

# Game Theory in Banking, Finance, and the International Arena

Master PEI - Autumn 2022

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## Introduction

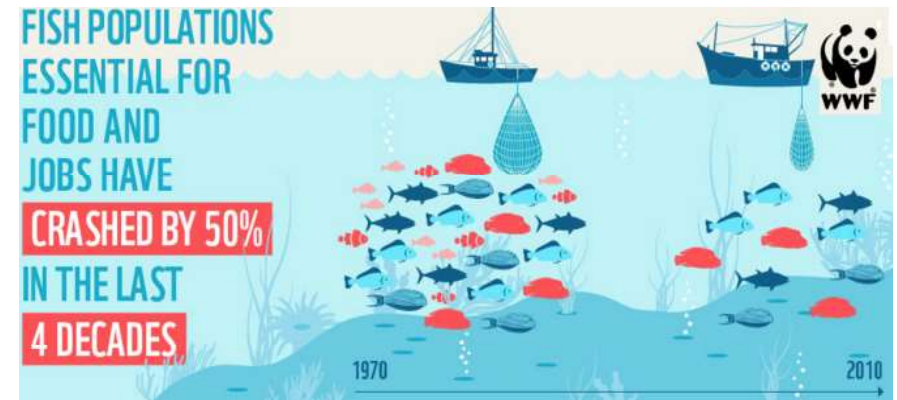


## Introduction Outline

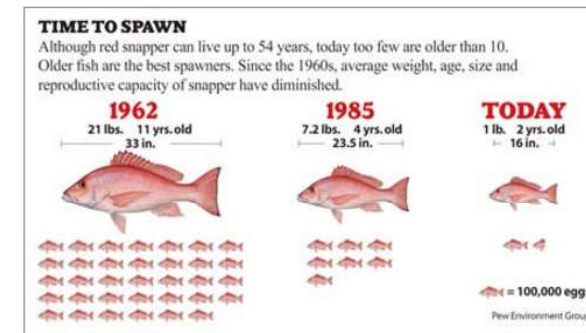
- 1 Introduction
- 2 Outline of the course
- 3 Evaluation



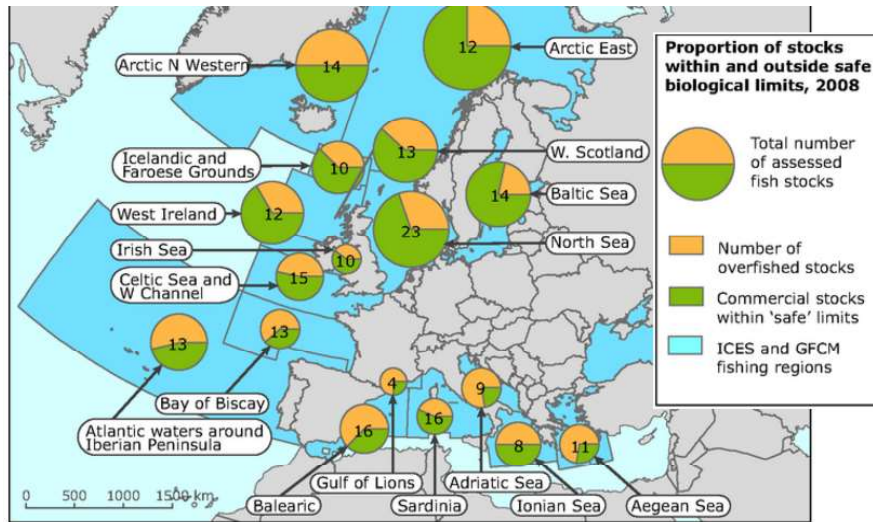
## Regulation in Fisheries



## Regulation in Fisheries



## Regulation in Fisheries



Navigation icons

## Regulation in Fisheries

### Solution

*Thought #1: If we have too many fishermen, we need to limit the number of boats that can fish*

### Problem

*Response #1: The remaining fishermen in the industry built bigger boats to catch the "extra" fish*



Navigation icons

## Regulation in Fisheries

### Solution

*Thought #1: If we have too many fishermen, we need to limit the number of boats that can fish*

