

CTYI GAME THEORY: COURSE SUMMARY 2021

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INTRODUCTION

Game theory is the study of mathematical models of conflict and cooperation arising when rational, intelligent decision-makers (“players”) compete against one another according to a predefined set of universally agreed upon rules. This course was intended to serve as an introduction both to the spirit and mathematics of the subject where we studied *games* and their application to real life scenarios. The following is a brief overview of how the course was organised and what we tackled over the last two weeks.

1. UNIT I

- *Some simple games.* We played some games and then determined mathematically what the winning strategies were.
- *The Euro Auction, $\frac{2}{3}$ -the-average, Tic Tac Toe, Ultimate Tic Tac Toe, and the Prisoner’s Dilemma.*
- *The History of Game Theory* and the three major contributors.

2. UNIT II

- *The Dark Knight & Game Theory.* We began to look at how one can apply game theory in real life or fictional situations.
- *The Ferry Exercise: does morality matter?*
- *Intuitive examples of games & approaching the definition of a Nash equilibrium.* We developed more serious mathematics used to calculate optima.
- *Analysing some simple games: the Grade Game, Battle of the Saxons, Kylo’s Dilemma.*

3. UNIT III

- *An introduction to some technicalities.* We explored the definition of a “Nash equilibrium” in more detail, and introduced technical concepts such as “action profiles”, “best responses”, “preference relations” and “payoff functions”.
- *Strategic games & what we can learn from them.*
- *The game of Hex.* We analysed Hex in detail, by playing some games, talking about good strategies, then proving mathematically that in Hex there is always exactly one winner and loser, and that there exists a winning strategy for the first player (but no one knows what it is for 11×11 boards).

4. UNIT IV

- *The Cuban Missile Crisis, Chicken, & Alternative.* We developed game theory for non-simultaneous games, using the “theory of moves” to define nonmyopic equilibria.

- *The 2016 US Presidential Election Debates, and Brexit Lobbying in the 2015 UK Government.* We applied the theory of moves to model these historical events.
- *Guest speaker: Dr. Leeanne Hinch.* You know Leeanne as the fun Academic Coordinator of CTYI, but did you know she is also the top female player of *Magic: The Gathering* in Ireland? Leeanne introduced to us the rules, gameplay and culture of *Magic: The Gathering*.

5. UNIT V

- *Werewolf.* We looked at the gameplay and game theory behind this popular party game.
- *Miscellaneous topic, chosen by the students.*
 - *Evolutionary Biology & Game Theory.* See links on our Google classroom page.
 - *Game Theory in the Media.* The Iran-Israeli conflict over nuclear power, the Iran hostage crisis, the EU-Astrazeneca vaccine dispute, and other student-led examples of applying game theory in real life.