



CS 312

Algorithm Design

Homework 1

Stable Matching

Due: January 30, 8:35 AM

1. (10 points) Use the Gale-Shapley algorithm in the text to find a stable matching for the following men and women, given the preference lists shown for each.

Man	Preference list
Adam	Eve, Greta, Hannah, Faith
Ben	Eve, Faith, Greta, Hannah
Caleb	Greta, Eve, Faith, Hannah
Dan	Faith, Eve, Hannah, Greta

Woman	Preference list
Eve	Ben, Caleb, Dan, Adam
Faith	Adam, Ben, Caleb, Dan
Greta	Caleb, Dan, Adam, Ben
Hannah	Ben, Dan, Adam, Caleb

2. (10 points) Do Chapter 1, Question 2 from the text.
3. (10 points) Do Chapter 1, Question 5 from the text. If your answer is that an algorithm exists, you need to also prove that the algorithm guarantees that it produces a matching that contains no instability.
4. (10 points) Do Chapter 1, Question 6 from the text. The trick to answering this question is to figure out how to map the problem onto the stable matching problem. To answer this question, be clear about what you are using as the two sets to do the mapping and how the preference list for each set is defined. Then, you need to explain why a stable matching corresponds to a truncated schedule that satisfies the conditions stated in the problem.

Note that the detail about when ships are at sea is important to this problem. Otherwise, the constraint that only 1 ship can be at a port becomes trivial. Each ship could just pick the last port on its schedule. By allowing a schedule to end with "port A; at sea" and "at sea; port A" means that more than one ship can want port A to be their last port.