Midterm exam: Instructions and study guide

ENM140, Game theory and rationality 2017

Contents

1   Purpose, format, and rules

The midterm exam is intended to test your understanding of the basic game-theoretic concepts covered in weeks 1–3. The study guide is Section 3 below details what you are expected to know for the exam.

Exam format and grading

- The exam will consist of 36 statements, of which 18 will be true (correct) and 18 will be false (wrong). Your task is to mark the true statements on a form.

- The 36 statements will be divided into groups, where each group has some background information that is common to all the statements in the group.

- You will be given 95 minutes (no break) to complete the exam.

- Your exam score is calculated as follows:

  (number of true statements marked true)−(number of false statements marked true)

  In other words, true statements that you mark as true are awarded 1 point, and false statements that you mark as true give 1 point deduction.

- The maximum score is $+18$ and the minimum is -18. You must be awarded at least $+6$ points to pass the exam. Your exam score contributes directly to your total course score that is used to calculate your grade on the course (i.e., the exam contributes at most 18 points to your course score).

Other rules

- The exam will be given in two lecture rooms on Monday 20 November 10:00–11:45. You must show up in one of the rooms (see TimeEdit) no later than this time to be seated, or you will not be allowed to take the exam.

- You must write your full name and personnummer (Swedish ID number) on the exam form. You must also present a valid photo ID, i.e., a passport, Swedish driver's licence or other approved identification document that specifies citizenship and period of validity.

- You may only use a pen or pencil and an eraser. Specifically, no electronic equipment, no books, and no notes are allowed.

- In addition to the form, we will provide paper for you to make notes, calculations, etc., during the exam. Hence, you only need to bring a pen or pencil and optionally an eraser.

2 Example questions

Group 1

Consider the Prisoner's dilemma game with symmetric payoff matrix:

	C	D
C	3	0
D	5	1

Mark the statements that are true:

☐ The only Pareto optimal situation is (C,C)

☑ The only pure Nash equilibrium is (D,D)

☑ There are only pure strategy Nash equilibria in this game

☑ (C,D) is Pareto optimal

☑ The game can be represented in extensive form

Group 2

Consider the infinitely repeated game where the stage game is the Prisoner's Dilemma with payoff matrix as in Group 1 above, and with no discounting, i.e., so that the average payoff over all rounds is used.

Mark the statements that are true:

☑ There is a pair of strategies resulting in playing (D,D) in all rounds that is a Nash equilibrium

☐ There is a pair of strategies resulting in playing (C,C) in all rounds that is a Nash equilibrium

☐ There is a pair of strategies resulting in the average payoff 0.75 for player 1 and the average payoff 4 for player 2 that is a Nash equilibrium

☑ There is a pair of strategies resulting in the average payoff 1.25 for player 1 and the average payoff 3.75 for player 2 that is a Nash equilibrium

3 Study guide

The midterm exam will cover materials from the following sections of the course book by Leyton-Brown and Shoham. The exam will use notation and terminology from these sections.

- Chapter 1 (all)

- Chapter 2 (all)

- Sections 3.3 and 3.8

- Chapter 4 (all)

- Section 5.1

- Sections 6.1 and 6.2

Specifically, the exam will test that you understand and can apply concepts from the following list of topics:

- Agents, actions, strategies, action profiles and strategy profiles

- Normal form and extensive form

- Pure and mixed strategies

- Zero-sum and non-zero-sum games

- Pareto optimality

- Best response

- Nash equilibrium:

  - Define and identify pure strategy and mixed strategy Nash equilibria in simple two-player games

  - Know and be able to apply Nash's 1951 theorem on existence of Nash equilibrium (Theorem 2.3.1 in the course book)

- Domination: only strict domination is included. You need to be able to define strict domination and use the concept to perform elimination/removal of dominated strategies as in Section 3.3 of the course book.

- Sequential games:

  - Know the difference between perfect-information and imperfect-information extensive-form games

  - Subgame-perfect equilibrium in perfect-information sequential games

- Understand and apply backward induction in sequential games

- Repeated games:

  - Finitely and infinitely repated games

  - Infinitely repeated games with average payoff: Understand and apply the Folk theorem as stated in the course book (Theorem 6.2.5)

- Evolutionary game theory:

  - Evolutionarily stable strategy (ESS)

  - Understand the relationship between ESS and Nash equilibrium as stated in Theorem 3.8.3 and Theorem 3.8.4.