CEGE 4011/5214 Homework 4

Due Date: Tuesday, October 13, 2020 11:59 PM

Instructions

- The assignment should be typed or neatly handwritten. If you decide to type your solution, you can use any word processor or LaTeX (a template is uploaded on Gihub). The final version should be submitted as a PDF document.
- The PDF document should contain the solutions and figures/graphs (if any). Submit computer codes as a supplementary file. All the files should be zipped before submission.
- The front page of the homework file should have the name, student ID, and x500 of the student.
- You are encouraged to collaborate with other students, but you must submit your solutions individually.
- If you have any questions related to homework problems, feel free to email me (Pramesh Kumar (kumar372@umn.edu)).

Problem 1

Solve the following problems for the network given in Figure 1 using both Gurobi and Networkx and compare the results obtained.

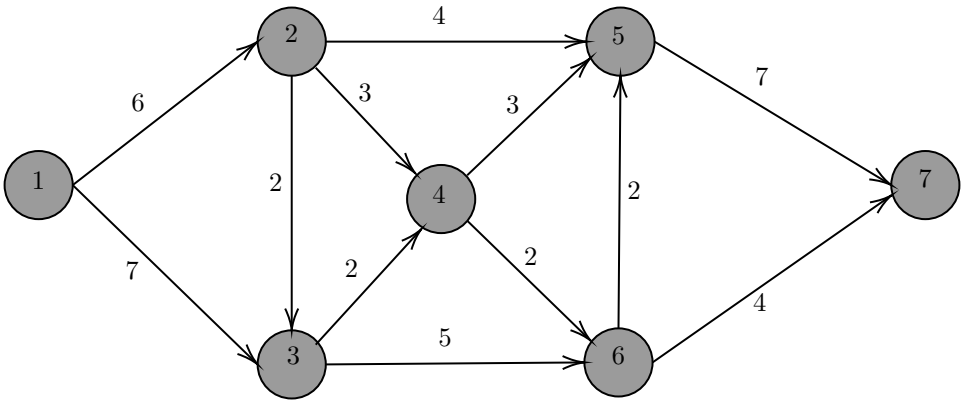

Figure 1: Network

A. (5 points) Find the shortest path between node 1 and node 7 in the network given in Figure 1. Assume the numbers by the links as the cost of traversing those links.

B. (5 points) Find the minimum cost of flowing 20 litres of water from node 1 to node 7 in the network given in Figure 1. Assume the numbers given by the links as the cost of flowing per litre of water. The lower bound on the flow is 0 and the capacity (upper bound on the flow) of various links is given below:

$(1,2):15,(1,3):10,(2,3):3,(2,4):7,(3,4):4,(2,5):18,(4,5):2,(4,6):2,(3,6):5,(6,7):1,(6,5):3,(5,7):\infty$

C. (5 points) Find the maximum flow from node 1 to node 7 in the network given in Figure 1. The lower bound on the flow is 0 and the capacity (upper bound on the flow) of various links is given below:

$(1,2):15,(1,3):10,(2,3):3,(2,4):7,(3,4):4,(2,5):18,(4,5):2,(4,6):2,(3,6):5,(6,7):1,(6,5):3,(5,7):\infty$

Problem 2

(10 points) A *bipartite graph* (or bigraph) is a graph whose vertices can be divided into two disjoint sets U and V such that every edge connects a vertex in U to one in V. Is the following graph (Figure 2) a bipartite graph? If yes, specify the nodes of the set U and V and the links connecting them. Find the matching/assignment of jobs in U to the employees in V that maximizes the total performance. The performance of any match is given by the link in the Figure.

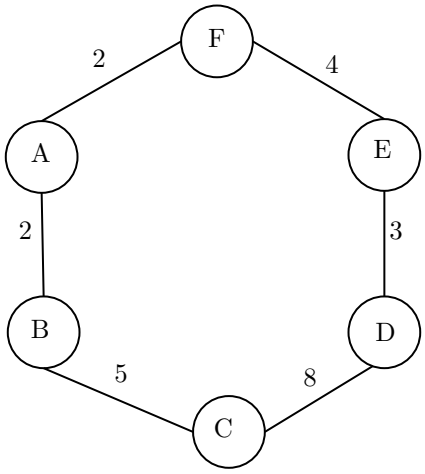

Figure 2: Network