

## A different example



Goal: divide the cake such that each kid is happy with his/her portion.

Kid<sub>1</sub> thinks that he got at least half of the cake. in their view  
Kid<sub>2</sub> thinks she got at least half of the cake.

Notion of at least half is subjective.

A third party, e.g., the mother, may not know what is at least half.

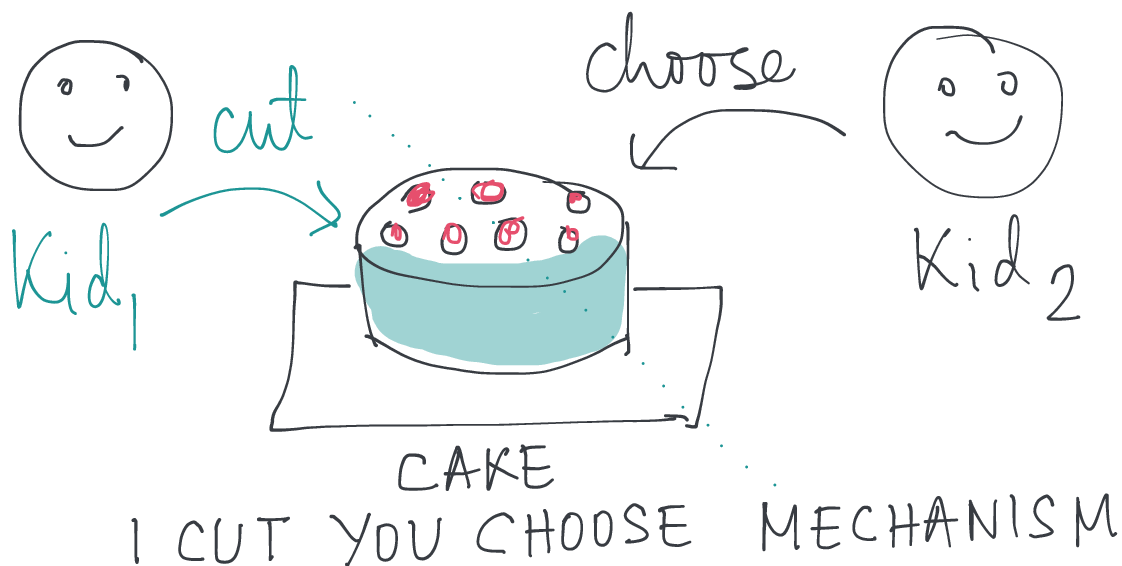
What if one kid complains after the mother made a division?

## Challenge:

- o The mother wants to achieve a "fair" division
- o Does not have enough information to do it (doesn't see the cake through kids' views)
- o Does not know what is a fair division

## Question:

Can she design a **mechanism** with that incomplete knowledge to achieve a fair division?



Why does this work?

Kid<sub>1</sub> will divide it equally in his view

- o because, if not, Kid<sub>2</sub> may pick the bigger one.
- o hence he is indifferent between the two pieces.

Kid<sub>2</sub> will pick the bigger one in her view.

## Mechanism Design: Inverse Game Theory

- o Start with an objective
- o Design a game, such that the "reasonable" outcome of that game satisfies that objective.
- o Provides a prescription

Why should we design a game?

Sports tournaments generally have groups

Round robin in every group - top 2 qualifies

Is this a good tournament design?

World Cup Football (Soccer) 1982, Group II

Teams: Austria, Algeria, West Germany, Chile

Game 1: Algeria beat West Germany 2-1 : shock

Game 2: Austria beat Algeria 2-0

Game 3: Algeria beat Chile 3-2

Algeria was almost going to be the first African team to qualify for knock out

But W. Germany and Austria made contract - Austria lost - Disgrace of Gijon.

## Course outline

Non-cooperative game theory

Mechanism design

Applications (interspersed)

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## Takeaways

- Apply principles of Economic Theory and computation to understand incentives in social systems and on the internet.
- Build a taste for mathematical description of social problems
- Make deployable AI system that does it automatically.

## Self contained course materials

- o Game Theory : Maschler , Solan , Zamir
- o Multiagent Systems : Shoham and Leyton-Brown