## Regulation in Fisheries

### Solution

*Thought #2: If they have too big of boats, we should limit vessel size*

Navigation icons

Navigation icons

## Regulation in Fisheries

### Solution

*Thought #2: If they have too big of boats, we should limit vessel size*

### Problem

*Response #2: Fishermen cut off the prow of their boats and loaded it with lots of crew*



## Regulation in Fisheries

### Solution

*Thought #3: If they have too many crew members, we should limit the crew size*

### Problem

*Response #3: Fishermen loaded up their boats with tons of fishing gear*



## Regulation in Fisheries

### Solution

*Thought #3: If they have too many crew members, we should limit the crew size*

## Regulation in Fisheries

### Solution

*Thought #4: This is getting ridiculous, we'll just close the season once a quota of fish have been caught*

## Regulation in Fisheries

### Solution

*Thought #4: This is getting ridiculous, we'll just close the season once a quota of fish have been caught*

### Problem

*Response #4: Fishermen set out the first day of the season and catch and catch and catch... and seasons which used to end in 180 days ended in 2 days.*



## Regulation in Fisheries

### Solution

*Thought #5: Well, we'll just set days on which they can fish*

### Problem

*Response #5: Fishermen buy enormous motors to "race for fish" creating a very dangerous "Fish Derby!"*



## Regulation in Fisheries

### Solution

*Thought #5: Well, we'll just set days on which they can fish*

## Regulation in Fisheries

### Question

Why did all these regulatory measures fail?

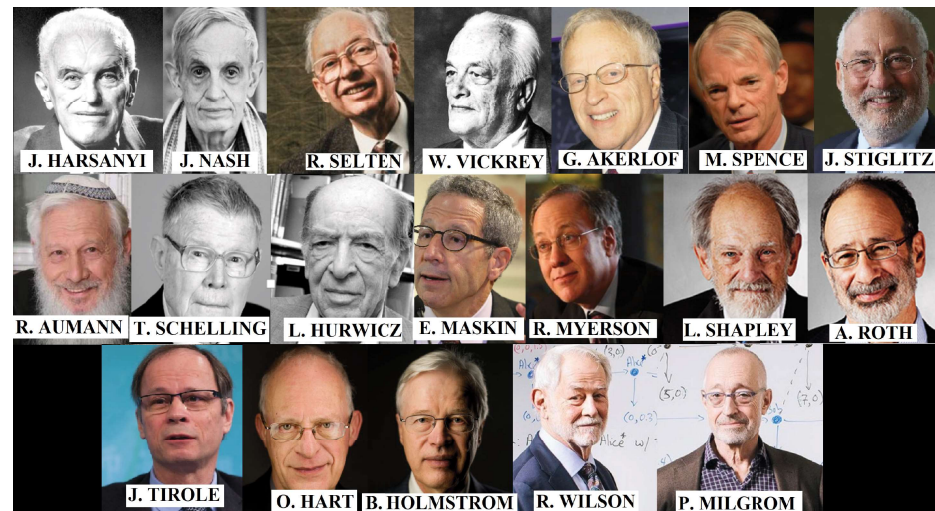
# Regulation in Fisheries

## Question

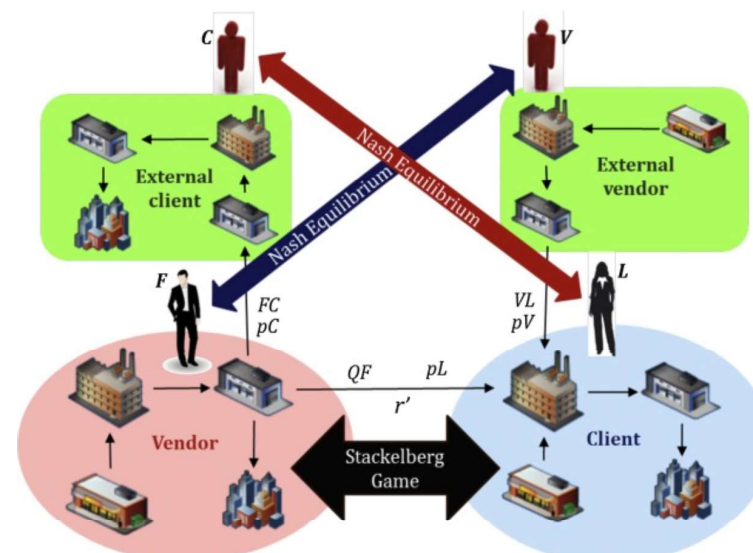
Why did all these regulatory measures fail?

