Progress has been tremendous

Artificial Intelligence (is no match for natural stupidity :)

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Announcements

- Pizza party Tuesday in Allen Hall (CSE building)
- Labs this week are devoted to pair programming; it is a perfect time to work, but of course, you may also need to work outside of those times

Review

- Last time, we emphasized a key fact of algorithm design …

- You must be able to explain *why* an algorithm works
  - It's different for every algorithm
  - You need to know, but often you may also have to explain it to someone else
  - Our illustration was explaining why two sorting algorithms worked

Thinking with Electricity

- The inventors of ENIAC, 1st computer, said it "thinks with electricity"
  - Do calculators "think"?
  - Does performing arithmetic, which is entirely algorithmic, require thinking?
  - Once, performing arithmetic, was thought to be divinely or magically conferred ability

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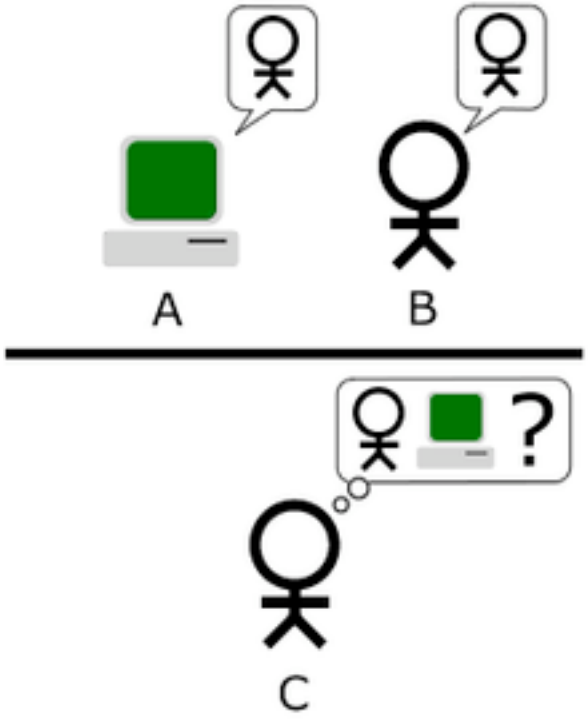
The Problem: Many human activities look like thinking until they are understood (to be algorithmic)

Turing's Test

- A.M. Turing, computer pioneer, worried about intelligence in humans & machines; proposed a test (1950)
  - Aware that it is intelligence until it's understood, Turing devised a test with this experimental setup:

    A computer (A) and a person (B) are connected to an examiner, who can ask questions using text to determine which is which



What Would You Ask?

- Formulate questions a person can answer but a computer can't

Turing's Idea of Interrogation

Interrogator In the first line of your sonnet which reads 'Shall I compare thee to a summer's day', would not 'a spring day' do as well or better?

Computer It wouldn't scan.

Interrogator How about 'a winter's day'? That would scan all right.

Computer Yes, but nobody wants to be compared to a winter's day.

Interrogator Would you say Mr. Pickwick reminded you of Christmas?

Computer In a way.

Interrogator Yet Christmas is a winter's day, and I do not think Mr Pickwick would mind the comparison

Computer I don't think you're serious. By a winter's day one means a typical winter's day, rather than a special one like Christmas.

Captcha

- Completely Automated Public Turing Test To Tell Computers and Humans Apart
  - Developed at CMU by Luis Van Ahn and his team

Seeming To Be Intelligent

- Joel Weizenbaum's "Doctor" [a\k\a "Eliza"] was a program that *appeared* intelligent

  User: I'm depressed.

  Doctor: Why are you depressed?

  User: My mother is not speaking to me.

  Doctor: Tell me about your mother.

  User: She doesn't want me to major in CS.

  Doctor: No?

  User: No, she wants me to go into medicine.

