IEOR151 Homework 7
Fall 2013
Due: Wednesday, November 13, 2013

Problem 1:
Solve a P-median problem with the heuristic algorithm: allocate 2 facilities among 7 demand nodes (demand nodes set and candidate sites set are the same). The demand and distance information is given in Fig.1:

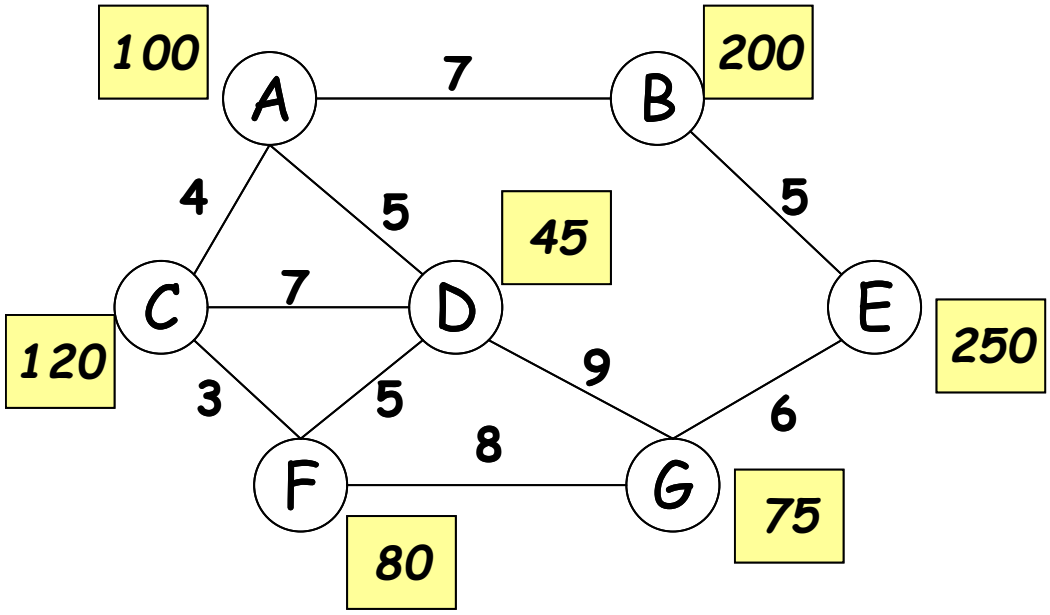

Fig.1

Problem 2:
For the same graph Fig.1 in Problem 1, solve a set-covering problem with the heuristic algorithm: cover all demands with covering distance of 10.

Problem 3:
One important issue in facility location modeling is the following. If you are given a problem on a network composed of nodes and links, when do you get the same solution (in terms of the objective function value) if you restrict the facility location to be on the nodes as opposed to the case in which you allow facilities to be on the nodes and the links. Clearly life is much easier if you know that restricting the candidate sites to be the set of nodes does not hurt you as you have a finite set of candidate locations as opposed to the infinite set of candidate locations you would have if you could locate on the nodes and links. (If you think they are different, give an example; If not, please explain thoroughly.)

a) For the set covering problem, do you get the same results if (i) you can locate only on the nodes and (ii) you can locate on the nodes and links? Prove that you either do get the same results or show by example that the results will be different depending on where you are allowed to locate.

b) Repeat question (a) for the maximal covering problem.

c) Repeat question (a) for the P-center problem.

d) Repeat question (a) for the P-median problem.

Problem 4:

Consider the data shown below for a vehicle routing problem. The depot is at node 0. Each vehicle has a capacity of 350 units. The maximum distance that a vehicle can travel is 50 units. Compute the distances using the Euclidean distance formula.

Node	X-coordinate	Y-coordinate	Demand	Angle	Radius
0	0	0	0		
1	5	7	65	54.46	8.60
2	3	5	95	59.04	5.83
3	6	–6	100	315.00	8.49
4	–5	–1	85	191.31	5.10
5	–3	–9	60	251.57	9.49
6	–7	–6	110	220.60	9.22
7	3	–8	100	290.56	8.54
8	7	2	85	15.95	7.28
9	–3	4	60	126.87	5.00
10	–4	8	75	116.57	8.94

Use the savings algorithm to solve the problem.

a) How many routes do you use?

b) What is the total route length?

c) List the nodes visited on each route, the demand associated with that route, and the route length.

Problem 5:

Exercise 1 on page 504 in textbook chapter 9 Hint: Service Science, by Mark Daskin http://onlinelibrary.wiley.com/book/10.1002/9780470877876

Problem 6:

Exercise 11 on page 455 in textbook chapter 8

Problem 7:

Suppose we have $\frac{\lambda}{\mu} = 25$, and we would like to have the probability of waiting be at most 5%. Use the square root law to decide the number of servers we should have.