# CSE431/531, Problem Set 5 Due Wed. Dec. 5, in class

**Note:** There are 6 problems with a total of 100 points. You are required to do all the problems.

1. (30 points) In a wireless ad hoc network, all communications are carried out through radio broadcasting. If a device $A$ needs to send a message to another device $B$, it first broadcasts $M$, all other devices within the transmission range $r$ (i.e., inside the disk centered at $A$ and with radius $r$) can receive the message. Upon receiving the message, a device other than $B$ can either ignore the message or relay the message to $B$ by broadcasting the received message. The energy consumption of a broadcast is a function of the transmission range $r$ and roughly equals to $cr^\alpha$ for some positive constants $c$ and $\alpha$ with $2 \leq \alpha \leq 5$. The routing problem for device $A$ and $B$ in such a network is to determine the set of devices which need to broadcast the message and their respective transmission ranges so that certain objective function is minimized. Note that different devices may use different transmission ranges. (i) Suppose that we are given the coordinates of a set $P$ of wireless devices on a 2D plane. Design an algorithm to route a message from device $A$ to device $B$ so that the total energy consumption is minimized. You may assume that $c$ and $\alpha$ are known in advance. (ii) In a wireless network, it is possible that a broadcasted message may get lost even if there is a device within the transmission range. Let $p$ be the probability of a message getting lost during one broadcast. Design an algorithm to route a message from device $A$ ro device $B$ with minimum energy consumption and with a success probability is at least $p_0$ for some given constant $p_0$. (iii) A wireless device may be out of service due to running out of battery. Design an algorithm to determine the minimum number of devices which can be out of service so that we can still maintain the communication between devices $A$ and $B$. For this problem you may assume that all broadcasts use the same transmission range. You should make your algorithms run as fast as possible for all three problems.

2. (15 points) Problem 24-4 in textbook.

3. (15 points) Problem 24-6 in textbook

4. (10 points) Problem 25-1 in textbook

5. (15 points) Problem 26-1 in textbook

6. (15 points) Problem 26-2 in textbook