EECS 340, Breakout Session Notes, September 9, 2019

1. Begin by handing out the quiz. The students are to work alone with no notes, phones, etc. Collect the quiz at 3:40 so that you have 30 minutes to do the exercise below.

2. Ask the students to get in groups of 2 or 3 so they can work together to solve this problem: You will be driving from Cleveland to Seattle along Interstate 90. You have an internet mapping program that lists the location of every gas station on the route, and suppose that you want to make as few stops for gas as possible. Also, to save time when stopping, you will always have the tank filled completely while you are running into the station to buy supplies. Finally, suppose this is a rental car and the company required you to pay for a full tank of gas so you would like to complete the journey with as little gas left in the tank as possible. Assuming that you know the fuel efficiency of the vehicle, give an efficient algorithm to determine at which gas stations you should stop, in order to minimize both the number of stops you take and the amount of gas remaining in the car when you return the rental.

3. As mentioned in our meeting, have them work in groups, and then periodically have the groups share what they think the next step should be. The goal is for the groups working as separate groups and as the class as a whole figure out most of the task without your telling them. Here are the key points to try to lead them to.

4. The algorithm is greedy. This is like the art guard problem, but now you have to start at the Seattle rental and work backwards. Find the most distant gas station still reachable from your last stop and mark that one to fill up.

5. The proof is to compare it to an optimal solution. Suppose that (from Seattle), G and O use the same stops up to stop k, but now G and O stop at different stations. It is impossible for O to stop at a further station since the car cannot go that far on a single tank of gas. So O stopped at a closer station to Seattle than G. Change O to O' by moving the station stopped to the one G stops at. O' still uses the same number of stations as O, and as the station is moved closer to Cleveland, there is no chance for there to be a gap opened up in the stations between this station and Cleveland where the car can't make it.

6. The running time is O(n) assuming n stations are already pre-given to you by Google/Bing maps.