

ICS Summer Academy Session II

Topic 9: Game-Playing AI

Michael Shindler

“In which we explore environments where other agents are plotting against us.” – tagline for the chapter on this topic in
Artificial Intelligence: A Modern Approach by Russell and Norvig

A simple example

- ▶ We begin play with 15 stones on the table
- ▶ (Two) players alternate 1,2, or 3 stones each (their choice; they can choose different numbers on different turns).
- ▶ You win if you take the last stone.

14	12
10	8
3	4

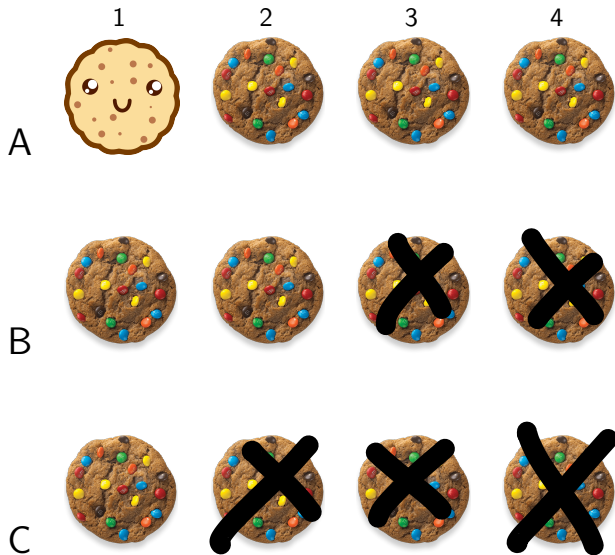
Let's play Chomp!



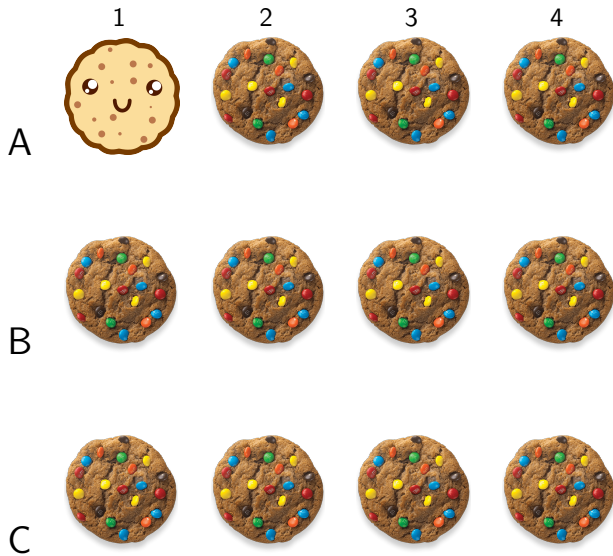
Let's play Chomp!



Let's play Chomp!



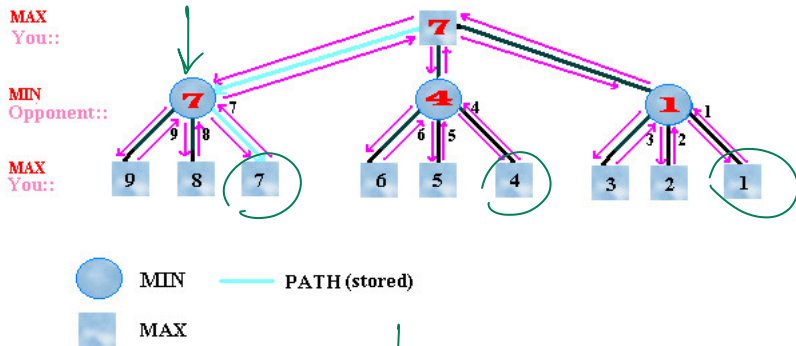
Let's play Chomp!



Types of Games

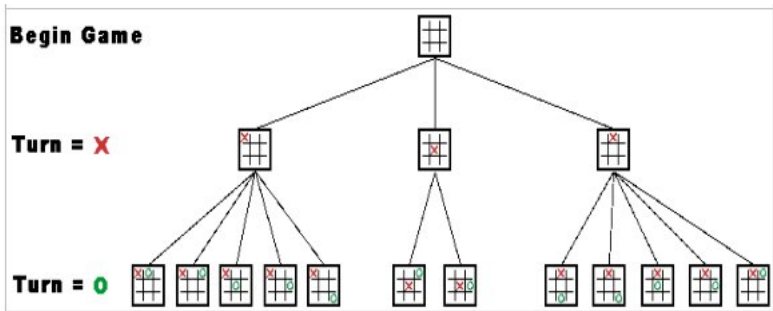
	deterministic	chance
perfect information	<p>Chomp! Chess</p> <p>Connect 4 / Sungka</p> <p>Mancala</p>	<p>Monopoly Ludo</p> <p>Snakes & Ladders</p>
imperfect information	<p>Battleship</p> <p>Guess Who?</p>	<p>poker Uno!</p> <p>Monopoly</p>

