Course syllabus and schedule

1. (MM) T. Schelling: Micromotives and Macrobehavior, 1978, W. W. Norton and Company.
2. (SC) T. Schelling: The Strategy of Conflict, 1980, Harvard University, Cambridge, Massachusetts.

These are required reading and the exam is based on both books and the lectures.

- Lecture -1. Some basics of game theory: Normal form games.
- Lecture 0. Some basics of game theory: Sequential form games.
- Lecture 1. Chapters 1 in MM.
- Lecture 2. Chapters 2-3 in MM.
- Lecture 3. Chapter 4 in MM.
- Lecture 4. Chapter 5 in MM.
- Lecture 5. Chapters 6-7 in MM.

- Lecture 6. Chapter 1 in SC.
- Lecture 7. Chapter 2 in SC.
- Lecture 8. Chapter 3 in SC.
- Lecture 9. Chapter 4 in SC.
- Lecture 10. Modern formulations of some of the preceding ideas.

Some basic game theory

- In the first two lectures we go through some basics of game theory.
- You are supposed to ponder upon the writings and ideas of Schelling using this machinery.
- This material corresponds to modern text books in game theory.
- Many of the Schelling's ways of expressing ideas or analysing strategic situations are a little old fashioned; this should not present problems.

Normal form games

- This is a way of depicting games where the order of making decisions is not important.
- The interpretation is that players make their choices simultaneously, or that they do not know what others have chosen at the time of their own decisions.
- We consider mostly two-player games; the extension to n-player games is straightforward.

- Players are called $P1$ and $P2$.
- They have action/choice/strategy sets $A1$ and $A2$.
- If the players' choices are a_1 and a_2 their utilities are

$$u_1(a_1, a_2)$$

and

$$u_2(a_2, a_1)$$

- The players' objective is to attain as high level of utility as possible

$$max_{a \in A_1} u_1(a, a_2)$$

- Notice that for some reason in the maximisation it is assumed that $P1$ knows, or expects, $P2$ to choose action a_2.
- If $P1$ does not know what $P2$ is going to choose then s/he must have expectation about $P2$'s choices (probability distribution over $A2$).
- Otherwise one cannot formulate the problem of the players.
- This is solved by the solution concept of Nash-equilibrium.

Definition

A Nash-equilibrium is a pair of choices $(a_1, a_2) \in A1 \times A2$ such that a_1 is a solution to $max_{a \in A1} u_1(a, a_2)$ and a_2 is a solution to $max_{a \in A2} u_2(a_1, a)$.

Prisoners' dilemma

	c	d
c	$2,2$	$0,3$
d	$3,0$	$1,1$

- Here one choice, d, is a dominating one, and the Nash-equilibrium is (d, d).

Battle of the sexes

	bo	*ba*
bo	$2,1$	$0,0$
ba	$0,0$	$1,2$

- Here the man wants to go to a boxing match, and the woman to the ballet; however, the most important thing is that both get to go together to a same place.
- There are two Nash-equilibria.

Co-ordination game

	l	r
l	$9,9$	$0,0$
r	$0,0$	$1,1$

- The most important thing is to make the same choice as the other player.
- There are two Nash-equilibria.

Congestion game

	l	r
l	$-1,-1$	$1,1$
r	$1,1$	$-1,-1$

- The most important thing is to make a choice different from the other player's choice.
- There are two Nash-equilibria.

Matching pennies

	h	t
h	$-1,1$	$1,-1$
t	$1,-1$	$-1,1$

- Two players choose simultaneously either heads or tails.
- If both choose the same player1 loses one euro and player2 gets one euro.
- If they choose differently then payoffs go the other way.
- There is no Nash-equilibrium in this game.
- However, there is so called mixed strategy Nash-equilibrium.
- We shall go into this in more detail later.

- Let us think about some examples.
- Two persons arrive simultaneously at a very narrow doorway from opposite directions. Who goes first?

- Two persons simultaneously and secretly write a number on a paper.
- Then they reveal the numbers and the person with the highest number wins.
- What is the Nash-equilibrium?

- The governments of two neighbouring countries decide on tax policy.
- Both would like a high tax rate if the other chooses a high tax rate because this way they can steal the most from the people.
- But if one chooses a high tax rate and the other a low, then the latter can attract business from the former country which then suffers.

- Two ladies ponder about getting a really fancy dress for the independence day party.
- There is a particular specimen of which two units are available.
- If both ladies happen to choose the same dress it will be an embarrasment, and on top of that, because it is such a wonderful piece of clothing, it costs a lot.
- If a lady chooses a lesser dress it is certain that she will not attract any attention, perhaps does not even get her picture in the newspapers.

Equilibrium is about expectations

- Consider the battle of the sexes game.
- If the row player, man, expects the column player to choose *bo* he chooses *bo*.
- If the column player, woman, expects the row player to choose *ba* she chooses *ba*.
- Both make the maximising choice given their expectations.
- But the outcome does not qualify as Nash-equilibrium.
- For the Nash-equilibrium it is not enough to maximise but to have correct expectations, too.

Rationality

- We assume that the players are rational.
- This means that they make optimal choices given their information/expectations.
- As demonstrated above, Nash-equilibrium requires more, namely, correct expectations.
- How do the players come to the correct expectations?
- The concept of Nash-equilibrium is silent about this.
- There are many stories about how to achieve the equilibrium but at the present we do not say more about this.