**Homework #3**

**MSiA Program, Fall 2023**

**Optimization**

**Due: At the start of class on Mon 10/9/23**

For some of these problems, you can find additional information at:

http://networkdesignbook.com/academic-use/course-materials/

1. Do problem #2 from Chapter 1 of SCND
2. Do problem #3 from Chapter 1 of SCND
3. Do problem #4 from Chapter 1 of SCND
4. Do problem #6 from Chapter 2 of SCND.
5. Go to the spreadsheet “Data for Homework 3 Student”, on the “Best Items” tab. In this problem, you have 40 potential items that you can select. Each item has a size. You only have capacity for 500 units of the size. Each item has a value. You want to do the following:
   1. Set up the problem as an integer program and solve it so that you maximize the total value of the items you pick while respecting the capacity.
   2. See if you can come up with a simple heuristic that gives you a fairly good answer. Describe how your heuristic works relative to the IP you set up in (a). What is the IP doing that your heuristic is not?
   3. Go back to your model in (a) and relax the integer constraints and discuss how realistic the solution is relative to your answers in (a) and (b). Note that there are several ways to relax the integer variable—feel free to try a few of these approaches.
6. Go to the spreadsheet “Data for Homework 3 Student”, on the “Ambulances” tab. The matrix shows the time it takes an ambulance to go from one location in a city to another. We need to position the ambulances at one of these 10 locations. An ambulance must be able to get to each of the 10 locations within 3 minutes. Build a good Excel or Python optimization model that minimizes the number of ambulances you need to reach all of the 10 locations within 3 minutes.