



## Course information 2011–12

### MT3040 Game theory (half course)

This half course is an introduction to the main concepts of non-cooperative game theory, and how they are used in modelling and analysing an interactive situation.

#### Prerequisite

If taken as part of a BSc degree, courses which must be passed before this half course may be attempted:

MT105a Mathematics 1 *and* MT105b Mathematics 2 *or*  
MT1174 Calculus

#### Aims and objectives

This half course is designed to:

- familiarise students with formal methods for strategic analysis
- develop the mathematical theory of games as used in economics.

#### Essential reading

The subject guide itself is the essential reading for this course. Additional reading is recommended.

#### Learning outcomes

At the end of this half course and having completed the essential reading and activities students should have:

- ✓ knowledge of fundamental concepts of non-cooperative game theory
- ✓ the ability to apply solution concepts to examples of games, and to state and explain them precisely
- ✓ the ability to solve unseen games that are variants of known examples.

#### Assessment

This half course is assessed by a two hour unseen written examination.

Students should consult the *Programme Regulations for degrees and diplomas in Economics, Management, Finance and the Social Sciences* that are reviewed annually. The Prerequisites, Exclusions, and Syllabus are subject to confirmation in the *Regulations*. Notice is also given in the *Regulations* of any courses which are being phased out and students are advised to check course availability.

## Syllabus

This is a description of the material to be examined, as published in the *Regulations*. On registration, students will receive a detailed subject guide which provides a framework for covering the topics in the syllabus and directions to the essential reading.

This half-course is an introduction to game theory. At the end of this half-course, students should be familiar with the main concepts of non-cooperative game theory, and know how they are used in modelling and analysing an interactive situation. The key concepts are:

- Players are assumed to act out of self-interest (hence the term 'non-cooperative' game theory). This is not identical to monetary interest, but can be anything subjectively desirable. Mathematically, this is modeled by a utility function.
- Players should act strategically. This means that playing well does not mean being smarter than the rest, but assuming that everybody else is also 'rational' (acting out of self-interest). The game theorist's recommendation how to play must therefore be such that everybody would follow it. This is captured by the central concept of Nash equilibrium.

- It can be useful to randomise. In antagonistic situations, a player may play best by rolling a die that decides what to do next. In poker, for example, it may be useful to bet occasionally high even on a weak hand ('to bluff') so that your opponent will take the bet even if you have a strong hand.

Topics covered are:

- Combinatorial games and Nim.
- Game trees with perfect information, backward induction.
- Extensive and strategic (normal) form of a game.
- Nash equilibrium.
- Commitment.
- Mixed strategies and Nash equilibria in mixed strategies.
- Finding mixed-strategy equilibria for two-person games.
- Zero sum games, maxmin strategies.
- Extensive games with information sets, behaviour strategies, perfect recall.
- The Nash bargaining solution.
- Multistage bargaining.