

ECON 2112 Notes

Week 1, 19/2/19

Normal form games and Nash equilibrium

Game theory

Game theory

- **Game theory** deals with strategic situations involving multiperson decision problems
- A strategic situation (**game**) is one in which 2+ individuals (**players**) interact and jointly determine the outcome
 - Typically, every player can modify the outcome but does not have full control
- The aim of game theory is to provide at least one **solution** for every game
 - A **solution** is a set of recommendations about how to play the game, such that no player has **incentive** not to follow these recommendations (i.e. the solution is **stable**)
- Assumptions:
 - Players have common knowledge about the structure of the game
 - Players choose their strategies independently
 - Players may be able to communicate at a specified cost

Normal form games with pure strategies

Normal form games

- In a **normal form game**, players take decisions simultaneously
- Components of **normal form games**:
 - Players – n players ($i = 1, \dots, n$)
 - A strategy set for each player (S_1, \dots, S_n) where $S_i = \{s_{i1}, s_{i2}, \dots\}$
 - Players' preferences over possible outcomes – i.e. a specific **payoff** ($u_i(s_1, \dots, s_n)$) for each player and each **strategy profile** (s_1, \dots, s_n) (combination of strategies from all players, where s_1 is a particular strategy in player 1's strategy set S_1)

Definition (Normal Form game)

An n -player normal form game $G = (S_1, \dots, S_n; u_1, \dots, u_n)$ consists of

- for each player $i = 1, \dots, n$, a set of strategies S_i ; and
- for each player $i = 1, \dots, n$ a utility function u_i that, for each strategy profile $(s_1, \dots, s_n) \in S_1 \times \dots \times S_n$ specifies a real number $u_i(s_1, \dots, s_n) \in \mathbb{R}$.

- Payoffs relating to each strategy profile can be represented in a **payoff matrix**

	<i>Not Confess</i>	<i>Confess</i>
<i>Not Confess</i>	-1, -1	-9, 0
<i>Confess</i>	0, -9	-6, -6

- A **strategy profile** is the combination of (P1 strategy, P2 strategy)
- Row player's **payoffs** are typically on the left, column player's on the right