Course Information

The pre-requisite of the course is ECON1001 Introduction to Economics I. Students are required to take ECON1001 before taking ECON0106.

Course Overview

This course is an introduction to game theory. Prior knowledge of game theory is not required. It is not suitable for students who have already completed a full course on game theory. Otherwise, students from different disciplines, e.g. economics, business, social sciences, law, science, and engineering, are welcome (provided that you have fulfilled the pre-requisite).

The course is example driven, which means that examples are usually used to introduce new concepts. However, it is not a soft course. Nor is it non-mathematical. Some results are derived using calculus and Bayes’ rule. When we use calculus and Bayes’ rule, I will remind you what they are. But I will not teach them in this course, because they are not used often. Basic algebra is used most often. The point is that strict logical argument is always used.

The course is divided into two parts. The first part consists of basic game theory and the second part extends the abstract theory in the first part to
more specific contexts. In other words, the first part is more theoretical and the second part more applied. In the first part, we start with sequential games (instead of simultaneous games). Sequential games mean that players “move” sequentially. The key idea for a rational player to play optimally in these games is to be “forward looking”. The logic that incorporates the idea of forward looking in sequential games is called “backward induction” and the corresponding equilibrium concept is “subgame perfect equilibrium”.

After we finish sequential games, we proceed to simultaneous games. In simultaneous games, players move simultaneously. It should be clear that the logic of backward induction is not relevant for simultaneous games, because there are no sequential moves in simultaneous games. Consequently, subgame perfect equilibrium is not appropriate for simultaneous games and a new equilibrium concept is needed. Indeed, coming up with a general equilibrium concept for simultaneous games is a fundamental breakthrough in game theory. To appreciate how this concept is developed, some partial solutions are offered first. For example, games like the “prisoners’ dilemma” can be solved by identifying the “dominant strategy” of the suspects. The concept of dominant strategy is further generalized to “successive elimination of dominated strategies”.

Another example is the class of “zero-sum games”. (Many people mistake all games to be zero-sum.) Zero-sum games are restrictive. For example, you cannot use a zero-sum game to analyze win-win situations, or mutual beneficial exchanges in economics. Nonetheless, zero-sum games do highlight the strategic interaction between two players. (By the way, zero-sum games are most meaningful in the two-player context. But “non-zero-sum” simultaneous games and sequential games are easily generalized to more than two players.) The “minimax approach” is developed to solve zero-sum games. If you are able to master the minimax approach, you will appreciate why John Nash has a “beautiful mind”.

In this course, we interpret the beautiful mind of John Nash as “Nash equilibrium”. Nash equilibrium is a powerful equilibrium concept that is used to solve non-zero-sum games. Indeed, Nash equilibrium is so powerful that you could apply it to essentially all classes of games, including zero-sum games, sequential games, other games in this course and those beyond the purview of this course. That is why John Nash has a beautiful mind. Two versions of Nash equilibrium will be introduced: “pure strategy” and “mixed strategy”. It is usually difficult for people to appreciate the concept of mixed strategy. It may be easier if you view mixed strategy as random strategy. Note that it is random in the statistical sense (as a random variable), instead of being irrational.
The last two topics in Part I are to put sequential and simultaneous games together, which is used to analyze strategic moves such as “threats”, “promises”, and “commitments”. Part I is summarized in the course schedule below, which also lists the topics in Part II.

Course Schedule

<table>
<thead>
<tr>
<th>Part I: Basic Theory</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Sequential Games</td>
<td>Chapter 3</td>
</tr>
<tr>
<td>2. Simultaneous Games: Pure Strategies</td>
<td>Chapters 4, 5</td>
</tr>
<tr>
<td>3. Simultaneous Games: Mixed Strategies</td>
<td>Chapters 7, 8</td>
</tr>
<tr>
<td>4. Sequential-Simultaneous Games</td>
<td>Chapter 6</td>
</tr>
<tr>
<td>5. Strategic Moves</td>
<td>Chapter 10</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Part II: Extensions</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>6. Prisoners’ Dilemma</td>
<td>Chapter 11</td>
</tr>
<tr>
<td>7. Collective Actions</td>
<td>Chapter 12</td>
</tr>
<tr>
<td>8. Evolutionary Games</td>
<td>Chapter 13</td>
</tr>
<tr>
<td>9. Uncertainty and Information</td>
<td>Chapter 9</td>
</tr>
<tr>
<td>10. Optional Topics</td>
<td></td>
</tr>
</tbody>
</table>


Course Objectives

- To introduce game theory at the undergraduate level
- To help students appreciate how various equilibrium concepts are related
- To illustrate how to apply game theory in different contexts

Intended Learning Outcomes

Upon completion of the course, students should be able to:

- Formulate strategic problems as sequential and/or simultaneous games
- Understand various equilibrium concepts and how they are related
- Apply game theory in specific contexts

Assessment

The assessment of the course consists of four components: tutorial participation (10%), mid-term examination (20%), term paper (20%), and final
examination (50%).

**Tutorial participation (10%)**

The keyword is *participation*. Tutorials offer a small-class, interactive learning environment to supplement large lectures and help you develop their (oral) communication skill.

**Mid-term examination (20%)**

The mid-term examination will cover the first part of the course. *It will be held on October 23, 2008 (Thursday) from 2:10–3:40pm at LE2.*

**Term paper (20%)**

You are required to submit an individual term paper. In the term paper, you are expected to write an application of the game theory you learn in this course. The application can be related to economics, business, politics, sports, or other daily life observations. You are not allow to repeat the examples used in this course in your term paper. However, if you can come up with an interesting twist to our examples, feel free to borrow our examples in your term paper. The term paper also develops your (written) communication skill. *It should not be more than 3,000 words.*

*The term paper is due on December 1, 2008 (Monday) at 5:00pm. Please submit your term paper to the SEF office on the 9/F of K K Leung. Electronic submission is not allowed.*

**Final examination (50%)**

Final examination is a comprehensive examination focusing on the second part of the course. The final examination is scheduled by the Examination Unit of the university. The university will notify you your examination schedule. The examination period is from December 8–20, 2008.

*There is no early examination for this course (including exchange students).*