

History and Philosophical Underpinnings

Last Class Recap

- game-theory – why normal search won't work
- minimax algorithm – brute-force traversal of game tree for “best” move
- alpha-beta pruning – how to improve on minimax for a more efficient traversal
- position evaluator functions – how to determine utility of a non-terminal node using heuristics

Homework

5	4	1
6	7	8
	3	2

initial state

1	2	3
8		4
7	6	5

goal state

Generate the first two levels of the state space for this problem by drawing a labelled state tree, using the **Manhattan distance** heuristic to assign an A^* value to each node. What are the first three moves you would make?

Let's work it through...

5	4	1
6	7	8
	3	2

$h(n) = 20$

5	4	1
	7	8
6	3	2

$h(n) = 19$

	4	1
5	7	8
6	3	2

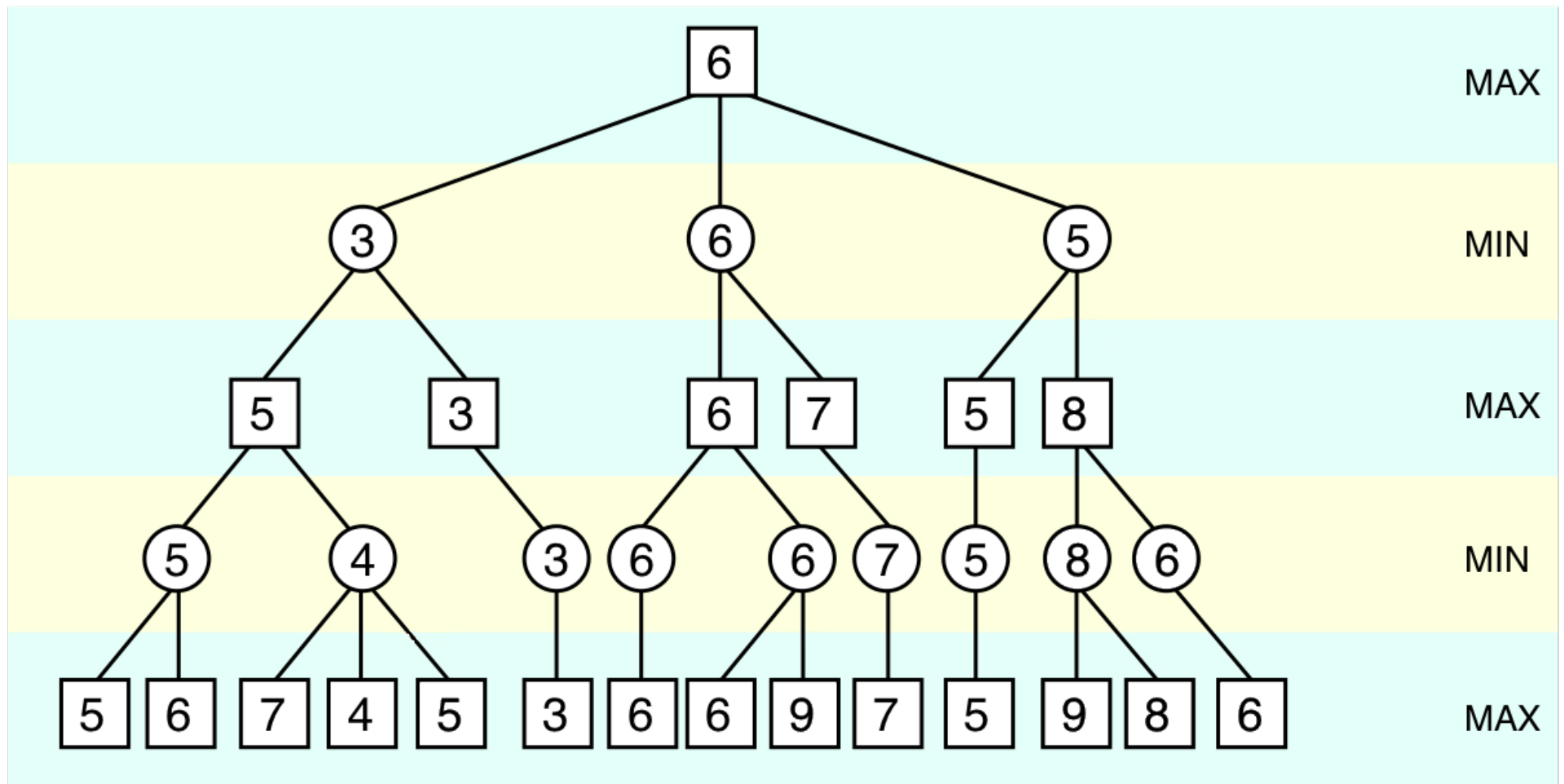
$h(n) = 18$

4		1
5	7	8
6	3	2

$h(n) = 19$

- That's no good!
- What to do?

Alpha-Beta Pruning



René Descartes

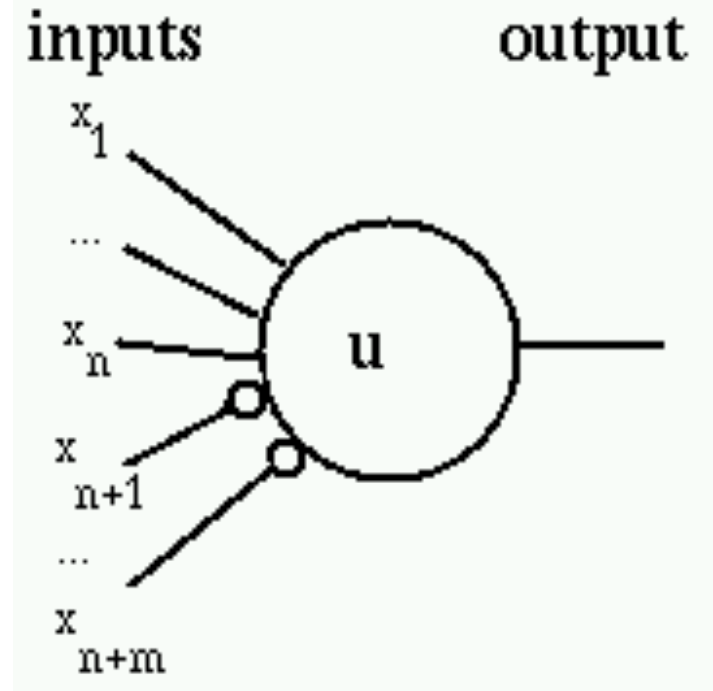
cogito ergo sum (1637)

- it would never be possible to make a machine that thinks as humans do
- there could be no feeling without a conscious state of awareness, and no conscious state of awareness without a true mind to perceive it



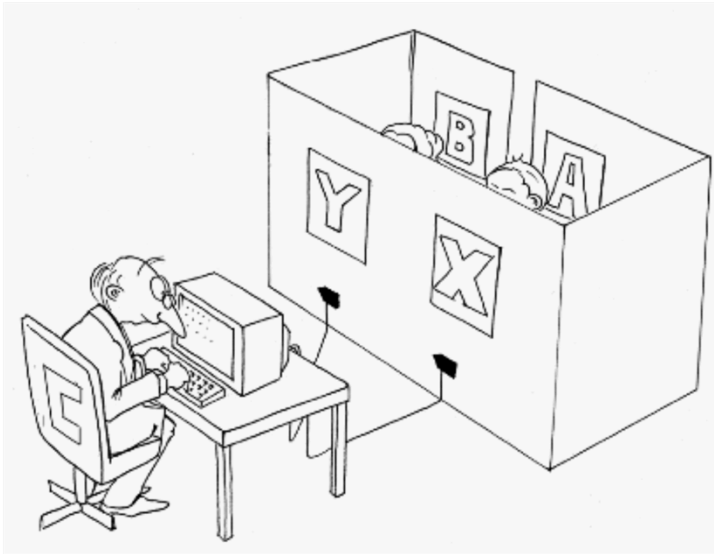
McCulloch and Pitts Neural Logical Calculus (1943)

