Homework #2

Deadline: Monday, 17 April 2023, 13:00

Submit your solutions for (up to) three of the following four exercises. If you solve all four, we will consult a random number generator to decide which three to look at and grade.

Exercise 1 (10 points)

We have seen that iterated elimination of strictly dominated strategies is order-independent. Show that the same is *not* true for the iterated elimination of weakly dominated strategies.

Exercise 2 (10 points)

In class we had discussed the following hierarchy of solution concepts for normal-form games:

$$\text{Dom} \subseteq \text{PureNash} \subseteq \text{Nash} \subseteq \text{CorrEq} \subseteq \text{IESDS}$$

We had seen (straightforward) proofs for the first three 'inclusions', but not for the last one. Express the claim symbolised by 'CorrEq $\subseteq$ IESDS' as a theorem. Then prove that theorem.

Exercise 3 (10 points)

We saw examples where a correlated equilibrium of a normal-form game intuitively seems 'better' than any of its Nash equilibria. For the Nash equilibria we had to choose between either an equal distribution of expected utility between the players or a high sum of expected utilities, while for the correlated equilibrium we could get both. In particular, the sum of expected utilities in the correlated equilibrium was *at least as high* as it was in any of the Nash equilibria, while at the same time also achieving perfect equity between the players.

This exercise is about showing that we can do even better. Find a game and a correlated equilibrium for that game where the sum of the expected utilities is *strictly higher* than for any of the Nash equilibria of the same game.

Exercise 4 (10 points)

Write a program to compute the set of all (mixed and pure) Nash equilibria of a given normal-form game with two players and two actions per player. The exact specification of the task (e.g., how to represent games in the input and how to report (possibly infinite) sets of equilibria in the output) is up to you, as is the choice of programming language.

Designing an algorithm that systematically covers every possible case is not straightforward. Full marks will be given for well-presented solutions that work correctly at least in those cases where the game in question has only finitely many equilibria, provided your report includes a brief discussion of what would be required to turn this into a general solution.