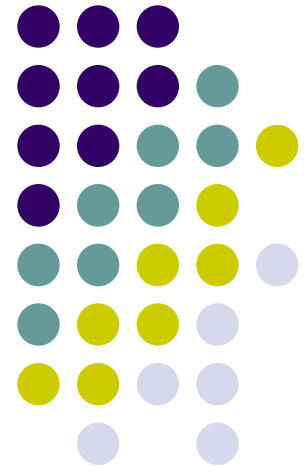


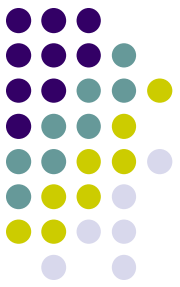
# Game Theory

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Stephanie Storer  
Historical Perspectives  
April 22, 2010

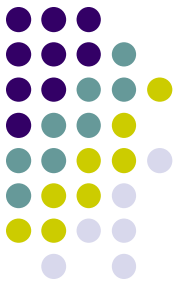


# Philosophical and Historical Motivation



- “Invented” by John von Neumann and Oskar Morgenstern (1944)
  - Special and limited conditions
- Aim of game theory
  - Work out rational courses of actions for opposing sides
- Cortez
  - Used game theory
  - Bloodless victory over the Aztecs
    - Burning ships
- Soldiers

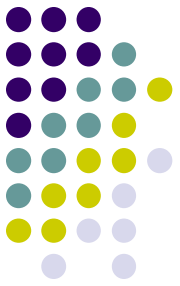




# Games and Information

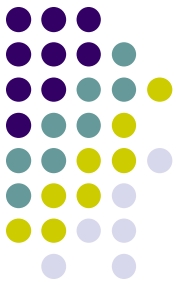
- Several different features
  - Conducted with fully defined rules
  - Number of players
    - Make choices, receive payoffs from outcomes
  - Strategies per player
    - Choose options from a set of possible actions (strategies)
  - Nash equilibrium
    - Group players take into account the decisions of others
    - Does not mean best cumulative payoff for all players

# Types of Games



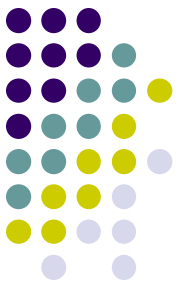
- Sequential game
  - One action after another
- Simultaneous game
  - Players are unaware of earlier players' actions
- Perfect information
  - Must be sequential
  - Every player knows strategies of other players
  - Ex. Chess, checkers, and tic-tac-toe
- Imperfect Information
  - Do not know other players moves before own
  - Ex. Bridge-crossing game
- Constant sum game
  - Player gains iff another player loses
  - Zero-Sum: special case
    - Ex. Poker
- Non-Zero-Sum game
  - Player does not necessarily win if other loses
  - Ex. Prisoner's Dilemma





