

Topic

The purpose of this part of course is to teach students to formulate problems as mathematical games and provide the basic tools to solve them. We will cover:

- Two-person zero sum games. We will start with the Strategic Form of a Game, analyse the so-called Matrix Games. We will talk about players, payoffs, strategies, etc. and the actual solving of Finite Games. We will also discuss the Extensive Form of a Game.
- Two-person general sum games. Noncooperative and Cooperative theory. The main concept in noncooperative theory is the strategic (or Nash) equilibrium. The cooperative theory is itself broken down into two branches: Transferable Utility models, in which side payments are allowed; and Non-Transferable Utility models, in which we assume that the payoffs of each player have distinct monetary units. In the latter case, the main concept is the Nash bargaining model.
- Games in coalitional form. Here we consider Many-Person Transferable Utility (Cooperative) Games. We will discuss ways to reach an agreement on a fair division. The central concepts are those of Imputations, the Core and The Nucleolus. We will also talk about the Shapley Value and, in particular, the Shapley-Shubik Power Index.

Textbooks

The main textbooks are Part II and Part III of

Game Theory (lecture notes), Thomas S. Ferguson, Math Department, UCLA.

electronically available at http://www.math.ucla.edu/~tom/Game_Theory/Contents.html;
Chapter 4 of

An Introduction to Game-Theoretic Modelling, Michael Mesterton-Gibbons, AMS,
2nd ed, 2000.

and Chapters 1-10 of

Strategies and Games - Theory and Practice, Prajit K. Dutta, The MIT Press, 1999.

The latter can be replaced by any book with an emphasis on the application side of game theory.

Homework Assignments

There will be two homework assignments

- Problem exercises on two-person games.
- Model real situation in game theoretic terms.

Detailed Program

In units of one hour we will cover the program as follows.

Class, Date	Content	References
01, Nov 06	Introduction. The strategic form of a game.	[TF,2.1]
02, Nov 06	The minimax theorem. The principle of indifference.	[TF,2.2+3]
03, Nov 06	Solving finite games. The extensive form of a game.	[TF,2.4+5]
04, Nov 06	Review and sketch proof of selected exercises.	[TF,2]
05, Nov 06	Bimatrix games. Safety levels.	[TF,3.1]
06, Nov 06	Noncooperative games (Nash equilibria)	[TF,3.2]
07, Nov 10	Models of duopoly (Cournot)	[TF,3.3]
08, Nov 10	Cooperative Games (with TU and with Non TU)	[TF,3.4]
09, Nov 10	Review and sketch proof of selected exercises.	[TF,3]
10, Nov 10	Games in coalitional Form. Characteristic functions.	[MM,4.1]
11, Nov 11	Imputations and the Core.	[MM,4.2,3]
12, Nov 11	Coreless games	[MM,4.4]
13, Nov 11	The Nucleolus	[MM,4.5]
14, Nov 11	Improper games	[MM,4.6]
15, Nov 11	The Shapley value functions. The Shapley-Shubik power index.	[MM,4.7+8]
16, Nov 11	Review and sketch proof of selected exercises	[MM,4]

Thus, we will cover most of what is covered in the first two references. Copies of the MM reference will be made available.