Advanced Microeconomics II

Introduction To Game Theory

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Games

A game is a description of strategic interaction that includes what the player's can do (actions) and what they like (preferences).

- Games can be cooperative or non-cooperative.
- Non-cooperative games can be *static* (strategic) or *dynamic* (extensive).
- Games can have *complete* information or *incomplete* information.

This course will focus on non-cooperative games.

Game Theory

Game Theory is set of tools used to better understand multi-person decision theory.

- Assumes strategic rationality - (individuals pursue well-defined objectives taking into account other people's behaviour.).

You will learn

- the terminology of game theory,
- how to formally model a given strategic setting,
- how to use different solution concepts to explain individual behaviour.

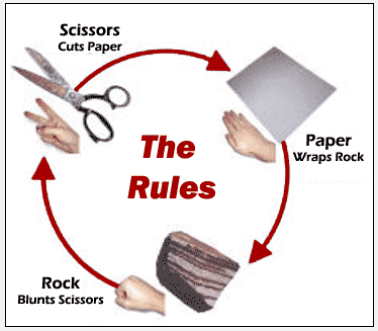
Non-Cooperative Games and Their Solution Concepts

- Static Games of Complete Information
  - Concepts: Nash equilibrium, Rationalizability
  - Applications: Co-ordination Game, Prisoner's Dilemma, Battle of the Sexes
- Dynamic Games of Complete Information
  - Concepts: Sub Game Perfection, Repeated Games
  - Application: Bargaining
- Static Games of Incomplete Information
  - Concept: Bayesian Nash Equilibrium
  - Application: Auctions
- Dynamic Games of Incomplete Information
  - Concepts: Sequential Equilibrium, Perfect Bayesian Equilibrium
  - Applications: Adverse Selection, Moral Hazard

Matching Pennies

- Each player has a penny. They each secretly choose a side of the coin to reveal and then they reveal their coins simultaneously.
- If the penny faces match, the second player gives the first player $1.
- If the penny faces do not match, the first player gives the second player $1.

Rock, Paper, Scissors



- On the count of three, two people use their hands to make a symbol.
- The loser pays the winner $1, no money changes hand if there is a tie.

Pure Coordination Game

My wife and I both like watching movies and football together. We like watching movies more than football.

- If we watch movies together we both receive $3.
- If we watch football together we both receive $1.
- If we watch different things, neither of us receive any benefit.

Battle of the Sexes

My wife and I have agreed to meet for dinner. However, neither can remember if we should meet at my favourite restaurant for rice or her favourite restaurant for noodles.

- If we both go for rice, I receive a benefit of $3, my wife receives a benefit of $1.
- If we both go for noodles, I receive a benefit of $1, my wife receives a benefit of $3.
- If we go to different restaurants then neither of us receive any benefit.

Stag Hunt

Two hunters independently choose whether to hunt for a stag or a rabbit.

- If they can catch a stag they both receive a large benefit of $10 but it requires both hunters to do it.
- If only one hunter tries to catch a stag he will be unsuccessful and receive nothing.
- Hunting rabbits guarantees a modest benefit of $3.

Chicken

Two car drivers play "chicken" - they start driving head-on towards each other and choose whether or not to swerve.

- If neither swerves, they crash and suffer lots of damage ($10,000).
- If only one player swerves, then he loses and is labelled a chicken ($10 damage), while the winner enhances is reputation ($10 benefit).
- If both swerve then it is a tie and there is no benefit or loss to either player.

Hawk/Dove

Two animals are contesting for a resource with value, V. Each animal can act in either an aggressive (Hawk) or peaceful (Dove) manner.

- If both are Hawks then they fight, which costs each animal $C/2$ ($C > V$) and they share the resource evenly.
- If both are Doves there is no conflict and they share the resource evenly.
- If one is a Hawk and the other is a Dove then the Hawk obtains the resource without fighting and the Dove receives nothing.

Prisoner's Dilemma

Two criminal are being questioned by police in separate rooms about a burglary.

- If they both confess to the crime, they receive 5 years in jail.
- If one confesses and one denies, the confessor is released and the denier receives 10 years in jail.
- If the both deny, they both receive 1 year in jail for a lesser charge.

Cournot Competition

Two firm compete in the same market.

- They can produce costlessly.
- They face a market demand schedule, $P(Q) = 1 - Q$.
- They choose how much to produce.
- The equilibrium price is the market clearing price.

Bertrand Competition

Two firm compete in the same market.

- They can produce costlessly
- They face a market demand schedule, $P(Q) = 1 - Q$.
- They choose how much to charge for their product.
- If they charge a lower price than their competitor, they capture the market.
- If they charge a higher price than their competitor they sell nothing.
- If they charge the same price as their competitor they evenly share the market demand.

First-Price Auction

There is one seller and N buyers.

- For bidder i the object is worth v_i.
- Bidder i knows only his own value of the good.
- Bidders submit their bid.
- The highest bidder wins the item and pays the highest bid.
- Everybody else gets nothing.

Second-Price Auction

There is one seller and N buyers.

- For bidder i the object is worth v_i.
- Bidder i knows only his own value of the good.
- Bidders submit their bid.
- The highest bidder wins the item and pays the second highest bid.
- Everybody else gets nothing.

Education and the Labor Market

There is a firm and a worker.

- Workers are either productive or unproductive but firms cannot tell the difference.
- There is a competitive labour market so firms pay workers their expected productivity.
- Before starting to work, workers can receive costly education.
  - Education has no effect on productivity.
  - Education is less costly for low cost workers than high cost workers.