Network Optimization (Fall 2024): Homework 4

- AMO stands for the text (Ahuja, Magnanti, Orlin). Exercises and page numbers are listed from AMO.
- Exercises marked with a **[G]** target the graduate students (Math 566), but undergrads (Math 466) can attempt them for extra credit.
- The total points (given in parentheses) add up to 130. Math 566 students will be graded for 125 points, and Math 466 students for 110 points.
- You should email your submission to kbala@wsu.edu.
- **Your main submission should be in a PDF file**. You are welcome to write answers by hand, and scan the writings (or take pictures of your writings) **into a PDF file**. You can also include output from running your program (for Problem 6) in the PDF file.
- Include all files—the main PDF and any program (.m) files—in a **zipped** folder.
- **You will not be allowed to include .py files in your email attachment. Notebooks (.ipynb files) are allowed. Another option is to rename your .py files as .txt instead.**
- **Your folder name should identify you in the following manner. If you are Tweek Tweak, you should name your folder TweekTweak_Hw4.zip. If you want to add more bits to the title, e.g., Math566, you could name it TweekTweak_Math566_Hw4.zip, for instance. But you should start the file name with TweekTweak. And please avoid white spaces in the file name.**
- **Begin the SUBJECT of your email submission with the same `FirstnameLastname`, expression, e.g., "TweekTweak Hw4 submission".**
- **This homework is due by 11:59 PM on Thursday, September 19**.

1. (20) AMO 3.10 (page 87).
2. (20) AMO 3.24 (page 89).
3. (20) AMO 3.29 (page 90).
4. (20) AMO 3.34 (page 90).
   The definition of the diameter of a *directed* graph as given in this problem is somewhat ambiguous. Use the following definition instead. The *distance* from node i to node j is the length of a shortest directed path from node i to node j. Note that *length* is measured as the number of arcs in the path. The diameter of a directed graph is then defined as the *longest* **finite** distance from any node to any other node in the graph.
5. (20) **[G]** AMO 3.40 (page 91).
6. (30) Write a Matlab (or in another package/language) function that takes as input the forward star representation matrix of a network and a starting node s, and performs the breadth-first search on the network. The program should output the `pred` vector as well as the BFS `order` vector. Name your file as `BFS_FirstnameLastname.m` (e.g., if you're Tweek Tweak, name it as `BFS_TweekTweak.m`) and include the Matlab file in the homework submission folder. You should also illustrate your code on the network in Problem 2 (AMO Figure 3.12) by displaying the output.