## Solution

Because they ignore the **strategic interaction** so they just failed to account for the fundamental **incentives** driving fisherman behavior.



# Game theory applications Economics



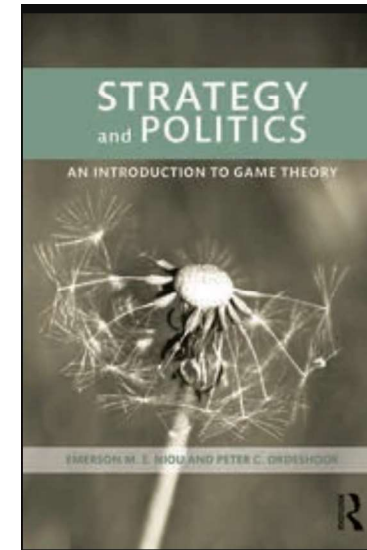
# Game theory applications

## Finance



# Game theory applications

## Political science



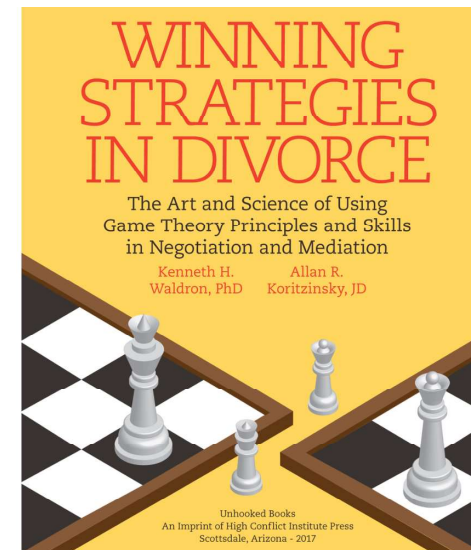
# Game theory applications

## International relations



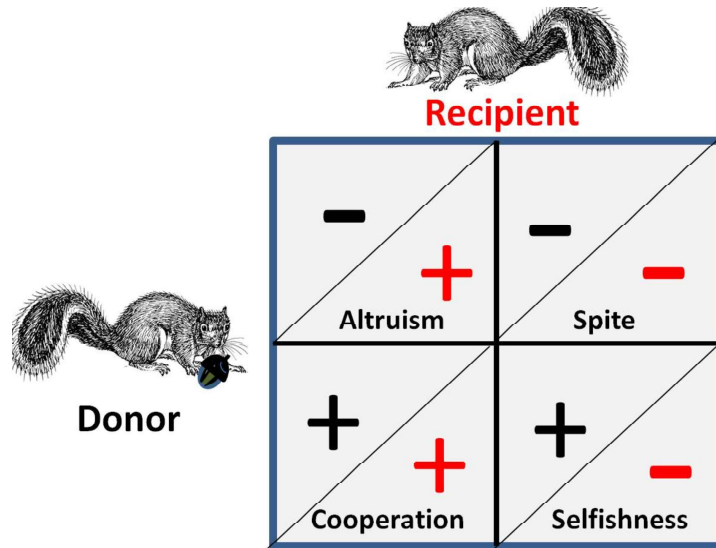
# Game theory applications

## Law



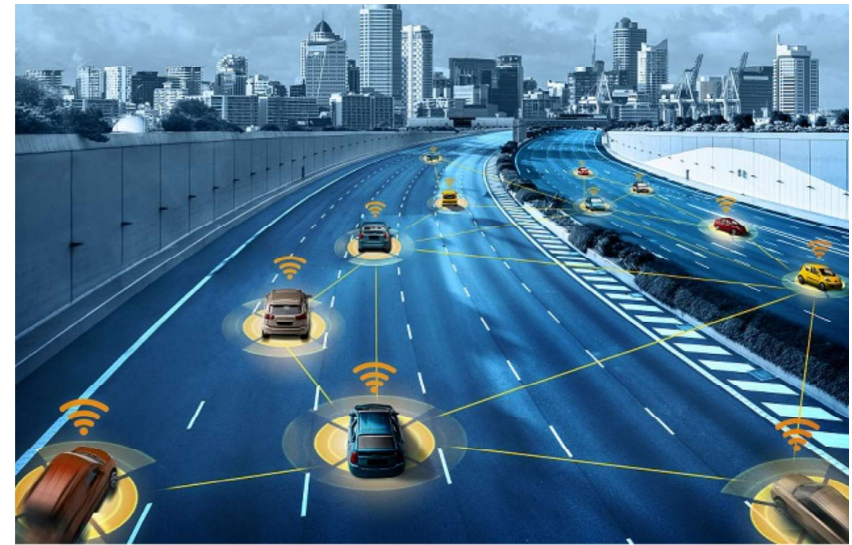
