

## Discussion 1

2/02/2018

Name:

You will be randomly assigned groups to work on these problems in discussion section. List your group members on your worksheet and turn it in at the end of class.

1. (10 points) **Stable Matching.** Consider the following stable matching instance.

College	Preferences	Student	Preferences
A	1 > 2 > 3 > 4	1	$D > B > C > A$
B	2 > 1 > 4 > 3	2	$A > D > B > C$
C	1 > 3 > 2 > 4	3	$A > B > C > D$
D	2 > 1 > 3 > 4	4	$D > C > A > B$

- (a) Run the Propose and Reject Algorithm on the following instance.  
(b) Find another stable matching in this instance.

2. **Asymptotics.** Assume you have functions  $f(n), g(n)$  such that  $f(n) = \Theta(g(n))$ . For each of the following statements, decide whether you think it is true or false and give a proof or counterexample.

(a)  $f(n) + g(n) = \Theta(\min(f(n), g(n)))$

(b)  $2^{f(n)} = \Theta(2^{g(n)})$

(c)  $f(n)^2 = \Theta(g(n)^2)$

3. **Graphs.** Give an algorithm to detect if an undirected graph contains a cycle. The algorithm should output one cycle if one exists in the graph and it should run in time  $O(m + n)$  for a graph with  $m$  edges and  $n$  nodes.