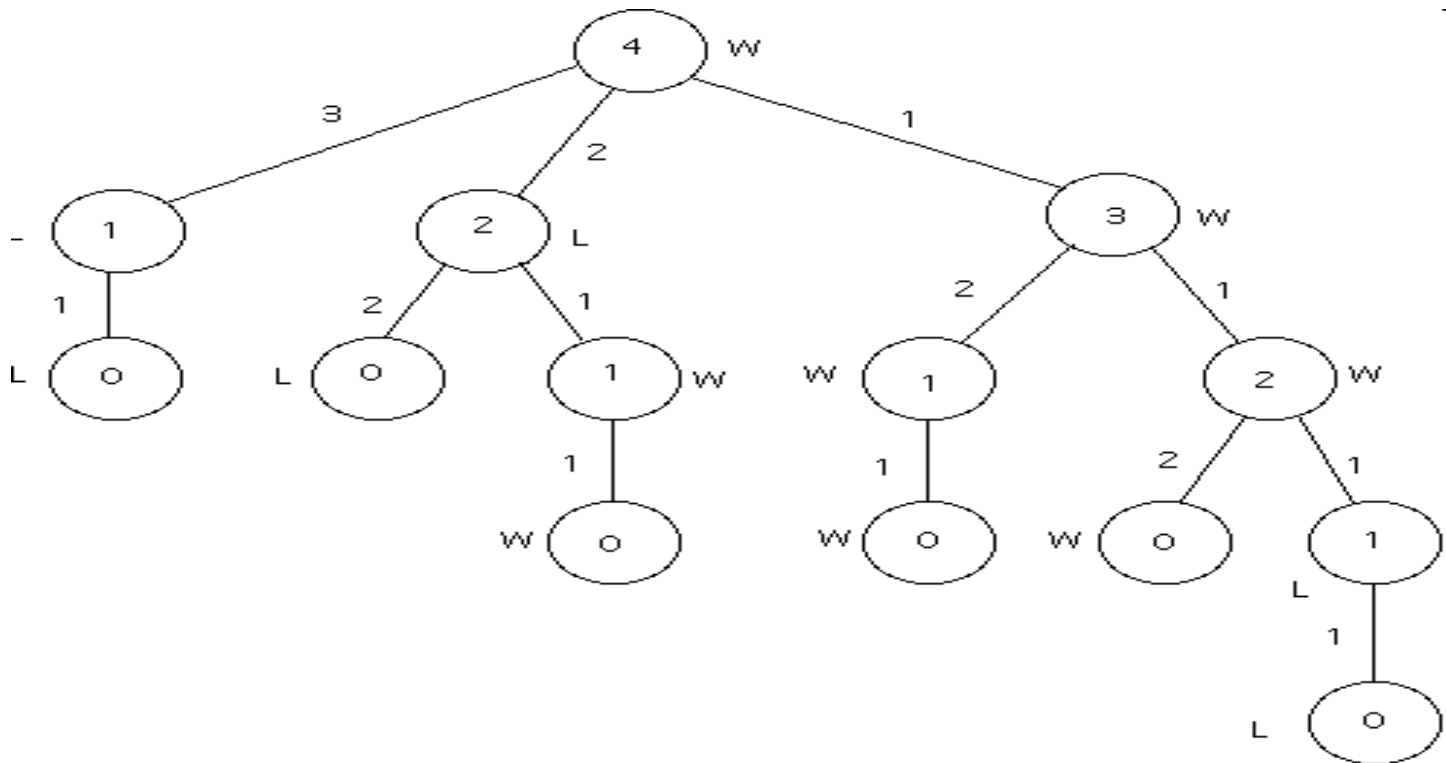
# Types of Games Continued

- Cooperative game
- Non-Cooperative game
- Symmetric game
- Asymmetric game
- Discrete game
- Continuous game
- Infinitely Long game

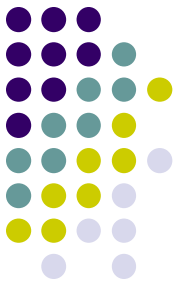


# Representing Games

- Game trees for sequential games
  - Directed graph
  - Backward induction



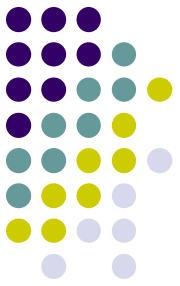
# Representing Games Continued



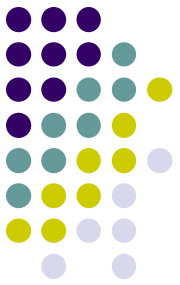
- Matrices
  - Easier to use for imperfect information games
  - Ex. Tree-crossing game
    - Many ways to fill out matrix

		Hunter		
		Safe Bridge	Rocky Bridge	Cobra Bridge
Fugitive	Safe Bridge	0,1	1,0	1,0
	Rocky Bridge	0.9,0.1	0,1	0.9,0.1
	Cobra Bridge	0.8,0.2	0.8,0.2	0,1

# Basic Elements and Assumptions of Game Theory



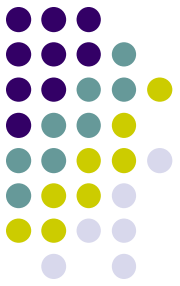
- Players – Agents
- Assume players are economically rational
  - Assess outcomes
  - Calculate paths to outcomes
  - Choose actions that lead to most preferred outcomes
- Strategy
  - Program of play
    - Response to others



# Prisoner's Dilemma

	Prisoner B Stays Silent	Prisoner B Betrays
Prisoner A Stays Silent	A: 2 years B: 2 years	A: 10 years B: Goes Free
Prisoner A Betrays	A: Goes Free B: 10 years	A: 5 years B: 5 years

- Best options/desire to minimize sentence
  - What is the best option
- Helps in areas of social sciences, such as, economics, politics, and sociology, as well as biological sciences, such as, ethology and evolutionary biology


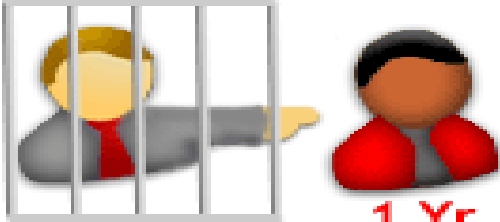
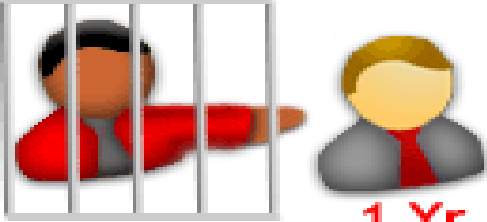
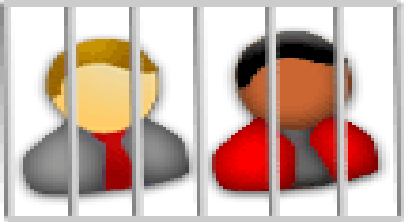


# Ways We See Game Theory

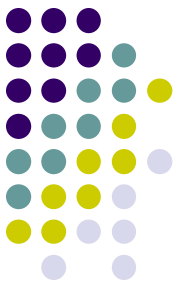
- Children
  - Tic tac toe
  - Rock Paper Scissors
  - Memory
  - Chicken
- Television
  - Golden Balls
  - Deal or No Deal
  - Stick or Switch

# Any Questions?



		Henry	
		Not Guilty	Guilty
Dave	Not Guilty	 2 Years	 5 Years      1 Yr.
	Guilty	 5 Years      1 Yr.	 3 Years





# Resources

- [http://www.templeton.org/capabilities\\_2008/images/HA/vn\\_withMorgensternat.jpg](http://www.templeton.org/capabilities_2008/images/HA/vn_withMorgensternat.jpg)
- [http://www.marketpsych.com/blog/uploaded\\_images/poker\\_cards-700633.jpg](http://www.marketpsych.com/blog/uploaded_images/poker_cards-700633.jpg)
- <http://gilkalai.files.wordpress.com/2009/07/chess.jpg>
- <http://www.math.cornell.edu/~mec/2008-2009/Anema/gametheory.gif>
- <http://plato.stanford.edu/entries/gametheory/>