











- 1  **Game Analysis**
 - BEST Summer Course 2005
 - Tom Verhoeff
 - TU/e
- 2  **Topics**
 - Game Concepts and Classification
 - Game Analysis: Criteria and Techniques
- 3  **Game Concepts**
 - Game Rules: well-defined vs fuzzy
 - Players: one, two, or more; teams; fixed number vs dynamic
 - Objectives: win/lose, score points, earn money, fame, survive
 - Constraints: communication, noise, time, aids, spectators
 - Play: Game States, Moves, Strategies
- 4  **Game Classifications**
 - Solitaire, 2-Person, Multi-Player
 - Finite vs Infinite State Space
 - Perfect vs Imperfect Information
 - Stochastic vs Deterministic
 - Zero-Sum vs Nonzero-Sum
 - Single Game vs Iterated
- 5  **Game Classifications 2**
 - Partizan vs Impartial
 - Symmetric vs Asymmetric
- 6  **Game Analysis: Criteria**
 - Objective: Win vs Maximize Profit
 - Value: Optimal; Expected, Variability
 - Winning Strategy: How to Play
 - Duration: Expected, Variability
- 7  **Game Analysis: Techniques**
 - Experiment:
 - Simulation, requires good models
 - Theory:
 - Games of Chance: Probability Theory, Statistics (Pascal, Fermat)
 - Combinatorial Games: Comb. Game Theory (Zermelo, Grundy)
 - Strategic Games: Game/Decision Theory (von Neumann, Nash)
- 8  **Experimental Challenges**
 - State-Space Explosion
 - Player Modeling (AI)
 - (Pseudo) Random Number Generation
 - Floating-Point Computation
- 9  **Theory Examples**
 - Game of Chance: (Micro) Yahtzee
 - Combinatorial Game: Chomp
 - Strategic Game: Euro Matching
- 10  **Games of Chance**

- Bellman's Optimality Principle
- Optimal strategy can be deterministic

11 Combinatorial Games

- Theorem of Zermelo: 2-Person, Zero-Sum, Finite, Deterministic Games with Perfect Information are algorithmically solvable
- Sprague-Grundy Theory

12 Strategic Games

- Mixed strategies (stochastic, randomized)
- Saddle point, Nash equilibrium

13 Miscellaneous

- The Petersburg Paradox
- Prisoner's Dilemma, Trader's Dilemma
- Nomic: A Self-Modifying Game Based on Reflexivity of Law (by Peter Stuber: <http://www.earlham.edu/~peters/nomic.htm>) in Hofstadter, Metamagical Themas.

14 Literature

- Jörg Bewersdorff. Glück, Logic und Bluff. (Eng. translation: Luck, Logic, and White Lies) <http://www.bewersdorff-online.de/>
- Berlekamp, Conway, Guy. Winning Ways for Your Mathematical Plays (4 volumes). http://en.wikipedia.org/wiki/Winning_Ways_for_your_Mathematical_Plays
- William Poundstone. Prisoner's Dilemma. http://en.wikipedia.org/wiki/Prisoner%27s_dilemma