Spēļu teorija
1. lekcija

o Course outline
  - o Combinatorial games
  - o Traditional game theory stuff
  - o Mechanism design (practical application of GT)
o Homeworks will be only on first two parts of course.
o Exam will be in written format.

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o **Why do we play games?**
  - o We enjoy to be a winner   o Socializing
  - o We enjoy thinking ✓
  - o We can win money
  - o Games are good models

o Why games are interesting?
  - o Outcomes of games are unpredictable

o Why unpredictable?
  - o Complexity
  - o Human factor
  - o Hidden information (imperfect info)
  - o Element of chance
  - o Incomplete info

o Imperfect info vs. incomplete info

  - o Example of imperfect information

    $$A \begin{array}{c|c|c|} & 1 & 2 \\ \hline 1 & +1 & -1 \\ \hline 2 & -1 & +1 \\ \hline \end{array}$$

    Outcome: how much B will have to pay A?
    - o A and B choose strategy independently
    - o A doesn't know B's choice => imperfect info
      B doesn't know A's choice

  - o Example of incomplete information

    $$\begin{array}{c} A \\ \hline B \end{array} => toss\ coin \Rightarrow \begin{array}{c|c|c|} & +1 & -1 \\ \hline & -1 & +1 \\ \hline & H & T \end{array}$$

    o In this game, player 2
    actions don't affect the
    outcome

- Other example of incomplete info

  Policeman   Guy

  There is 50% chance of game being

  Policeman vs Criminal ⓐ

  and 50% chance of

  Policeman vs Innocent ⓑ

- Guy know's which situation, but not policeman.

- In situation ⓐ

Policeman	Criminal	
	Fire	Stay
Fire	-10	-10
Stay	-50	+10

- In situation ⓑ

  ...

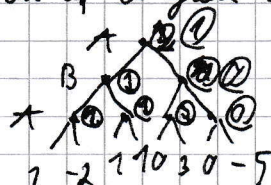 Further analysis will be explained later.

- Fair games

  - Both players know everything about the game state

  - Formally these are games with only combinatorial complexity

  - Examples: Tic tac toe, chess, checkers

- Subtraction game

  - Heap of stones (100 stones)   P1   P2
  - Players take 1, 2, 3, or 4 stones
  - Some element of chance and combinatorics

  - 1 stone : Player 1 wins

    2, 3, 4 :   same

  - 5 stones: Player 2 wins
  - 6 stones: Player 1, by getting to situation of 5 stones

    N mod 5

- Representation of a game with multiple outcomes

  ⊗ out come of game, can be figured by going bottom up.

  1 -2 1 0 3 0 -5

- Theoretically, any game with perfect information can be solved.