Homework 1

EL-GY 9123 – Game Theory for Multi-Agent Systems

Fall 2014, New York University

Due Date: Sept. 26, 2014

Reading Assignment 1. Read [BO] Chapters 2 and 3. You can find similar topics in Chapters 1-3 of [GO] and Chapter 1 of [FT] and [RB].

Reading Assignment 2. Read the following papers:

- John F. Nash, ”Equilibrium Points in n-person Games,” Proc. National Academy of Sciences, 36(1):48-49, Jan. 15, 1950.
- John Nash, ”Non-Cooperative Games,” Annals of Mathematics, 54(2):286–295, Sept. 1951.
- Robert J. Aumann, “Correlated Equilibrium as an Expression of Bayesian Rationality,” Econometrica, 55(1):1-18, January 1987.
- Roger B. Myerson, “Nash Equilibrium and the History of Economic Theory,” J. Economic Literature, 37(3):1067-1082, Sept. 1999.
- “The Work of John Nash in Game Theory,” Nobel Seminar, Dec. 8, 1994. `http://www.nobelprize.org/nobel_prizes/economic-sciences/laureates/1994/nash-lecture.html`
- Julia Robinson, “An Iterative Method of Solving a Game,” Annals of Mathematics, 54(2):296-301, Sept. 1951
- Jeff S. Shamma and Gurdal Arslan, “Dynamic Fictitious Play, Dynamic Gradient Play, and Distributed Convergence to Nash Equilibria,” IEEE Trans Automatic Control, 50(3):312-327, March 2005.

Problem 1. Problem 1 from [BO], page 70.

Problem 2. Problem 2 from [BO], page 70.

Problem 3. Problem 6 from [BO], page 70.

Problem 4. Problem 7 from [BO], page 154.

Problem 5. Obtain all pure-strategy Nash equilibrium solutions of the following bi-matrix game, where both players are minimizers.

$$P1: \begin{bmatrix} 8 & -4 & 8 \\ 6 & 1 & 6 \\ 12 & 0 & 0 \\ 0 & 0 & 12 \\ 0 & 4 & 0 \end{bmatrix}, \quad P2: \begin{bmatrix} 0 & -4 & -4 \\ -4 & -4 & 0 \\ -4 & 0 & -4 \\ -4 & 0 & -4 \\ -4 & -3 & -4 \end{bmatrix},$$

Problem 6. Obtain all pure- and mixed-strategy Nash equilibrium solutions of the following bi-matrix game, where both players are minimizers:

$$P1: \begin{bmatrix} 5 & -7 \\ -6 & -4 \end{bmatrix}, \quad P2: \begin{bmatrix} -2 & 5 \\ 4 & 2 \end{bmatrix}.$$

Problem 7. Use fictitious-play algorithm to solve the following zero-sum matrix game. Player 1 (row player) is the minimizer while Player 2 (column player) is the maximizer.

$$\begin{bmatrix} 2 & 3 & 5 & 2 \\ 4 & 1 & 0 & 3 \\ 5 & 6 & -1 & 6 \end{bmatrix}$$