

Thinking, Algorithmic and Otherwise



When algorithmic thinking was introduced, it was observed that everything a computer does was planned out for it by a programmer ... does that mean a computer cannot think? Or could a programmer plan out a way to think?

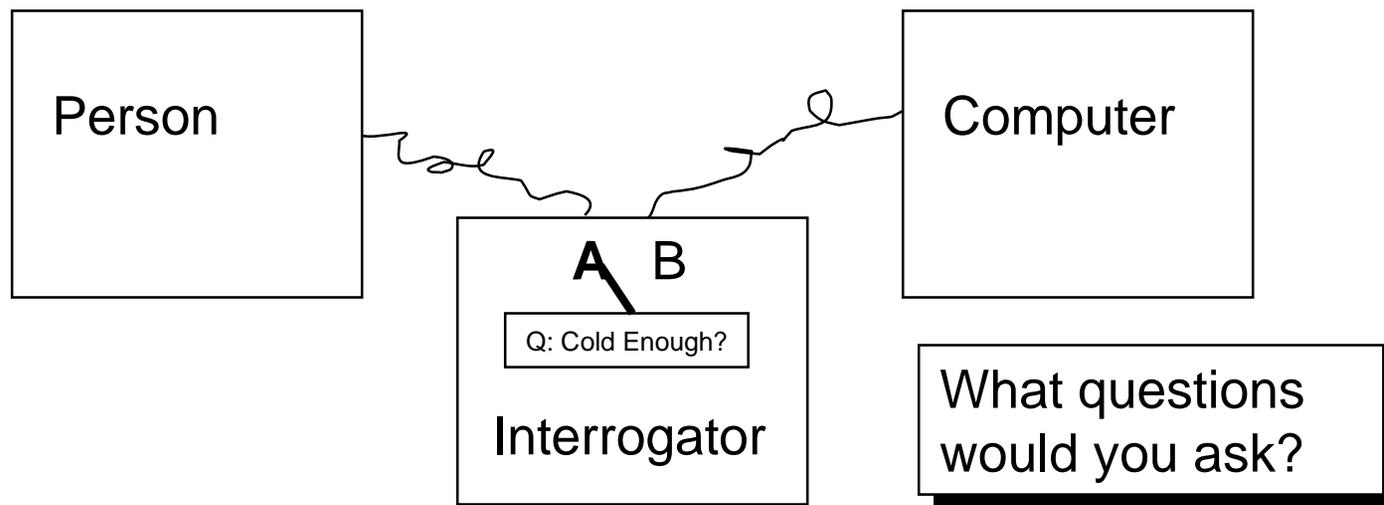
Can A Computer Think?

“Asking if a computer can think is like asking if a submarine can swim”

- ❖ Intelligence could be defined as a property of people
- ❖ But computers can do interesting things that people do that seem to take intelligence:
 - ❑ Balance a check book and approximate pi
 - ❑ Check for spelling errors
 - ❑ Type-set documents aesthetically
 - ❑ Make medical diagnoses
 - ❑ Recognize spoken English over the phone
 - ❑ Play and win at games
 - ❑ ...

Turing Test

- ❖ In 1950 A.M. Turing proposed a way for answering the question of whether computers are intelligent
- ❖ Strategy: If a person cannot determine through a dialog with a computer and a person which one is the person, then the computer must have some level of intelligence



