Doctoral Program in Economics

UNIVERSITÀ DEGLI STUDI FIRENZE | UNIVERSITÀ DI SIENA | UNIVERSITÀ DI PISA

Academic year 2023/24

GAME THEORY

Period:

Second term: January/February 2024

Course hours:

20

Teachers:

Annalisa Luporini (10), Stefano Vannucci (10) (doc. resp.)

Exam methods:

Written exam

Prerequisite

Mathematics

First Module: Non-Cooperative Game Theory (Annalisa Luporini)

Programme

Representation forms: information and strategies, extensive form and strategic form. Solution concepts: dominated strategies, rationalizability, Nash equilibrium. Equilibrium refinements: backward induction, subgame perfection, perfect Bayes-Nash equilibrium, sequential equilibrium, trembling hand perfection, forward induction. Repeated games and Folk Theorems. Classes of games: prisoner dilemma, stag hunt, hawk-dove, centipede game, public goods game, ultimatum game, dictator game.

Educational objectives

Learn the methods and techniques of non-cooperative game theory, and the ability to apply them to represent and understand socio-economic phenomena

Bibliographical references

Fudenberg D, Tirole J. : Game Theory. MIT Press 1991.
Lecture slides will be made available.

Second Module: Game Formats and their Solutions (Stefano Vannucci)

Games as data structures to model multi-agents. Game formats: strategic, extensive, coalitional.
Games in stategic form: basic syntax: players, outcomes, strategy sets, strategic outcome function, preferences on outcomes). Examples of strategic games: 2x2 bimatrix games, generalized second price auctions, majority voting games with endogenous pseudorandomized choice of the president role, majority judgment games, random dictatorship games, competition by differentiation game. Solution theories for games: noncooperative, cooperative and hybrid. Noncooperative solution rules: Nash equilibrium and dominant strategy equilibrium. Mixed extension of finite strategic games, expected utility theory. The Nash

equilibrium existence theorem: statement and sketch of proof via the Kakutani fixed point theorem. Further noncooperative solution rules: strict Nash equilibrium, rationalizable strategy profiles, iteratedly non-weakly-dominated strategy profiles. Cooperative solution rules for strategic games: strong Nash equilibrium, coalitional equilibrium and the core of a game. Correlated equilibrium of a finite strategic game. Basic properties of correlated equilibrium. Mixed Nash equilibria as correlated equilibria. Convexity of the set of correlated equilibrium payoff profiles of a finite strategic game. Coarse correlated equilibrium of a finite strategic game, and the `competition by differentiation' game as an example. Evolutionary games and evolutionary game theory: a very short introduction. Evolutionarily stable strategies: two equivalent definitions, some elementary properties, and examples.
Coalitional game forms and games. Alpha-effectivity function and beta-effectivity function of a game in strategic form: examples. Properties of effectivity functions. Examples: voting games and 2x2 bimatrix ames. Two-sided matching: introduction. Two-sided matching games in coalitional form. Matching games and the deferred acceptance protocol. Solution rules for coalitional games: the core and VNM-stable sets.

Educational Objectives
This module provides a basic presentation of the main game formats, emphasizing their syntax and some of their main applications in mechanism design.

Bibliographical References:
M.Osborne, A. Rubinstein: A Course in Game Theory, MIT Press
T. Roughgarden: Algorithmic Game Theory, Cambridge University Press.