Optional Projects
for
Game Theory
Fall 2021

Projects are divided into two types, theoretical and implementations. In theoretical projects, you should read a text (papers, textbooks) about the subject and prepare a 20-min lecture in which you will use slides. You should also hand in a package including references you used, the slides and a typed report. Groups of at most two persons are permitted.

In the implementation projects, you have to implement a computational task. The software and platform you are using is optional, however you are not allowed to use codes and toolboxes available on the web, unless in case of prior communication (unclaimed use of others' codes is instance of plagiarism and has negative point). Groups are not allowed.

To get a project, you have to send an email to rjavadi@iut.ac.ir with the subject "GT project", including your name, your student number and the project title. You can choose at most one project of first type and any number of projects of second type. If your desired subject is not included here, you can communicate your proposed one.

Projects Titles (Lectures)

1. The Computational Complexity of Computing a Nash Equilibrium: PPAD-Completeness Results

2. Graphical Games

3. Market Models and their Equilibria

4. Cryptography and Game Theory

   - Rational Fairness in Cryptographic Protocol Design

5. Basics of Mechanism Design, VCG Mechanisms

6. Design of Auctions

7. Secretary Problems and Their Applications.

   - A multiple-choice secretary algorithm with applications to online auctions
   - Improved algorithms and analysis for secretary problems and generalizations
   - Matroid secretary problem in the random assignment model

8. Fixed-parameter-tractable Algorithms and Game Theory

   - On the computational complexity of coalitional resource games
   - Parameterizing the winner determination problem for combinatorial auctions
   - Easy and hard coalition resource game formation problems

9. The Price of Anarchy

10. Evolutionary Game Theory

11. Incentives and Pricing in Communications Networks

12. Applications of Stable Marriage Problem and related problems

Implementations

1.
   - Write a program which gets a zero-sum game and computes its value and optimal strategies.
   - Write a program which gets a general-sum two-person game and analyze cooperative theory for it (find agreement point, threat strategies and profit-sharing policy).

2.
   - Write a program which gets a general-sum two-person game and depicts the convex-hull of all feasible payoff vectors.
   - Write a program which gets a general-sum n-person game and returns all payoff vectors obtained by pure strategies which are Pareto-optimal.

3. Write a program which gets a characteristic function and computes the core, the Shapley value and the Nucleolus.

4. Read about an algorithm computing Nash equilibrium of a general-sum two-person game (e.g. Lemke-Howson Algorithm) and implement it.

5.
   - Write a program which gets a game in extensive form and convert it to the normal form.
   - Write a program which gets a game in extensive form and find all its subgame-perfect Nash equilibria.

6.
   - Write a program which gets an atomic congestion game and find a pure Nash equilibrium.
   - Write a program which gets a non-atomic congestion game and find the flow equilibrium and optimal flow and price of anarchy.

7.
   - Write a program which gets the preference matrix of boys and girls and find a boy-optimal and a girl-optimal stable marriage.
   - Implement top trading cycle algorithm, which gets preferences of the agents and outputs a stable permutation.

8. Othello-Game.

   - Read about the game in Wiki or Google and implement the game including a computer player. Note that in your algorithm, the computer should use the Minimax strategy for winning.