

title: Game Theory

code: CS4501

category: PME

credits: 3-0-0-3

prereq: []

consent: Required

Learning Objectives

The main objective of this course is to introduce the fundamental tools of game theory, a few equilibrium concepts, apart from numerous exercises. During this course, we will also look at applications from a variety of disciplines and delve into some of the fascinating mathematics that underlies game theory. This course begins with an introduction into Game Theory. It then introduces strategic and extensive form games. Subsequently, we will move onto understanding/designing a few games and mechanisms. Finally, we will explore games and concepts that have a societal aspect to them.

Learning Outcome

Upon successful completion of this course, students are expected to:

- Differentiate between different types of games
- Identify various equilibria within games
- Gain knowledge about fundamental concepts of non-cooperative and cooperative game theory
- Explain precisely, and apply solution concepts to examples of games
- Retain and apply the mathematical concepts discussed over the duration of the course.

Syllabus

- **Introduction:** motivation, theory of rational choice, utility functions
- **Strategic form games:** definition, examples, dominant strategy equilibria, pure strategy Nash equilibrium, mixed strategy Nash equilibrium, existence of Nash equilibrium, potential games, games with infinite strategy space, zero sum games, minimax theorem, Braess paradox, price of anarchy.
- **Extensive form games:** definition, examples, games of imperfect information,

games of incomplete information, repeated games, the folk theorem of average payoffs

- **Designing games and mechanisms:** Fair division, stable matching and allocation, auctions, truthful auctions in win/lose settings, Vickrey-Clarke-Groves mechanism, scoring rules, matching markets
- **Cooperative games:** Transferable utility games, the core, the Shapley value, Nash bargaining
- **Social choice and voting:** Voting and ranking mechanism, Arrow's Impossibility Theorem, The Gibbard-Satterthwaite Theorem, desirable properties of voting and ranking

Textbooks

1. Anna R. Karlin and Yuval Peres, **Game Theory, Alive**, American Mathematical Society, Apr 27, 2017, ISBN-13: 978-1470419820 [Available Online].

References

1. Siddharth Barman and Y. Narahari, **Game Theory Lecture Notes** [Available online at <http://lcm.csa.iisc.ernet.in/gametheory>]
2. Roger B. Myerson, **Game Theory: Analysis of Conflict**, Harvard University Press, September 1997, ISBN-13: 978-0674341159.
3. Martin J. Osborne, **An Introduction to Game Theory**, Oxford University Press, 2003, ISBN-13: 978-0195128956.
4. D. Fudenberg and J. Tirole, **Game Theory**, Indian Edition by Ane Books, 2005, ISBN-13: 978-8180520822.

Meta Data

- Offering Faculty : Albert Sunny
- Department / Centre : Computer Science and Engineering
- Programme : B.Tech
- Proposal Type: New Course
- Offerings: S5 and S7, Jul-Nov 2018