CSE 516: Homework 2

Due: February 27, 2014

Note: Please keep in mind the collaboration policy as specified in the course syllabus. If you discuss questions with others you **must** write their names on your submission, and if you use any outside resources you **must** reference them. Keep in mind that homework (in hardcopy) is due **at the beginning of lecture.** Grading will take into account how clearly you communicate your solutions, so please write your answers up carefully. There are six questions on two pages.

1. (20 points) **A very unfair final:** 15 people show up for the final exam in CSE 777, "Gamification". The instructor orders them by their current score in the class, with the person with the highest score first and the person with the lowest score last (there are no ties). So now let's say Student 1 is the highest scoring, Student 2 the second highest, etc. In this order, they play a splitting game of the following form. 100 points are to be split between the students, with only integer splits allowed. Student i gets to propose a split among all the remaining students (students i through 15). Now all the remaining students (i through 15) vote on the split. If it gets at least 50% of the votes (therefore, ties are broken in favor of the proposal) the proposal is accepted and the proposed split constitutes the scores of the students on the final. If the proposal is rejected, the student who proposed it receives an F for the course and leaves the game, and student $i+1$ gets to make the next proposal.

   (a) What is the (subgame perfect) outcome of this game?

   (b) How does this change if ties are now broken in favor of rejecting the proposal?

2. (20 points) **Scheduling game** Problem 2.3 in Chapter 2 of Parkes and Seuken (available on Piazza)

3. (15 points) **Network routing game** Problem 2.6 in Chapter 2 of Parkes and Seuken (available on Piazza)

4. (15 points) **Load balancing game** Problem 2.7 in Chapter 2 of Parkes and Seuken (available on Piazza)

5. (20 points) **On selling and rebuying** I'm auctioning off a book. Everyone in class receives a private signal s_i of the value of the book, and these signals are uniformly distributed in $[0, M]$. I'm going to run an auction where everyone gets to write down her or his bid b_i for the book on a piece of paper (along with his or her name), and put it in an envelope. I will sell the book to the highest bidder at her or his bid, b_i, but immediately buy it back from him or her at a price equal to the average of all the signals each individual received. Find a Bayes-Nash equilibrium for this game, where each bid b_i is a linear function of the received signal s_i.

6. (10 points) **Lawyers, money, and subgame perfection** Suppose the famous tech company Pear is contemplating suing Sam and Sons for patent infringement. It costs Pear c to initiate the lawsuit, and they have to pay a lawyer l_p. Meanwhile, Sam and Sons would have to pay l_s to defend themselves in court. The probability that Pear wins the lawsuit is p, and the expected payoff if it wins is x. In between initiating the lawsuit and taking it to trial, Pear can offer a settlement in which Sam and Sons pay s to have Pear drop the case. Draw out the game tree. Suppose $px < l_p$, what is the subgame perfect equilibrium of this game? What happens if Pear puts a lawyer on staff and has to pay them l_p regardless of whether they go to trial or not? In what circumstances would having a lawyer on staff be beneficial?