CSCI 570
Network Flow - 2
Discussion Problems

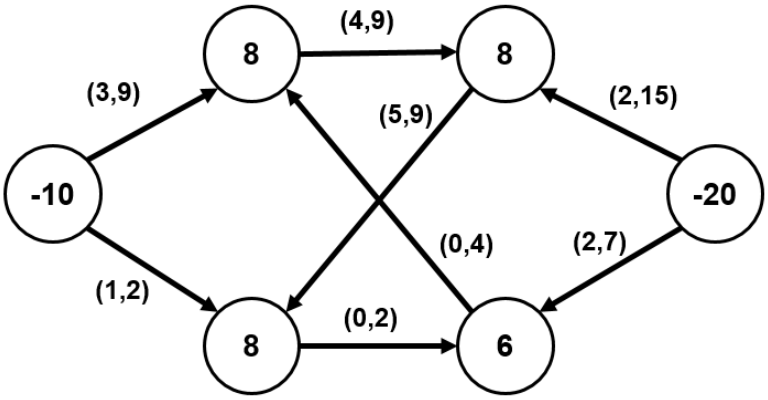
1. At a dinner party, there are n families $f_1, f_2, \ldots, f_n$ and m tables $t_1, t_2, \ldots, t_m$. The i-th family f_i has r_i relatives and the j-th table t_j has s_j seats. Everyone is interested in making new friends and the dinner party planner wants to seat people such that no two members of the same family are seated at the same table. Design an algorithm that decides if there exists a seating assignment such that everyone is seated, and no two members of the same family are seated at the same table. What would be a seating arrangement?

2. There are n students in a class. We want to choose a subset of k students as a committee. There has to be m_1 number of freshmen, m_2 number of sophomores, m_3 number of juniors, and m_4 number of seniors in the committee. Each student is from one of k departments, where $k = m_1 + m_2 + m_3 + m_4$. Exactly one student from each department has to be chosen for the committee. We are given a list of students, their home departments, and their class (freshman, sophomore, junior, senior). Describe an efficient algorithm based on network flow techniques to select who should be on the committee such that the above constraints are all satisfied.

3. A company has n locations in city A and plans to move some of them (or all) to another city B. The i-th location costs a_i per year if it is in the city A and b_i per year if it is in the city B. The company also needs to pay an extra cost, $c_{ij} > 0$, per year for traveling between locations i and j. We assume that $c_{ij} = c_{ji}$. Design an efficient algorithm to decide which company locations in city A should be moved to city B in order to minimize the total annual cost.

4. The edge connectivity of an undirected graph G = (V, E) is the <u>*minimum*</u> number of edges whose removal disconnects the graph. Describe an algorithm to compute the edge connectivity of an undirected graph.

5. Given the network below with the demand values on vertices and lower bounds on edge capacities, determine if there is a feasible circulation in this graph.



6. CSCI 570 is a large class with n TAs. Each week TAs must hold office hours in the TA office room. There is a set of k hour-long time intervals $I_1, I_2, \ldots I_k$ in which the office room is available. The room can accommodate up to 3 TAs at any time. Each j-th TA provides a subset of the time intervals he/ she can hold office hours with the minimum requirement of ℓ_j hour per week, and the maximum m_j hours per week. Lastly, the total number of office hours held during the week must be H. Design an algorithm to determine if there is a valid way to schedule the TA's office hours with respect to these constraints.