Homework 2
Networked Life (NETS 112)
Fall 2015
Prof Michael Kearns

Updated November 25, 2015. Due in hard-copy format at the start of lecture on Tuesday, 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:

There is only one problem for this homework assignment, which is really more in the form of a mini-project. The project asks you to carefully and creatively map a real-life situation of your own choosing to the language and tools of formal game theory. The example you develop should be original, and not something that you read or found somewhere other your own imagination.

You should think of a real-life example of strategic interaction or confrontation involving two or more parties, and first describe in prose the setting for your example, the motivations for the players, the strategic tensions involved, etc.

You should then carefully express your chosen example as a payoff matrix with numerical entries for all players. Be sure to first describe all of the (pure) strategies or actions available to the players. Then specify the numerical payoff to each player under all possible joint actions. Alternately, if your game is too large or complex to literally write down all the payoff matrix entries (as it was in our network formation game), you can instead carefully describe your game as a function mapping joint actions to payoffs.

If you like, you may initially describe the payoffs abstractly using symbols or variables, as we did with α and β in our description of the network formation game. But you should eventually choose specific numeric values for these variables so you can do a concrete equilibrium analysis.

Be sure to make the connection between your prose description of the real-life scenario and your formal game matrix as clear and tight as possible. Don't just give a vague description of the scenario and a weak link to your game matrix.

Now that you have a game matrix, you should apply the analytical tools of game theory to analyze what "should" happen if "rational" players participate. In particular, give a careful analysis of all the Nash equilibria of your game. If your game has multiple equilibria, discuss the differences between them and whether all players or certain players might have a preference between them. Try to determine whether your game has any

mixed strategy equilibria (one resource for such analysis is here: http://cramton.umd.edu/econ414/chap04.pdf; you can probably find many others online).

Next you should compare the equilibrium payoffs of your game to the maximum social welfare solution --- that is, the maximum sum of payoffs achievable by any joint strategy of the players. Discuss whether this solution is in fact also a Nash equilibrium, and if not, how much worse off the players can be at equilibrium. Are there "good" and "bad" equilibria in your game?

Finally, give some discussion of how you think real people would behave in your real-life scenario, as opposed to what game theory predicts "should" happen. Do you think people would play a Nash equilibrium, and why or why not? If not, what do you think they would do? You might want to take into consideration some of the behavioral biases we discussed briefly in class, such as fairness and inequality aversion.

As only a very rough length guideline, I might expect your assignment to take about 3-4 pages in the format of this document. You will be graded on the following criteria:

- Originality and creativity of your motivating real-life example. Do not use any of the examples given in class, nor one that you find on the Internet, including those posted in the Fourth Column of the class website. You are encouraged to look at these for inspiration, however.
- Precision in the game-theoretic formalization of your example, including description of the pure strategies and numerical payoffs.
- Strength of the connection between your motivating example and your game-theoretic formalization.
- Correctness and completeness of your equilibrium analysis.
- Thoroughness and thoughtfulness of your comparison to the maximum social welfare solution and your discussion of behavioral considerations.