MSAN 631-2

PROGRAMMING PROJECT

Description: The objective of the project is the design of a **Lagrangian relaxation** heuristic that solves the **Maximal Covering** problem and one that produces **quality** solutions. Here are the details of the heuristic you are expected to develop: 1. Apply the problem size reduction technique discussed in class (see, column reduction). This is optional but if you can eliminate a good chunk of potential facility sites by applying this technique. 2. Next, apply the Lagrangian relaxation method iteratively to obtain a near-optimal solution to the maximal covering problem. This is the required part for the project. 3. You may use an improvement heuristic to improve the feasible solution you obtain, either at every Lagrangian iteration or only at the last Lagrangian iteration. This is also optional. Implementing improvement heuristics may potentially reduce cpu time requirements as well as the optimality gap.

Coding: You may use any programming language of your choice, i.e., R, Python, C++, Java, or Matlab. The code should be able to handle up to 150 customer demand points and candidate facility sites. Three different data sets will be provided for testing of your code and analysis of your solutions.

Technical Report: The body of the report cannot exceed 8 double-spaced pages in length with one inch margins and a 12 point font. The technical report should have the outline of a technical paper; i.e. Abstract, introduction, model description, solution algorithm, computational results/findings and conclusions with heavy emphasis on solution algorithm and the results section. There is no restriction on the length of the appendices; however, consider carefully how

data in the appendices helps you make your case, and whether it can be summarized concisely.

Outputs: In addition to the solution of the Maximal Covering Problem, a summary of some of the interesting analysis/results should also be provided in the technical report. For example, sensitivity analysis of the solution to the coverage distance; the utilization of a facility (amount of demand covered by a facility); average demand weighted distance; if the operations of one of the facilities provided by the optimal solution was disrupted (due to strike, natural disasters, etc.) how would that affect percentage coverage?, etc. *Providing a visualization of the solution is not required but is highly recommended.*

Grading: Grades will be based in large part on the quality of the solutions obtained and the solution time required. However, the technical report and presentation of your analysis **will** also count towards the final grade for the programming project.