Thursday 5

Sylvain Sorin
Lectures.
Introduction to equilibria in games

1 Basic results
1.1 Strategic game. Definition, mixed extension, best reply correspondence
1.2 Equilibrium. Definition, examples
1.3 Existence. Brouwer, pure, mixed equilibria, symmetric game
1.4 Finite games. Nash's proof, semi-algebraic aspects
1.5 Supermodular games. Tarski
1.6 Examples: minmax principle, minority game, congestion games and Wardrop equilibria

2 Complements
2.1 Equilibria and variational inequalities finite games, C^1 games, population games
2.2 Nash maps and dynamics
2.3 Manifold of equilibria
2.4 Potential games
Examples and dynamics

3 Extensions
3.1 Correlated equilibria. Information structure, canonical representation, existence's proof
3.2 Incomplete information games. Bayesian equilibria, distributional strategies

Rida Laraki
Lectures.
Lecture 1: Existence of Nash equilibria in discontinuous games
In this lecture, we will prove some classical results on existence of Nash equilibria.
1. Better reply security (Reny).
2. Continuous security (Barelli-Meneghel).
3. Necessary and sufficient conditions (Baye Tian and Zhou).

Lecture 2: Existence of alternative solution concept in discontinuous games
In this lecture, we prove existence of some relaxations of Nash equilibrium (that coincide with Nash when the game is continuous).
1. Reny equilibrium.
2. Approximate equilibrium
3. Endogenous sharing rules.

4. Strategic approximation.
5. Applications.

Friday 6

John Hillas
Lectures.
Normal and Extensive Form Refinements.
(1) Extensive Forma Games
• Perfect Recall, Imperfect Recall, and Nonlinear Games
• Pure Strategies, Behaviour Strategies, Mixed Strategies, and General Strategies
• The Normal Form
• Kuhn Equivalence and Kuhn's Theorem
(2) Admissible Equilibria and Normal Form Perfect Equilibria
(3) Backward Induction
• Subgame Perfect Equilibria
• Selten Extensive Form Perfect Equilibria
• Quasi-Perfect Equilibria
• Sequential Equilibria
• Proper Equilibria
(4) Invariance
(5) The Need For Set-Valued Solutions
(6) Forward Induction
(7) Introduction to Strategic Stability.

Dries Vermeulen
Lectures.
 Strategic Stability.
(1) Kohlberg-Mertens requirements
(2) The need for set-valued solutions
(3) Kohlberg and Mertens Stability
(4) Variants of the definition: quasi-atability; full stability
(5) Best reply stability
(6) CKM and equivalence with best reply
(7) Homology groups
(8) Definition of Mertens
(9) Minimal diversity games, some proofs + discussion
(10) The example of an anonymous referee

Monday 9

Alejandro Jofré
Lectures.
Equilibrium, approximation and convergences

1. Bi-functions and maxInf points
2. MaxInf points examples: complementary problems, Variational inequalities, fixed-points, Nash and Walras equilibrium
3. Lopsided convergence
4. Approximate maxInf points and its convergence
5. Tight lopsided convergence and approximate equilibrium convergence
6. Ky-Fan inequality extension and applications of lopsided to variational inequalities, Nash and Walras equilibrium.
7. Computing equilibrium points

Tristan Tomala
Lectures.
Lecture 1. Revision games.
In a revision games, players maximize the payoff from their actions implemented at a given deadline. Prior to the deadline, they may receive revision opportunities, which arrive according to some continuous-time jump process. Actions can influence stochastic state variables, and players can control the intensity of arrival.
This lecture will review recent results for existence of equilibrium and provide characterizations results. In particular, synchronous models where all players revise actions simultaneously have multiple equilibria. These are drastically different from asynchronous models where equilibria are essentially unique.

Lecture 2. Cheap-talk and persuasion games.
This lecture will focus on sender-receiver games where an informed player sends a costless message to an uninformed player who takes an action. We will first study one-shot cheap-talk games and characterize the equilibrium outcomes. Then, we will consider different dynamic settings: the long-cheap talk case where the sender can send messages repeatedly about the same state, the repeated cheap-talk games, where the sequence of states follows and i.i.d. (or Markovian) process.
Then, we will study persuasion games where the sender chooses a Blackwell experiment without knowing the realized state.

Tuesday 10

Andy Mc Lennan
Lectures.
1. Brouwer and Kakutani via imitation games.
2. Degree, fixed point index, and vector field index for smooth functions (regular case) in Euclidean context. C. Sard's theorem, and extensions of index- degree to continuous functions.
3. ANR's: definition and infinite dimensional examples, Kinoshita's example of a contractible compact set without the fixed point property, approximation of compact ANR's by simplicial complexes, extension of the index using Commutativity.
4. Approximation of contractible valued correspondences by functions.
5. Conditional systems and sequential equilibria as fixed points of a contractible valued best response correspondence.
6. Dynamic stability and relation to index.

Srihari Govidan
Lectures.
1. The structure theorem for Nash equilibria
2. Definition of the degree of Nash equilibria
3. Equivalence of index and degree
4. Components of equilibria with non-zero index
5. Global Newton methods
6. The structure theorem for extensive-form games

Wednesday 11

Bernhard von Stengel
Lectures.
Lecture 1. Finding Nash equilibria of bimatrix games
1. Mixed equilibria
2. Best response condition
3. Upper envelope diagrams
4. The Lemke-Howson algorithm
5. Odd number of Nash equilibria!
6. Nondegenerate bimatrix games
7. Handling degenerate games
8. Endpoints of equilibrium-finding paths have opposite index

Lecture 2. Efficient computation of equilibria for extensive games
1.Games in extensive form
2. Strategic form of a game tree
3. Reduced strategic form
4. Exponential blowup of (reduced) strategic form
5. Use behavior strategies
6. Realization plans
7. The sequence form
8. Kuhn's theorem via linear program
9. Best responses - LP duality
10. LCP - Lemke's algorithm for the sequence form

Yannick Viossat
Lectures.
Lecture 1: dynamics and stability
1. Nash mass action interpretation.
2. Derivation of game dynamics (replicator, Smith, best-reply)
3. Folk Theorem of evolutionary game theory.
4. Convergence results: ESS. Stable games. Potential games.
5. Divergence results: Rock-Paper-Scissors games and variants.
Time-allowing:
6. Learning dynamics (fictitious play, no-regret dynamics, trial and error à la Young)
7. Stochastic stability.
8. A problem with equilibrium selection: dynamics leading to different equilibria.

Lecture 2: structure of the set of equilibria
1. Nash equilibria and Nash equilibrium payoffs.
1a) Zero-sum games
1b) Bimatrix games, maximal Nash subsets, characterization of sets of equilibrium payoffs.
1c) N-player games: generic case, semi-algebraicity, richness of the possible equilibrium sets, and characterization of sets of equilibrium payoffs.
2. Correlated equilibria, and links with Nash equilibria.
2a) Zero-sum games
2b) Bimatrix games: extreme Nash equilibria are extreme correlated equilibria.
2c) N-person games: Nash equilibria are on the boundary of the correlated equilibrium polytope.
2d) Joint characterizations of sets of Nash and correlated equilibrium payoffs
3. Evolution of the equilibrium set as payoffs vary.
3a) Upper-semi continuity
3b) Arbitrarily close games with arbitrarily different equilibrium payoffs.
3c) Is having a unique equilibrium robust?