General Framework: Minimax



b moves avail
 look m moves ahead
 $\sim b^m$ board configs

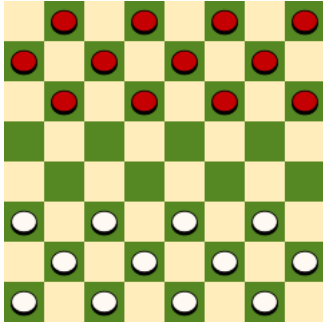
Tic Tac Toe



- Why only three choices for first move?
(Aren't there nine choices?)

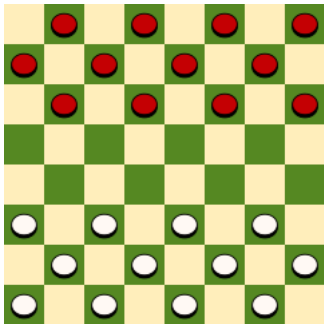
5 4 7 8 distinct boards

Checkers / Draughts



- ▶ How would you test the system?

Checkers / Draughts



- ▶ How would you go about writing it?
 - ▶ Minimax?

Chess

- ▶ Opening
 - ▶ Good openings:
 - ▶ 1. e4
 - ▶ 1. d4
 - ▶ “Irregular openings”
 - ▶ 1. f3
 - ▶ 1. h3
 - ▶ “Don’t do this” openings?
- ▶ Midgame
- ▶ Closing

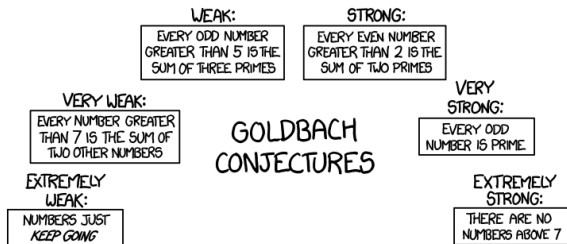
Chess

- ▶ Opening
- ▶ Midgame
- ▶ Closing

Chess

- ▶ Opening
- ▶ Midgame
- ▶ Closing

Are games solved?



There are three types of “a game is solved” :

- ▶ Ultra-weakly solved
- ▶ Weakly solved
- ▶ Strongly solved

Interlude: Why bother?

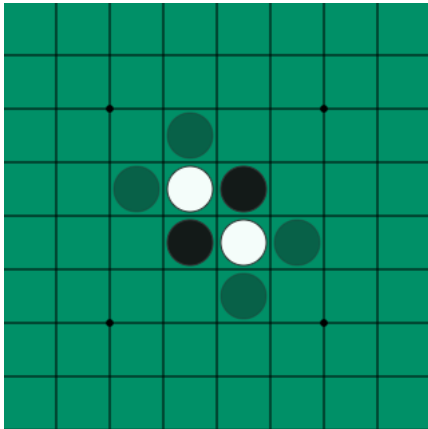
- ▶ Why bother with game-playing AI?
- ▶ Practical benefit to these programs?

Go

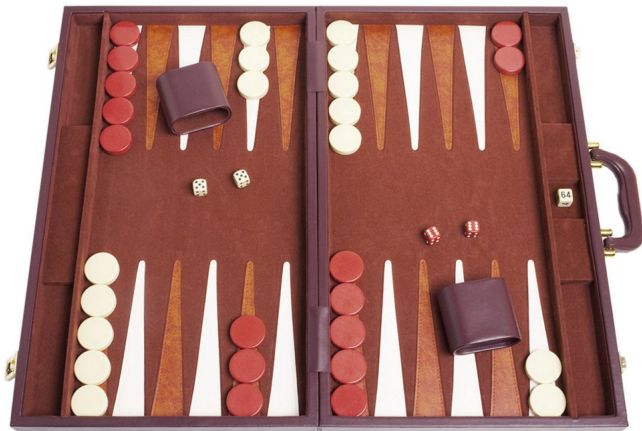
- ▶ Harder for a computer than a human?
- ▶ Pre-2015, best Go AI were amateur

Othello

But men are men; the best sometimes forget



Backgammon



- How is this game different from the rest so far?

Bridge

Meyer

♠65432

♥T9872

♦JT9

♣--

M

♠T987

♥6543

♦--

♣76532

Bond

♠--

♥--

♦Q8765432

♣AQT84

Drax

♠AKQJ

♥AKQJ

♦AK

♣KJ9

Starcraft II



Scrabble

It's still better to be a human than to be a computer." – David Boys, former world champion defeated by AI