- proposed highly simplified model of a biological neuron
- binary threshold neuron – influenced by logic



Alan Turing

The Turing Test (1950)

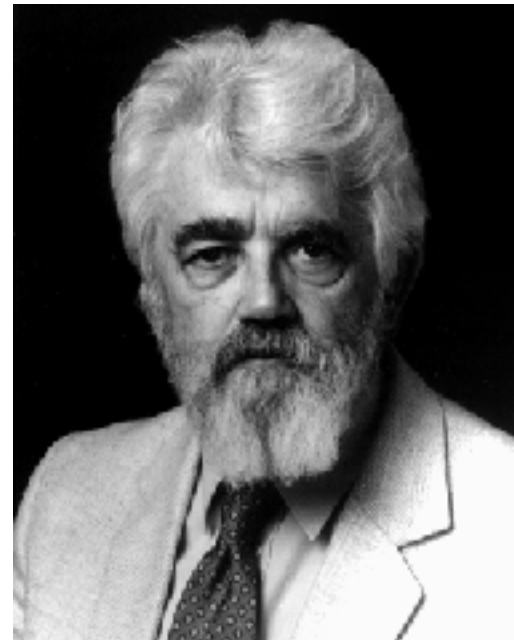


"I believe that in about fifty years' time it will be possible to program computers ... to make them play the imitation game so well that an average interrogator will not have more than 70 percent chance of making the right identification after five minutes of questioning."

John McCarthy

Organizer (with Minsky) of Dartmouth Conference (1956)

- coined the term “Artificial Intelligence”
- invented LISP (1956-1959)
- wrote first paper on logical AI: “Programs with Common Sense” (1959)
considered foundation of Good Old Fashioned Artificial Intelligence (GOFAI)



Newell and Simon

General Problem Solver (1957)

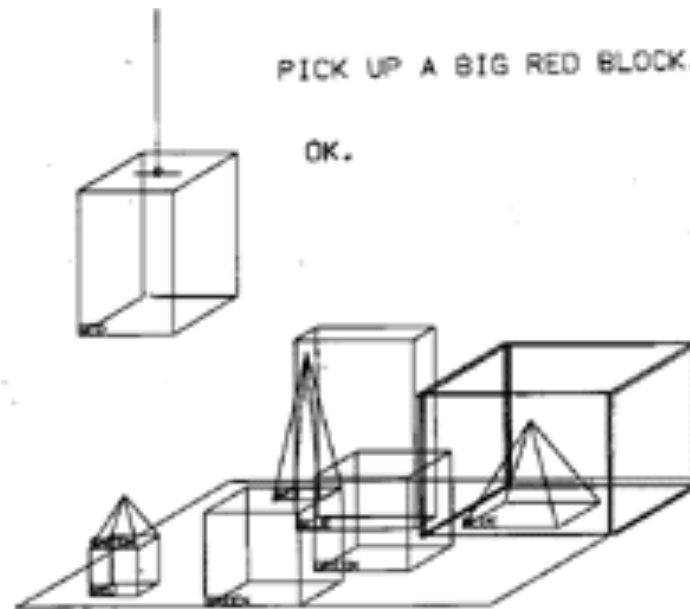
- any formalized symbolic problem can be solved, in principle
- solves (simple) problems following line of human reasoning



