CTYI GAME THEORY: COURSE OUTLINE 2020

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Introduction

Welcome to the CTYI course *Game Theory.*

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 is intended to serve as an introduction both to the spirit and mathematics of the subject where we will study *games* and their application to real life scenarios. The following is a brief outline of how the course is organised and what I hope we can tackle in the coming weeks.

1. Monday

- *Introducing me, you, and game theory.* We begin by introducing everyone and everything.
- *Some simple games.* We will play some games and then determine mathematically what are the wining strategies.
- *The Euro Auction,* $\frac{2}{3}$*-the-average, Ultimate Tic Tac Toe,* and *the Prisoner's Dilemma.*

2. Tuesday

- *Intuitive examples of games & approaching the definition of a Nash equilibrium.* We will develop more serious mathematics used to calculate optima.
- *Analysing some simple games: the Grade Game, Battle of the Saxes.*
- *The Dark Knight & Game Theory.* We will begin to look at how one can apply game theory in real life or fictional situations.

3. Wednesday

- *An introduction to some technicalities.* We'll explore the definition of a "Nash equilibrium" in more detail.
- *Strategic games & what we can learn from them.*

4. Thursday

- *The game of Hex.* This will be our first in-depth analysis of a game.
- *The Cuban Missile Crisis, Chicken, & the nuclear capability of Iran in 2012.* We develop game theory for non-simultaneous games, using the "theory of moves" to define nonmyopic equilibria.

5. Friday

- *Mixed-strategy Nash equilibria.* How to always win the game (from a probabilistic viewpoint).
- *Miscellaneous topic, chosen by the students.* We will make a deeper study of a topic covered previously. The choices are:
  - *The mathematics & graph theory behind Hex/the Brouwer Fixed Point Theorem.*
  - *Evolutionary Biology & Game Theory.*
  - *Debate: Should the U.S. have invaded Iraq?* (Debating from a game-theoretic standpoint.)
  - *Game Theory in the Media.* (Applying our mathematics to Star Wars, the 2016 U.S. presidential election, Brexit, the Princess Bride, the Cold War & other examples.)
  - *Analysing other simple games.* Bagh-Chal (AKA Tigers & Goats), Order-and-chaos, etc.