# Game theory applications

## Biology



# Game theory applications

## Artificial intelligence



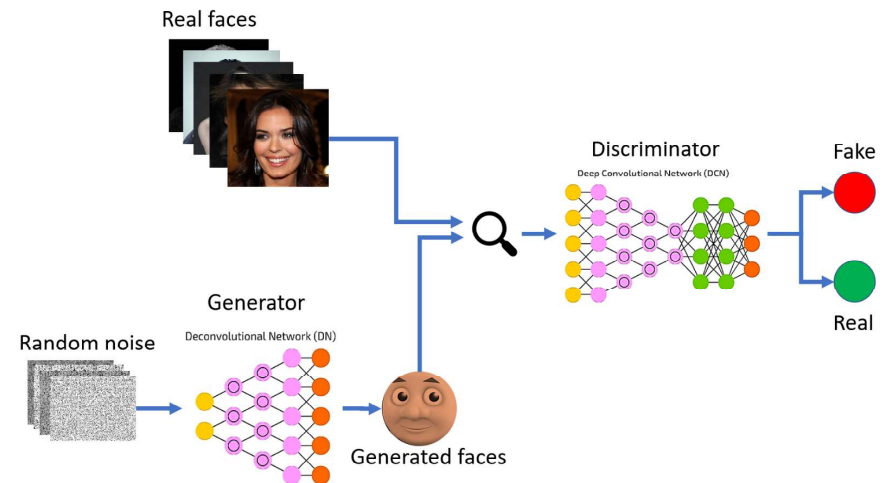
# Game theory applications

## Biology



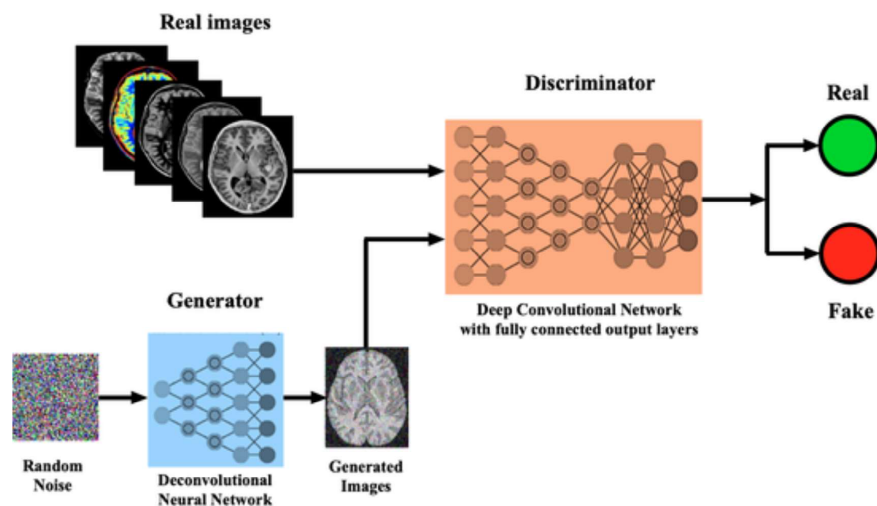
# Game theory applications

## Artificial intelligence



## Game theory applications

### Artificial intelligence



## Beauty contest

### Rules of the game

- 1 All take a piece of paper, write your name
- 2 Write a number between 0 and 100
- 3 The student whose number is the closest to half the average is the winner
- 4 If tie between several students, random draw
- 5 Cannot discuss with others or look at their piece of paper....



