Homework #11

You should try to solve these problems by yourself. I recommend that you start early and get help in office hours if needed. If you find it helpful to discuss problems with other students, go for it. **The goal is to be ready for the in class quiz that will cover the same or similar problems.**

Problem 1: Base Station Connectivity

Consider a set of mobile computing clients in a town who each need to be connected to one of several possible base stations. We'll suppose there are n clients and k base stations; the positions of both clients and base stations are specified by (x, y) coordinates. For each client, we wish to connect it to exactly one of the base stations. Our choice of connections is constrained in the following ways:

- A client can be connected to a base station that is within distance r.
- No more than L clients can be connected to a single base station.

Design an efficient algorithm that determines whether every client can be connected simultaneously to a base station. Formulate the problem as a network flow problem. Briefly justify the runtime of the algorithm that you design.

Problem 2: Network Flow

You're given a set of n sensors with known positions represented by an (x, y) coordinate for each sensor. You want to design an algorithm that determines whether it is possible to choose a back up set for each of the n sensors (i.e., for each sensor, find k other sensors within d meters), with the added constraint that a single sensor can serve as a back up for at most b other sensors.

Formulate the problem as a network flow problem. This means define the vertices, edges, and capacities of the network flow graph *and* relate your rationale for the structure of the network flow graph to the original problem.