Terry Winograd

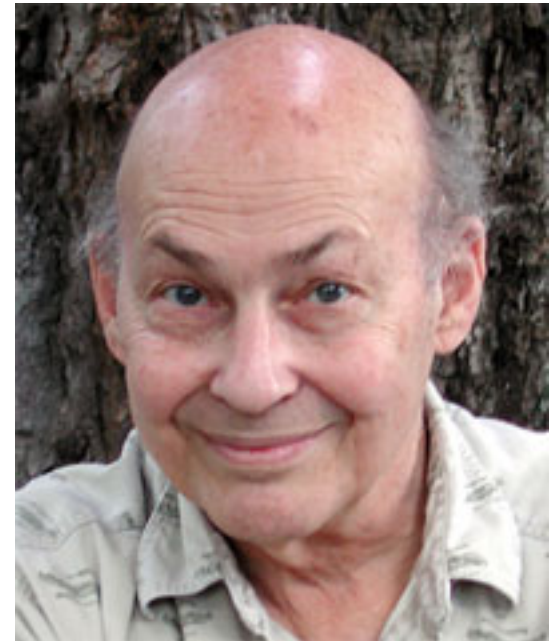
SHRDLU (1968-1970)

- computer programs could solve spatial and logic problems



Marvin Minsky

- (SNARC, 1951)
built first neural network simulator:
Stochastic Neural-Analog
Reinforcement Computer
- ([Society of Mind](#), 1986)
what we call intelligence could be
a product of the interaction of non-
intelligent parts



Lenat

Cyc (1984)



- "Intelligence is 10 million rules."
 - "every tree is a plant": (`#$genIs` `#$Tree-ThePlant` `#$Plant`)
 - "plants die eventually"
 - Question: Do trees die?
- massive knowledge engineering effort

John Searle

The Chinese Room (1980)



A man is in a room with a book of rules. Chinese sentences are passed under the door to him. The man looks up in his book of rules how to process the sentences. Eventually the rules tell him to copy some Chinese characters onto paper and pass the resulting Chinese sentences as a reply to the message he has received.

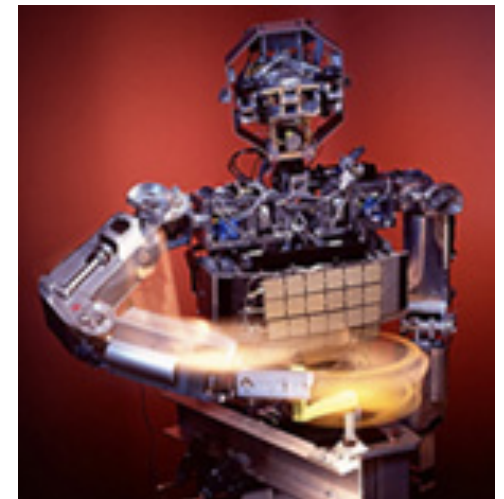
Strong vs. Weak AI

(Searle 1980)

- **Strong AI**
 - the supposition that some forms of artificial intelligence can truly reason and solve problems, achieve self-awareness and demonstrate a wide range of human-level cognitive abilities
- **Weak AI**
 - machines can demonstrate intelligence but do not necessarily have a mind

Rodney Brooks

Subsumption Architecture & Embodiment (mid-1980s)



decomposing complicated intelligent behaviour into many "simple" behaviour modules

Deep Blue

First Computer Chess Victory over a reigning world champion (1996)



*"A machine would be
world chess
champion within
ten years"*
(Herbert Simon,
1957)

Hiroaki Kitano

RoboCup (1995)



By the year 2050, develop a team of fully autonomous humanoid robots that can win against the human world soccer champion team.

DARPA Grand Challenge

- race for a \$2 million prize where cars drive themselves across several hundred miles of challenging desert terrain without any communication with humans, using GPS, computers and a sophisticated array of sensors



The Future of AI?



Hiroshi Ishiguro (Japan) - Repliee Q2
13 degrees of freedom in head alone!
<http://www.is.sys.es.osaka-u.ac.jp/development/0006/>

Definitions: Bases of AI

Systems that...	think	act	how
	neural nets, GPS	Turing Test	like a human
	logical inference	subsumption	rationally

Next Class Agenda

- Agents