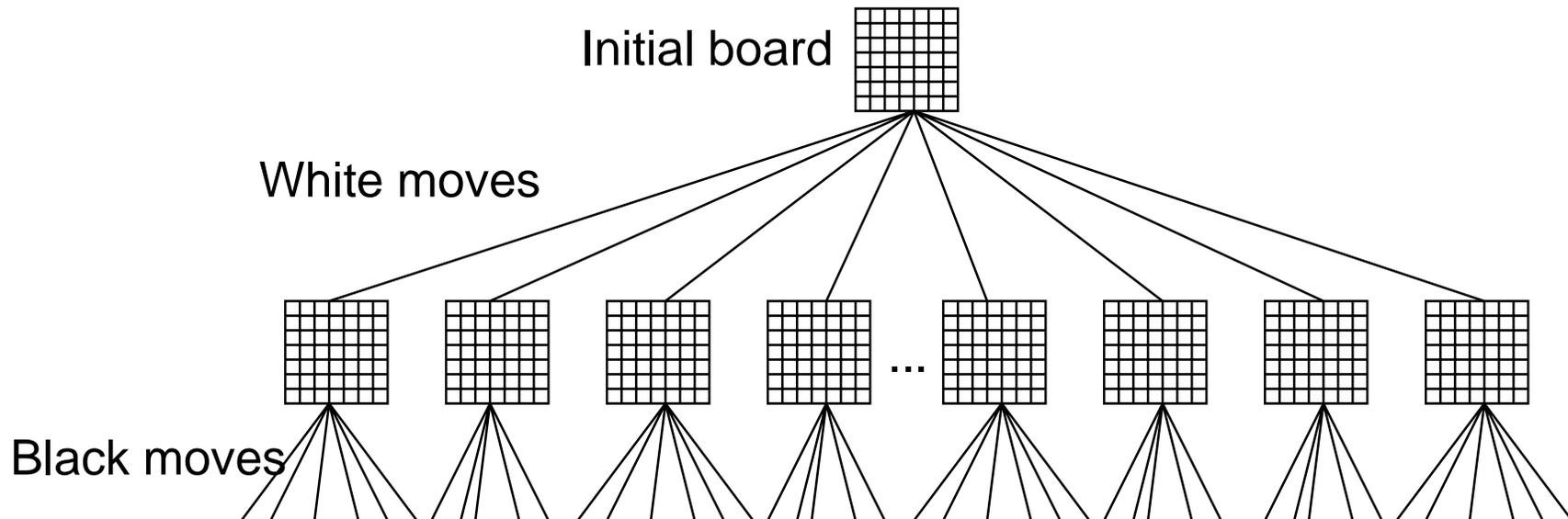
Revealing Questions

- ❖ Are you a person?
- ❖ What day is it?
- ❖ Who was the first president of the US?
- ❖ What is 441093387×77327 ?
- ❖ Can white win in 1 move from this chess position ...?
- ❖ How does Hamlet's most famous soliloquy start?
- ❖ What's odd about "We all scream for ice cream"?
- ❖ What was your father like?
- ❖ What is your opinion about impeaching someone for private, personal behavior?

Which of these might
a computer answer?

The Challenge of Chess

- ❖ Chess is a deterministic game in the sense that it does not involve randomization, such as dice
- ❖ There are a finite number of chess positions, that is, legal arrangements of chess pieces on a board
- ❖ Computers are fast, so enumerate all positions ...

