EL7363, Spring 2018: Homework #5

Please submit your code, data files and all other solutions as a single zip file through newclasses

1. In a node-location design problem, there are four areas need to be connected to four potential switch locations, the opening cost for location 1 to 4 is 1,0, 2,3 respectively, each switch can handle at most two areas, the connectivity cost between area i and switch j is listed in the following table. Use the ADD Heuristic to solve this design problem, and suppose the initial location is chosen to be switch 2. Please show the steps of your calculation in a similar way to Example 6.1 on page 215.

Area	Switch 1	Switch 2	Switch 3	Switch 4
1	2	1	4	2
2	5	4	3	2
3	1	3	2	4
4	2	4	3	2

Figure 1: Connectivity Cost for Question 1 and 2

2. Develop an AMPL model for the node-location design problem defined on slide 5 of lecture 7, apply the developed model to solve Q1. Is the network cost higher or lower than Q1?

3. Develop an AMPL model for a node-link based flow allocation to minimize the total network delay, using the piece-wise linear load sensitive link delay function defined on slide 8 and 9 of lecture 8.

4. Develop an AMPL model for the MIP formulation of the ECMP shortest path routing problem on slides 12-13 of lecture 8, add in the objective function of minimizing the total network delay, using the piece-wise linear load sensitive link delay function defined on slide 8 and 9 of lecture 8.

5. Apply the AMPL model developed in Q3 to find the optimal flow allocation for the network in Figure 2, there are three source nodes, A, B and C, sending traffic to the common destination node D. The traffic volumes are $h_{A \to D} = 3$, $h_{B \to D} = 2$ and $h_{C \to D} = 3$. There are six links, (including two links from C to D). Each link is marked with its capacity. What is the optimal flow for each demand? What is the total network delay?

6. Apply the AMPL model developed in Q4 to find the optimal link weights for the network in Figure 2 with the same demands and link capacities as in Q5. What is the optimal weight for each link? What is the resulting flow for each demand? What is the total network delay? Is the total delay higher or lower than the results of Q5

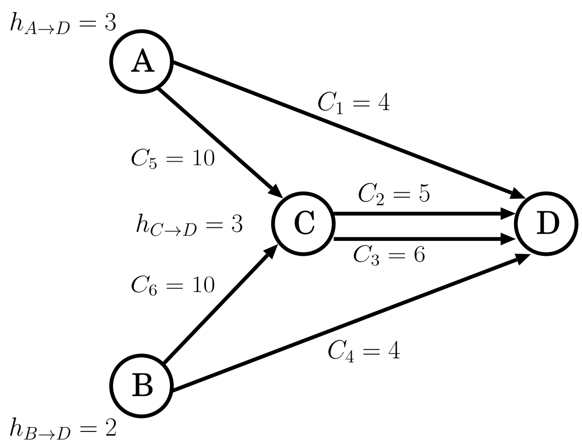

Figure 2: Network Topology for Question 5 and 6