CSCI 570 - Fall 2016 - HW 1

1. Reading Assignment: Kleinberg and Tardos, Chapter 1.
2. Solve Kleinberg and Tardos, Chapter 1, Exercise 1.
3. Solve Kleinberg and Tardos, Chapter 1, Exercise 2.
4. State True/False: An instance of the stable marriage problem has a unique stable matching if and only if the version of the Gale-Shapely algorithm where the male proposes and the version where the female proposes both yield the exact same matching.
5. A stable roommate problem with 4 students a, b, c, d is defined as follows. Each student ranks the other three in strict order of preference. A matching is defined as the separation of the students into two disjoint pairs. A matching is stable if no two separated students prefer each other to their current roommates. Does a stable matching always exist? If yes, give a proof. Otherwise give an example roommate preference where no stable matching exists.
6. Solve Kleinberg and Tardos, Chapter 1, Exercise 3.
7. Solve Kleinberg and Tardos, Chapter 1, Exercise 4.
8. N men and N women were participating in a stable matching process in a small town named Walnut Grove. A stable matching was found after the matching process finished and everyone got engaged. However, a man named Almazo Wilder, who is engaged with a woman named Nelly Oleson, suddenly changes his mind by preferring another woman named Laura Ingles, who was originally ranked right below Nelly in his preference list, therefore Laura and Nelly swapped their positions in Almanzos preference list. Your job now is to find a new matching for all of these people and to take into account the new preference of Almanzo, but you don't want to run the whole process from the beginning again, and want to take advantage of the results you currently have from the previous matching. Describe your algorithm for this problem.
   Assume that no woman gets offended if she got refused and then gets proposed by the same person again.