Homework 2
Networked Life (NETS 112)
Fall 2016
Prof Michael Kearns

Posted November 29, 2016. Due in hard-copy format at the start of lecture on Thursday, December 8. Please don't forget to write your name and staple the pages together.

Collaboration of any kind is NOT permitted on the homework.

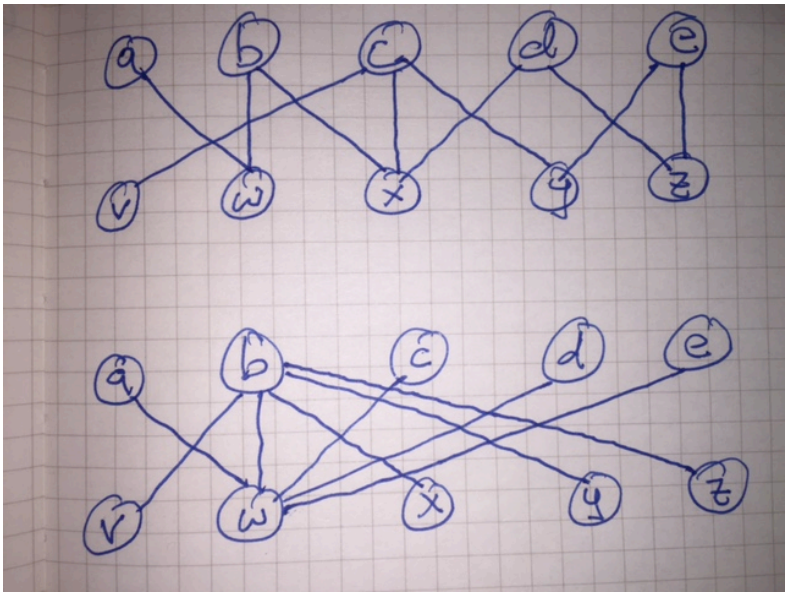
Your Name:

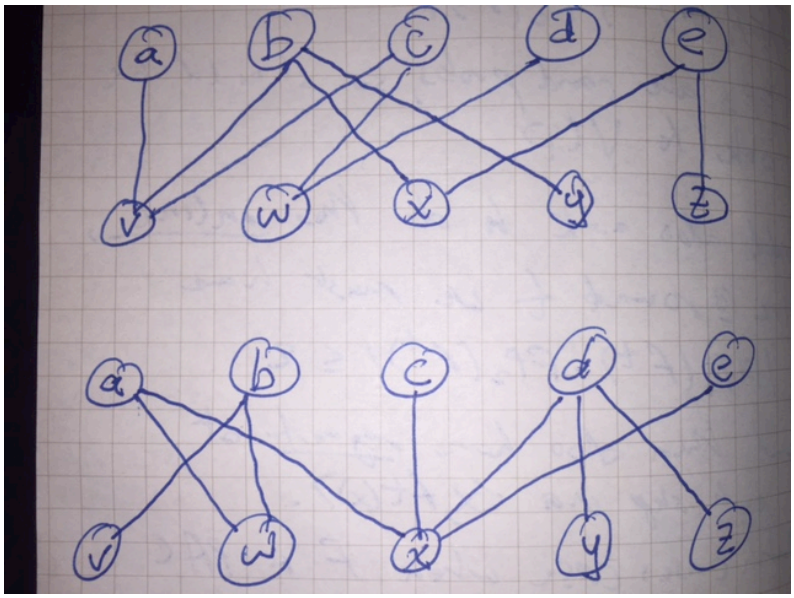
1. Give a concrete (numerical) example of a 2-player, 3-action game in which there is no pure Nash equilibrium, and in which (1/3, 1/3, 1/3) is not a mixed Nash equilibrium (and thus your game is not equivalent to Rock-Paper-Scissors). Give the (numerical) mixed Nash equilibrium of your game, and argue why there is no pure strategy equilibrium.

2. Give an example of a connected network with at least 6 vertices, and determine the minimum number of colors required for a proper coloring. (Recall that a proper coloring is an assignment of colors to vertices such that every vertex is a different color than all of its neighbors.) Show a proper coloring using this number of colors. Then show a Nash equilibrium of the coloring game on your network that is not a proper coloring.

3. Write a brief essay in which you apply ideas from Schelling's book to the behavioral experiments described in the required reading "Experiments in Social Computation". In particular, consider whether and when experiments resulted in "good" or "bad" equilibria, and what factors seem to have led to such outcomes. Discuss how useful equilibrium concepts were (or not) in predicting collective outcomes in the experiments.

4. For each of the four bipartite networks shown below, determine the equilibrium prices or exchange rates, and the patterns of trade on each edge at equilibrium.





5. Consider diagrams of the kind discussed in lecture and in Schelling's "Micromotives and Macrobehavior" for modeling activities in which the number of people participating at the current round (the y axis) is a function of the number participating at the last round (the x axis).

a. Carefully draw such a diagram in which there are 3 stable equilibria and 2 unstable equilibria.

b. Carefully draw such a diagram in which there are 3 stable equilibria and 4 unstable equilibria.

c. What can you say in general about the relationship between the number of unstable and stable equilibria in such models?

6. Consider the following variation of the Milk-Wheat exchange networks we have been examining. As before, players start with 1.0 units of their endowment good, but have utility only for the other good, and can only trade with their network neighbors. Now, however, the exchange rates are on the edges of the network rather than on the vertices --- that is, players can now offer different prices to different neighbors. Rationality still means that players will not trade with any neighbor that is not offering the lowest price in their neighborhood. Briefly discuss the ways in which you think this model will lead to different equilibrium outcomes than the original model. Give an example of a network in which the two models yield very different equilibrium wealths, and another example in which they yield the same equilibrium wealths.