county) and compare the optimal solutions from these scenarios. If you are unable to come up with a reasonable estimation for the cost of opening/maintaining a POD, it is okay to provide a sensitivity analysis on the number of PODs that you can open – for example, provide insights on how the optimal solution changes as you increase/decrease the number of PODs you can afford to open. In addition, the *type* of supplies is up to you. This choice would have impact on all aspects of your parameters and model design. For example, vaccine distribution requires the help of medical professionals while test kits distribution does not, and this has implication on how you calibrate input parameters for supply capacity, and rate of distribution. Medicines, vaccines, and antibiotics might also have a shorter lifetime and more expensive inventory management cost than durable goods such as masks.

Note that this project is open-ended by design (unlike homework questions). It is part of your learning process to handle more realistic problems. As such, you will need to first define your problem more precisely before working on mathematical models and computational implementations. Only after you define the problem clearly and state all assumptions explicitly, would you be able to sensibly write down the model, gather data, implement, and analyze results.

Data Guideline. Data should be collected from online and publicly available sources. A (potentially incomplete) list of data you should consider:

- Candidate sites for PODs (you can use the Excel file provided for this project)
- Number of households in each neighborhood (e.g., zip code area)
- Transportation cost/time between each household and each candidate site (you can speed up this process by using an average value for every group of households, e.g., a neighborhood)
- PODs opening cost (optional; see project scope for alternative approach)

Collecting and cleaning real data is extremely time-consuming. Please start early, think creatively, and use synthetic data if needed.

Timeline.

- Nov 18, 2021 – Request for Proposal Release.
- Nov 25, 2021 - Submit names and emails of your team members to TA (2-4 students per team; contact TAs if you cannot find a team).
- Nov 10, 2021 – Proposal due: 1 page on problem definition and assumptions, 1 page on model formulation, and 1 page on what data are needed and what the data collection plan is. Data plan should answer: what data do you use for each parameter in your optimization model, and how do you plan to obtain/estimate them? Additionally, include an extra page for "team-work planning" where you detail the current and planned contribution from each team member. The total contribution is expected to be equal among the team members.
- Nov 29 and Dec 1, 2021 – Project Presentation (see below for instructions).
- Dec 1, 2021 – Project final report due (see below for instructions).

Deliverables. Details for the final deliverable (per team):

1. Final report:
   - Content should be 5 pages maximum and delivered in MS Word or PDF format.
   - The report should include background/literature review, problem statement, mathematical formulation, data summary, implementation, analysis, and recommendations.
   - The report should be written for a reader who is not necessarily familiar with the context but understands technical concepts in basic statistics and operations research.
   - Your report should clearly state what your solution and recommendation are.
   - Your report should include an "Analysis" section that addresses at least two of the questions posed in "Project Scope".
   - Modeling and implementation assumptions should be clearly written in the report.
   - Clearly define your decision variables, parameters, objective(s), and constraints. Write your model clearly and in mathematical terms (using MS Word equations or Latex). Your model can NOT be just described in words. You can use matrix format to write your model where your matrices are clearly defined in your report and data.
   - Include figures or tables as you see fit. (Include them if they add value to the report for the client's sake. There is no point in including figures as fillers. Your reports will be graded for quality not length.)
   - Do not delay writing the report to the last minute, start early. There are parts of the report that you can start writing immediately.
   - NOTE: Your final report should include a cover page (in addition to the 5 pages) that outlines all resources you used and contribution from each team member. It is expected that every team member contributes equally (in time and energy). Any potential imbalance should be discussed with the instructor as soon as possible.
2. Code
   - If you have multiple files, include a "ReadMe" file to explain which files should be executed and in what order, and/or the structure of the source/data file directories.

- Your files should be self-standing and executable on other computers (e.g., do not hard-copy your local address in your code, use relative addresses).

3. Data

   - Include all the data that you have gathered or generated.
   - Include a "DataDictionary" file to describe where and how you found the data. You can include web links in this file if you used online resources.

4. Presentation

   - 15-20 min for each team depending on how many teams we have.
   - Organize your presentation flow in the same way you organize the final report, but beware of the time constraints, and put emphasis on clearly describing what problem you are trying to solve, what assumptions you are making, data sources, and the results.

Grading. The project accounts for 35% of course grade: Proposal: 5%, Presentation: 5%, Project Report (including code and data files): 25%.