**IE709, IEOR for Health Care**

Assignment 1, January 13, 2018

Due Wednesday, January 24, 2018, 6PM

**Notes:**

1. There are 3 questions on 1 pages.
2. Submit all your program files, data files and write up on Moodle before the deadline.
3. Please work in teams of two.
4. Only one submission is should be submitted from a team. Clearly write the name and roll number of each team member in the report.
5. Similarity Penalty: Please work with a student different from your batch or department. Teams whose members have identical first 5 digits of roll numbers will be penalized 4 marks.

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1. We would like to find optimal locations of ambulances for a given set of 85 localities. There are 40 candidate locations where we can possibly locate the services. The distances in terms of time to reach from a candidate location to a demand location and demand measures are available on Moodle.
   (a) [3 marks] Find the minimum number of ambulances required to cover all locations within a response time threshold of 10 minutes.
   (b) [3 marks] Plot a graph of minimum number of ambulances required when the threshold varies from 4 minutes to 20 minutes. Comment on the graph and the possible implications of the trend seen.
   (c) [3 marks] Suppose $p$ ambulances are required in the solution of part (a). Then use another model of your choice to find a better redistribution of the ambulances. Quantify the improvements in solution quality.
   (d) [3 marks] Suppose 5 more ambulances are available than those available in part (c). How will you reassign the ambulances? How different is the solution from part (c)?
2. [4 marks] Construct small example where a certain $n$ locations that need to be covered with minimum number of ambulance services (the most basic model) with the following property. The optimal solution of the Linear Programming relaxation of the integer program should not be integer. Do it for an $n$ not more than 6. Depict this instance using a graph. Show how this example can be extended to very large values of $n$ while satisfying the same property.
3. [4 marks] Read the two papers on EMS in India uploaded on Moodle. Highlight the similarities and key differences in the setting of the studies, observations, data, key problems and suggested solutions (if any).

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