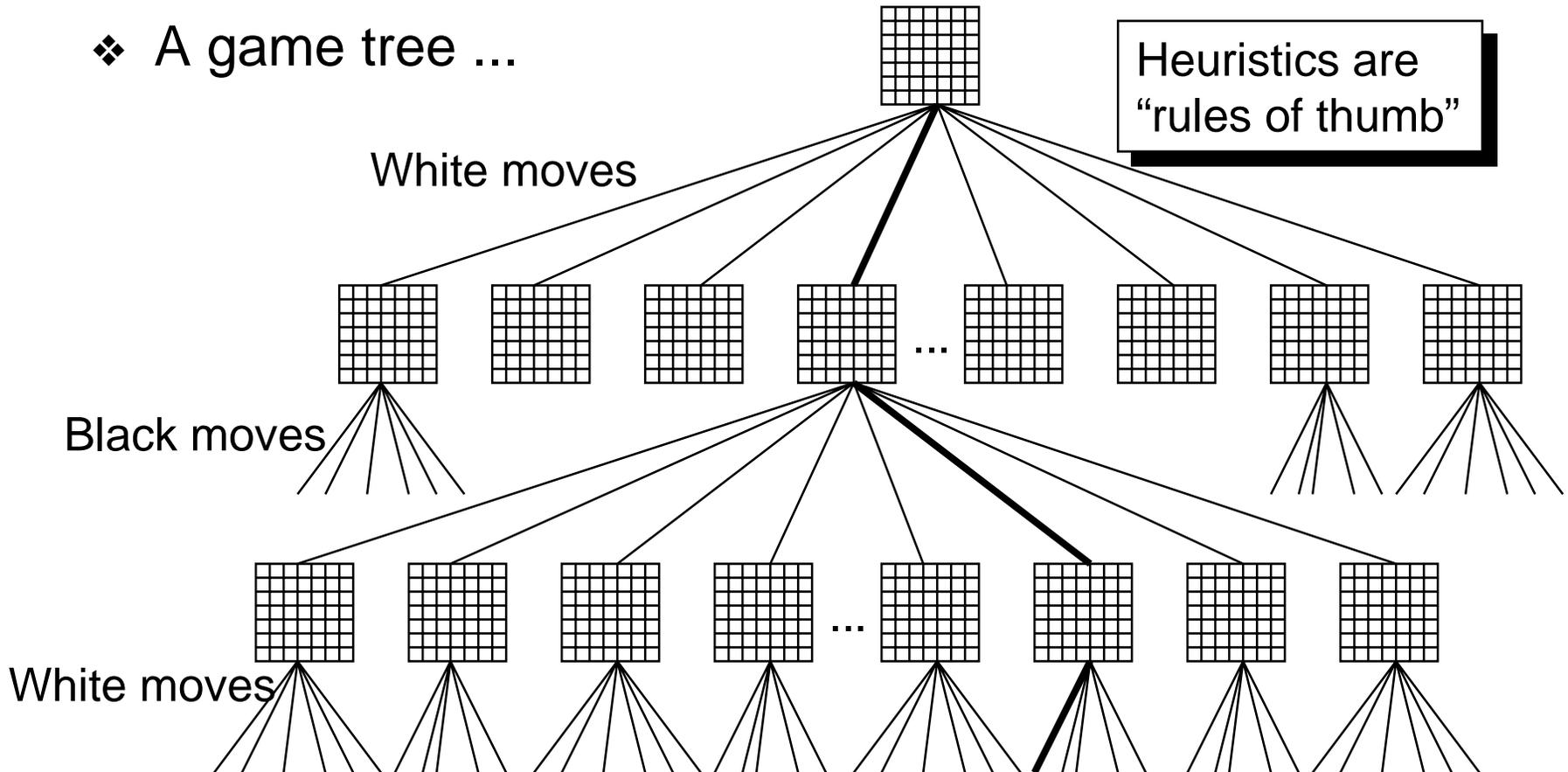


A Computer Can Solve Chess, Not

- ❖ Exhaustive searching of the chess game tree is impractical
 - ❑ 20 possible initial moves
 - ❑ On average there are about 35 moves possible from a given position
 - ❑ Typical games are about 100 moves long
- ❖ Estimate 35^{100} boards in the tree ... there are fewer protons in the entire universe
 - For a computer to play good chess it needs smarts!
- ❖ In the 1960s the pioneers of artificial intelligence -- researchers who study making computers “intelligent” thought that “the day is near when a computer will be the reigning world chess champion”

Game Trees

- ❖ How could a computer play chess, if not exhaustively
- ❖ A game tree ...





Heuristics

- ❖ Heuristic programming is simply encoding the guidelines of a heuristic into an otherwise deterministic program
- ❖ Heuristic techniques are can be used in “algorithmic” programming
 - ❑ Think of finding whether a grid point is covered by a drop by looking through the array of drops ... where to begin
 - + At the end
 - + With the last drop

The Day Came

- ❖ Deep Blue, IBM's chess playing supercomputer was the first computer to win a tournament against the world champion, Gary Kasparov
- ❖ Kasparov resigned (in a huff) after 19 moves into the sixth and final game of the match (losing 2.5 to 3.5)

"I tried to play through the rest of the game as best I could, but I lost because [Deep Blue] played great. It played like God."

Did Deep Blue Exhibit Intelligence?

FIT 100 Summary

- ❖ Are computers intelligent? The question is still open
- ❖ As time has passed programs have solved problems in a more intelligent way
- ❖ Many characteristics that make people appear to be intelligent can be programmed ... whether they all will be is unknown