UNIVERSITY OF LONDON | INTERNATIONAL PROGRAMMES

Course information 2018–19
MT3040 Game theory (half course)

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

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

MT2116 Abstract mathematics **and**
(MT1174 Calculus
or *(MT105a Mathematics 1* **and**
MT105b Mathematics 2)
or *MT1186 Mathematical methods)*

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.

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.

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

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

Students should consult the appropriate *EMFSS Programme Regulations*, which are reviewed on an annual basis. The *Regulations* provide information on the availability of a course, where it can be placed on your programme's structure, and details of co-requisites and prerequisites.

Syllabus

This is a description of the material to be examined. 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.