## Game theory: predictive tool?

Set of tools that leads to predictions on behavior of players

Are the predictions generally correct?

We will often examine lab evidence



## Beauty contest

### Results

- Result of the first round:
  - ▶ Average:
  - ▶ Half the average:
  - ▶ Winner:
- Result of the second round:
  - ▶ Average:
  - ▶ Half the average:
  - ▶ Winner:
- Result of the third round:
  - ▶ Average:
  - ▶ Half the average:
  - ▶ Winner:





## Beauty contest

### Interesting questions

- Are players rational?
- What does “rationality” imply in this game?
- How should a rational player behave in a population in which not everyone is perfectly rational?



## Beauty contest

### Pictures



## Beauty contest

### Pictures



## Beauty contest

### Market self-fulfilling prophecy: European sovereign-debt crisis

A **self-fulfilling prophecy** is a prediction that causes itself to become true, by the very terms of the prophecy itself, due to positive feedback between belief and behavior.



# Beauty contest

Market self-fulfilling prophecy: European sovereign-debt crisis

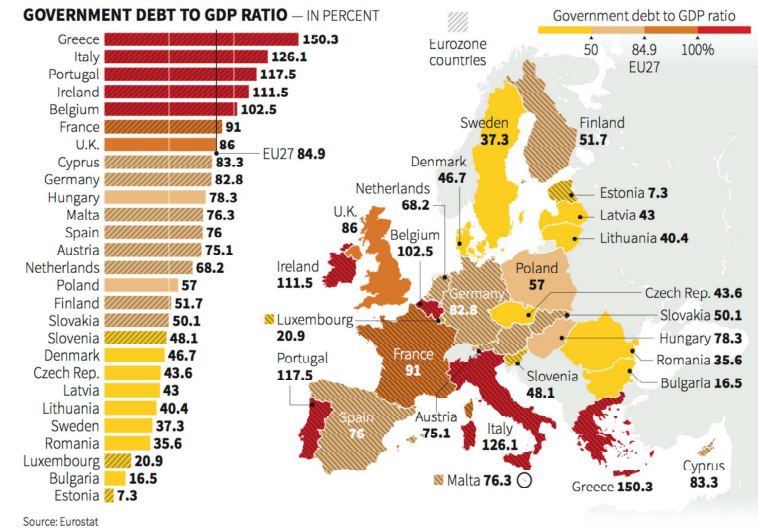


Rain dance: not a self-fulfilling prophecy



# Beauty contest

Market self-fulfilling prophecy: European sovereign-debt crisis

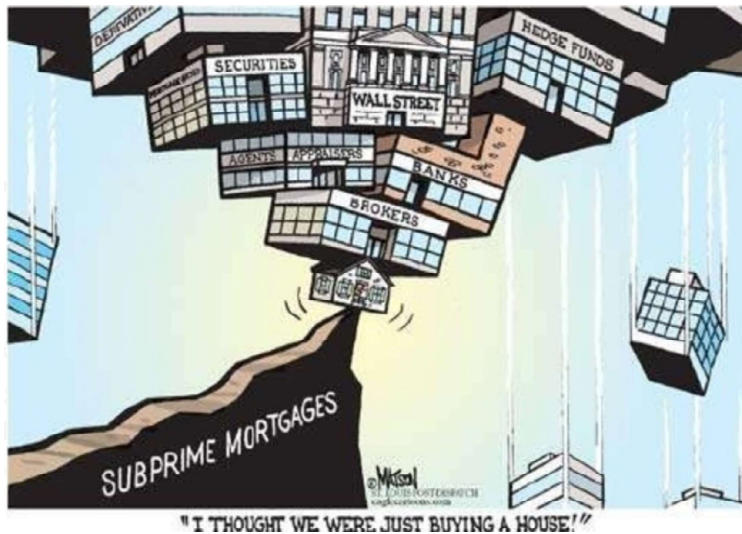


Government debt to GDP ratio 2012



# Beauty contest

Market self-fulfilling prophecy: European sovereign-debt crisis

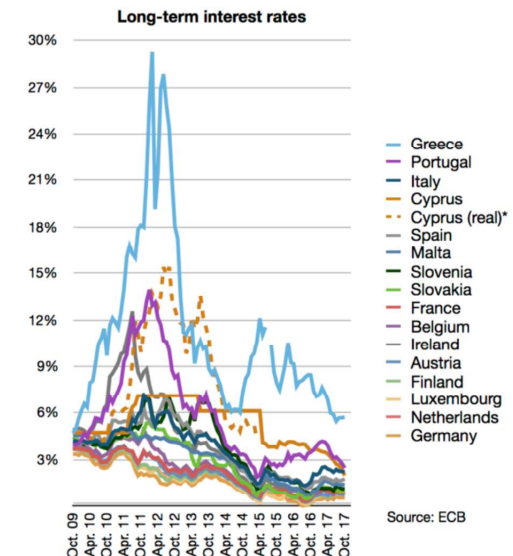


"I THOUGHT WE WERE JUST BUYING A HOUSE!"



# Beauty contest

Market self-fulfilling prophecy: European sovereign-debt crisis



Source: ECB



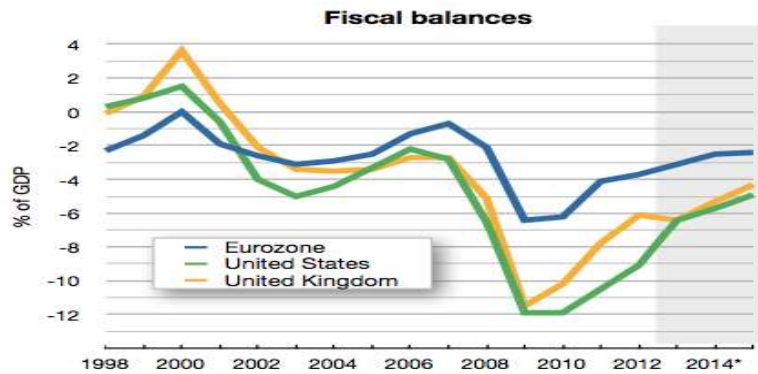
