Simon Fraser University

Spring 2010

CMPT 882

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Ideas for Project Topics

I am open to your own projects and ideas, as long as you use game theory in a meaningful way. A common mistake to avoid is to work on a single-agent optimization problem (e.g., scheduling). If you would like some feedback in advance, I suggest that you come to my office hour or send me a brief description (1 or 2 paragraphs). To give you ideas, I list some broad categories of projects.

1. Implementations of Algorithms. We have discussed various algorithms. You could implement some, or extend existing implementations. There are quite a few libraries for game theory, for example in Matlab. One thing I haven't seen is an implementation of iterated weak dominance.

2. Applications to specific problems. A fruitful use of game theory would be an application to a CS problem that you are interested in. For example, you could design an auction for sales you want to support. Or you could study the design of a computer network from a game-theoretic point of view. This could be either a theoretical study or an empirical/implementation one.

a. For theoretical study, you may give a model of a network, and analyze its equilibria, or design a new correlated equilibrium for it.
b. On the empirical side, you might implement an algorithm and apply it. For instance, you could simulate evolutionary dynamics for a user community that you are interested in. I would be interested in a simulation of evolutionary dynamics for the KP network model to test an ESS prediction. Some of our colleagues in economics have computer implementation projects, for example Jasmina Arifovic.

3. A survey or synthesis of a few related papers on a topic of interest to you. For example, you could summarize current developments on combinatorial auctions or network models, or survey algorithms for computing Nash equilibria.

4. A theoretical research project. This might look at mathematical questions in game theory. For instance, determining the computational complexity of computing solution concepts, or applying learning theory to repeated games. For instance, the computational complexity of finding an ESS is not particulary well understood.
Here's a specific research question. Many situations in which users access a common system can be modeled as congestion games. An important theorem states that every congestion game can be characterized by a potential function. If you know the potential function, it can tell you a lot about the character of the system under investigation. We will be talking about a common

network routing model called the KP model, which in some circumstances can be seen as a congestion game. What is the potential function for the KP model? This question relates to some research I'd like to do in the future, so I'm really interested.

5. If you cannot think of anything of interest to you, we could consider an additional assignment. This would be more difficult than the assignments we've had, more on the level of the final exam, it would focus on the last part of the course, and I would expect a nice write-up.