

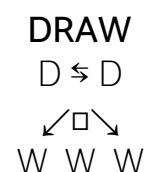
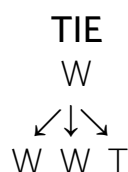
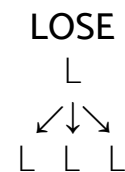
NEVER LOSE AGAIN

Solving the World's Board Games with Computational Game Theory

What is "Game Theory?"

Combinatorial	Computational	Economic
<ul style="list-style-type: none"> - Sprague and Grundy's 1939 Mathematics and Games - Board games - Games: Nim, Domineering, Dots and Boxes - Complete information, alternating moves - Maximize points - Goal: be the player to make the last move 	<ul style="list-style-type: none"> - RC Bell's 1988 Board and table Games from many Civilizations - Board Games - Games: Tic-Tac-Toe, Chess, Connect 4, Othello - Film: <i>Searching for Bobby Fischer</i> - Complete information, alternating moves - Using computer horsepower to solve abstract strategy games - Goal: varies from game to game 	<ul style="list-style-type: none"> - von Neumann and Morgenstern's 1944 <i>Theory of Games and Economic Behavior</i> - Matrix games - Prisoner's dilemma, auctions - Film: <i>A Beautiful Mind</i> - Incomplete information, simultaneous moves - Goal: maximizing payoff

What Kinds of "Board Games?"	The Components of a Strong Solution
<ul style="list-style-type: none"> - No chance, such as dice or shuffled cards <ul style="list-style-type: none"> - Both players have COMPLETE INFORMATION - No hidden information, like Battleship - Two players (Left and Right) usually alternating moves <ul style="list-style-type: none"> - Allowed: Repeat and skip moves - Not allowed: Simultaneous moves - The game must end <ul style="list-style-type: none"> - Capture, pattern, absence of move 	<p>For every position, there are four possible resulting values:</p> <p>Win: at least one of your children are loses</p> <p>Lose: all of your children are wins</p> <p>Tie: at least one of your children are ties</p> <p>Draw: can't force a win or be forced to lose</p>



1 to 10

The running total starts at 0. On your turn, you add either 1 or 2 to the running total. Whoever is the FIRST person to reach 10 wins!

Let's break the game down!

10 ← 9

↑ ↗ ↑

8 ← 7

↑ ↗ ↑

6 ← 5

↑ ↗ ↑

4 ← 3

↑ ↗ ↑

2 ← 1

↑ ↗

0

Each position has two possible values: you either can add one or add two, as symbolized by the arrows. You want to be the first one at 10, so if you are the one that has to make a move when the running total is at 10, you have lost – therefore, 10 is a losing position.

Let's work backwards from here. If 10 is a losing position, that means that the two possible numbers that can reach 10 are winning positions, making 8 and 9 winning positions. We keep working backwards from here and come to the final conclusion that ...

10 = losing position
9 = winning position
8 = winning position
7 = losing position
6 = winning position
5 = winning position
4 = losing position
3 = winning position
2 = winning position
1 = losing position
0 = winning position

So what's the strategy? How do you guarantee that you will ALWAYS win?

You want to always be the first player to go. Pick 1 so that your opponent is starting off in the losing position. Then, always pick the opposite value of your opponent. If they pick 1, you pick 2 and if they pick 2, you pick 1. This way, you will always force your opponent into a losing position, with you always with the winning position!