# Beauty contest

## Market self-fulfilling prophecy: European sovereign-debt crisis

- European sovereign-debt crisis:
  - ▶ The debt levels of European countries kept rising since 2007, mostly due to the large bailout packages provided to the financial sector during the late-2000s financial crisis.
  - ▶ However, high debt levels alone may not explain the crisis.
  - ▶ The budget deficit for the euro area as a whole is much lower and the euro area's government debt/GDP ratio of 86% in 2010 was about the same level as that of the US.

# Beauty contest

## Market self-fulfilling prophecy: European sovereign-debt crisis



Source: Eurostat and OECD  
\* Eurostat estimates from November 2013

Fiscal balance = tax revenue (and the proceeds of assets sold) - government spending.

When the balance is positive (resp. negative), the government has a fiscal surplus (resp. deficit).

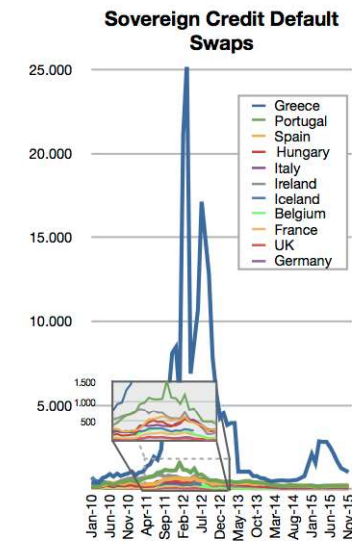
# Beauty contest

## Market self-fulfilling prophecy: European sovereign-debt crisis

- Banks had substantial holdings of bonds from economies such as Greece which offered a small premium and seemingly were equally sound.
- As the crisis developed it became obvious that Greek, and possibly other countries', bonds offered substantially more risk.
- The loss of confidence is marked by rising sovereign CDS prices, indicating market expectations about countries' creditworthiness.
- Next figure: Sovereign CDS prices of selected European countries (2010–2011).
  - ▶ The left axis is in basis points. E.g., a level of 1,000 means it costs \$1 million to protect \$10 million of debt for five years.

