

Why do we study game theory?

- we have selfish agents or self-interested agents, which optimize their own objective functions.
- Goal of Mechanism Design: encourage selfish agents to act socially by designing rewarding rules such that when agents optimize their own objective, a social objective is met.

How do we study these systems?

- First model the system (usually a network) as a game
- we analyze equilibrium points and then compare the social value of equl. points to global optimum

An equilibrium point or just equil. is a state in which no person involved in the game wants any change. more precisely an equil. is simply a state of the world where economic forces are balanced and in the absence of external influences the (equil) values of economic variables will not change.

Two Important class of Equilibrium: Nash equil and Market equil.
we introduce both of them in this session (or maybe the next) and give some important results for them. (first Nash and then Market)

change the order

Important Factors:

- Existence of equil as a subject of study
- Performance of the output (Approximation Factor)
- Convergence (Running time) ← Computer Science
- Lack of coordination in networks and equilibrium concepts
- Price of Anarchy (or stability) in basic scenarios (and balancing game, selfish Routing games, congestion games, market sharing games, network creation games, network formation games, etc.
- Coordination Mechanisms to obtain better price of Anarchy
- Convergence and best response dynamics and their outcomes e.g. in sink
- Market Equil. and applications e.g. in wireless networks
- Interdomain routing and stable paths problems, Gale-Ryserford Conditions
- Auctions, VCG, truthfulness, Sponsored Search Auctions, Online Auction
- Cost sharing, privacy and complexity (hardness)

Some important game theory concepts (some of them will be discussed in this course)