

# Game Theory

John Nash John Forbes Nash Jr. (June 13, 1928 – May 23, 2015) was an American mathematician who made fundamental contributions to game theory, differential geometry, and the study of partial differential equations.

Any interaction between multiple people in which each person's payoff is affected by the decisions made by the other

- multiple players
- interact
- reward
- players act rationally
- personal self interest

Relevant games and players

Poker

Economist, political sciences, psychology etc

Types of finite games:

- cooperative/ non-cooperative
- competitive: winner and losers

## The prisoner's dilemma

Wanda and fred (No communication)

DEA

- if you confess to the crime and your partner doesn't you will be granted immunity: partner stays 10 years in jail
- Both confess : dirt talk about each other : 10 years for each of you in jail
- Neither confesses: both spends 2 year in jail

Wanda and fred are split up, no loyalty.

	Dont confess	confess
dont confess	2/2	10/0
Confess	0/10	5/5 (solution)

## Nash equilibrium

A player in a game has found nash equilibrium when they make the choice that leaves them better off no matter what their opponents decide to do.

## Cooperative games (works towards to common goal)

Group of players in a cooperative game

- fairness

## Shapley value

- A method of dividing up gains or costs among players according to the value of their individual contribution.
- [#1](#) contribution of each player is decided by what is gained or lost by removing them from the game (Marginal Contribution)
- 3 friend making cookies, you decided not to go (50 less cookies)
- [#2](#) Interchangeable players have equal value
- 2 parties bring the same thing to the coalition they should have to contribute the same amount, & should be rewarded for their contribution equally. (same food same bills)
- [#3](#) If a member of the coalition contributes nothing then they should receive nothing. (Maternity leave)
- [#4](#) if a game has multiple parts, cost or payment should be decomposed across those parts. (different work different pay)
- [#5](#) individually 10, 20: combine 40 how to divide the earnings.
- friend marginal contribution : 30()remove your 10 (10 cookies/hr)
- your marginal contribution : 20()remove your 20 (20 cookies/hr)
- Average the numbers together  $30/2 = 15$ , friend gets 25

In competitive situation game theory tells you how to be smart

In cooperative situation game theory tells you how to be fair

Humans thrive in cooperation, Game theory can be used in most challenging decision of life and closest relationships.

You come across a situation in life try to find:

Rational players

Self interest

Rules of the game

Dominant strategy

Find the Nash Equilibrium

If all are not met : change the game (step aside and play other games )

**Winners are the ones who know how  
to play!**

References

<https://www.youtube.com/watch?v=7szPBZxBlg4>

<https://www.youtube.com/watch?v=MHS-hTjGgSY>

Images References:

<https://www.history.com>

(Vietnam War and World War 2)

Cheating Image : [Here](#)

Wanda And Fred animations: <https://www.youtube.com/watch?v=MHS-hTjGgSY>