# Beauty contest

## Market self-fulfilling prophecy: European sovereign-debt crisis



## Beauty contest

### Market self-fulfilling prophecy: European sovereign-debt crisis

- Beginning in early 2010, renewed anxiety about excessive national debt of investors demanded ever higher interest rates from several government with higher debt levels, deficits and current account deficits.
- This in turn made it difficult for some governments to finance further budget deficits and service existing debt, particularly when economic growth rates were low, as in the case of Greece and Portugal.
- The loss of confidence and the consequent government behaviors can be explained by the self-fulfilling mechanism.

## Introduction

### Outline

- 1 Introduction
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## Describing games

In general, a game is defined by:

- 1 Set of players
- 2 Set of choices for these players
- 3 Payoff function depending on choices

## Major differences between games

Certain dimensions will help us categorize and study games:

- 1 Timing of the game:
  - ▶ Do the players play at the same time (*simultaneous games*)?
  - ▶ Or do they observe other players moves and then decide (*sequential games*)?
- 2 Is the game played once or is it repeated several times?
- 3 Do all the players have the same information?
  - ▶ Can imagine that players have better information about some payoff of the game.

## Outline of the course

- 1 Introduction and Chapter 1: Simultaneous games (c1-c3)
- 2 Chapter 2: Sequential games (c4-c5)
- 3 Chapter 3: Repeated games (c6-c7)
- 4 Chapter 4: Incomplete information games (c8-c9)
- 5 Presentations and review for exam (c10-c11)
- 6 Exam (c12)

## Introduction Outline

- 1 Introduction
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## Evaluation

Your understanding of the course will be judged in the following way:

- 60% final exam
- 40% group project

## Evaluation Group projects

The idea is to take a topic of current news (that did not take place prior to last December) and analyze it using the tools learned in class.

Main parts of the project

- Describe the problem with appropriate references
- Set up the game and solve it
- Draw conclusions and discuss data if available / evidence that would be needed to go further

## Evaluation

### Group projects: Example of topics

- Example of topics (2020-2021):
  - ▶ Panic buying behavior during the COVID-19 pandemic
  - ▶ EU-UK Brexit negotiations.
  - ▶ The Virgin Australia Rescue.
- Example of topics (2019-20):
  - ▶ The Saudi-Iranian conflict
  - ▶ Amazon Deforestation.
  - ▶ North American Trilateral Cooperation and the Re-Negotiation of NAFTA to USMCA.

## Evaluation

### Group projects: Example of topics

- Example of topics (2017-18):
  - ▶ Trump and Fake News
  - ▶ The Venezuelan Crisis
  - ▶ Territorial Disputes between China and the Philippines
  - ▶ Spain and Catalan Crisis.

## Evaluation

### Group projects: Example of topics

- Example of topics (2018-2019):
  - ▶ Refugee migration problem in the European Union
  - ▶ Iran nuclear deal
  - ▶ US-China trade war
  - ▶ Maritime car carriers international cartel.

## Evaluation

### Group projects: Example of topics

- Example of topics (2016-17):
  - ▶ Free riding of non-U.S. NATO countries in military expenditure
  - ▶ FARC vs the colombian government
  - ▶ Why couldn't Spain form a government?
- Example of topics (2015-16):
  - ▶ The Greek referendum
  - ▶ US-Russian interactions in the Syrian conflict
  - ▶ EU refugee crisis: The relocation scheme

## Evaluation

### Group projects: Example of topics

- Example of topics (2014-15):
  - ▶ EU and US strategic responses to the Ukrainian crisis
  - ▶ Israel - Palestina conflict
  - ▶ Blue Nile-construction of Grand Ethiopian Renaissance Dam
- Example of topics (2013-14):
  - ▶ United States Government Shutdown
  - ▶ EU and Iran Sanctions
  - ▶ Negotiations on Debt Refinancing during the Debt Crisis

## Contact

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password: master-PEI

## Evaluation

### Group projects: timeline

- before class 3: create your groups
- before class 4: choose topic
- before class 7: have the main game set up
- before class 10: return manuscript and powerpoint (see contact below)
- class 10-11: give a powerpoint presentation.