Programming Assignment - Introduction to Game Theory

Spring 2026

Kindly note the following instructions before starting the assignment.

- This is a group assignment.
- You have to attempt any one of two questions.
- Kindly note that the following problems can be solved using brute force. If a team uses brute-force, they should program in C (any other language will lead to negative marks). C, C++, Python programming languages are allowed if the submission uses the Lemke–Howson / any other algorithm.

1 PSNE and Very Weakly Dominant Strategies for n-Player Game

Given an n-player game, list all PSNE and very weakly dominant strategies for each player. We are given n-the number of players, $|S_i|$-the number of strategies for each player $i \in \{1, 2, \ldots, n\}$.

1.1 Input Format

- First line contains the number of players n.
- Second line contains n numbers, i^{th} number representing $|S_i|$.
- Next line contains the payoffs in the NFG format (described in the Gambit Project).

1.2 Output Format

- First line should contain the number of PSNE (denoted by n_{psne}).
- Followed by n_{psne} lines, the i^{th} line containing n space-separated numbers corresponding to the equilibrium strategies for each player respectively.
- Next, you should output n lines, with the i^{th} line listing the number of very weakly dominant strategies for the i^{th} player followed by the dominant strategies.

1.3 Constraints

- $n \prod_i |S_i| \leq 10^6$.
- 60 seconds per test case.
- Memory limit: 1GB.

2 Find Nash Equilibria of a Bimatrix Game

Given a bimatrix game, find Nash equilibria of the bimatrix game. If there are multiple Nash equilibria, output in any order.

2.1 Input

The input is a non-degenerate bimatrix game with the payoffs listed in the NFG format (as described in the Gambit Project).

- First line contains the number of strategies for the row player (R).
- Second line contains the number of strategies for the column player (C).
- The third line contains the list of payoffs in the NFG format.

2.2 Output

The first line must contain the number of equilibria (denoted by n). You are required to output only $R + C$ equilibria if they exist.

- The next $2n$ lines must contain the description of the n equilibria as follows:
  - $(2i + 1)^{th}$ line contains the R floating point numbers $\in [0, 1]$ denoting the probability that the row player should play the R strategies respectively.
  - $(2i + 2)^{th}$ line contains the C floating point numbers $\in [0, 1]$ denoting the probability that the column player should play the C strategies respectively.

2.3 Constraints

- $R \times C \leq 25$.
- Time limit: 60 seconds.
- Memory limit: 1GB.