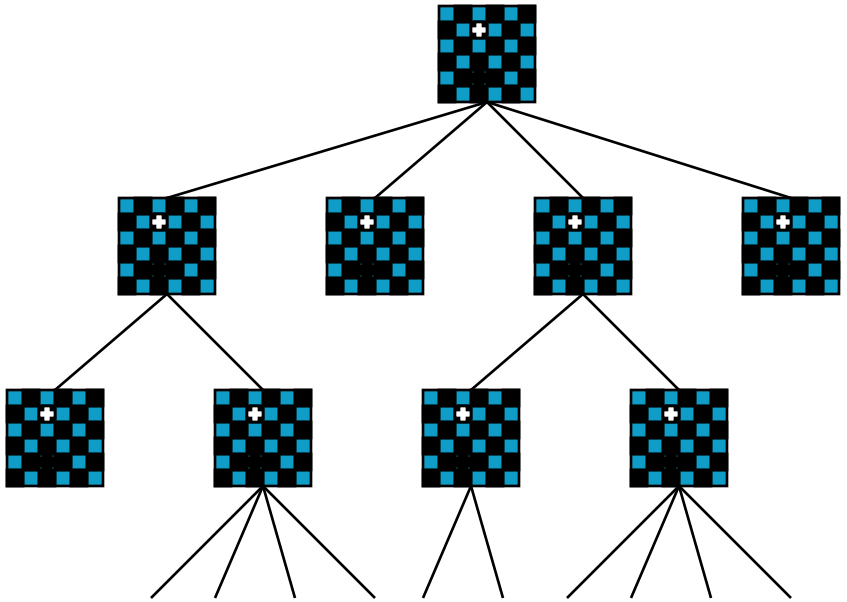
Doctor was basically scripted

Artificial Intelligence

- The study of making computers act intelligently
  - They already act intelligent … e.g. they can correct your spelling mistakes
  - Is this intelligent behavior? Most AI researchers would say "no" … algorithmic
  - Playing grandmaster level chess in a tournament became an AI goal (1952)
    - Minimizes real world knowledge
    - Clear goal, formal system

Playing Chess

- Chess is a game, so it uses a game tree
  - At each node is a 'board'-- easily digitized
  - Below it are all boards created in 1 move; below those, all boards needing another move



An objective function evaluates "goodness" of the position: go for highest … opponent goes for lowest

Deep Blue vs Kasparov

- An IBM system, Deep Blue, played world champion Gary Kasparov
  - In 1996 Kasparov won, but Deep Blue played 1 game well!!! This was a first.
  - In May 11, 1997 Deep Blue won 3.5-2.5

Deep Blue is a 32 processor parallel computer with 256 "chess processors" that can consider 200,000,000 chess positions per second + opens + ends

Intelligent?

- Does Deep Blue's performance show that a computer can be intelligent?
  - No -- it repeat's its designers intelligence (weak rebuttal)
  - Yes -- it's better than anyone in the world at something people find interesting and fun
  - Maybe -- it shows intelligence in chess, but can it apply its intelligence elsewhere?

What do you think?

And Now Watson plays Jeopardy

Watson: More Sophisticated

- Compared to Deep Blue, Watson is much more sophisticated in design, organization
  - runs on ~2,500 parallel CPUs, each capable of up to 33 billion operations a second; size of small RV
  - crawled and organized 200 million pages of data
  - "expert" analyzers — more than 100 different techniques running concurrently to analyze natural language, appraise sources, propose hypotheses, merge results and rank top guesses.

The Test Comes This Week

- It may be anticlimactic for the public, but the CS community is all a-buzz because this is REALLY difficult technically

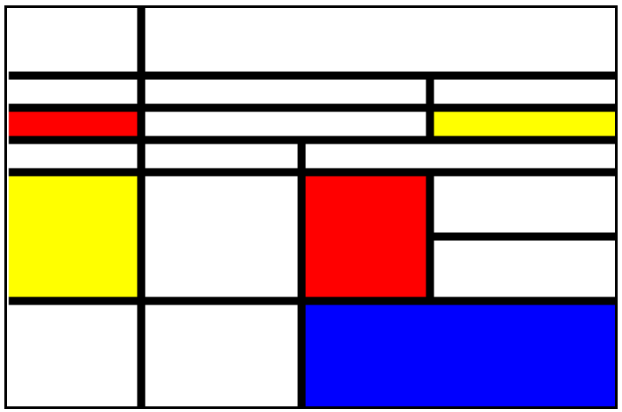
It's tough to "get" a pun!

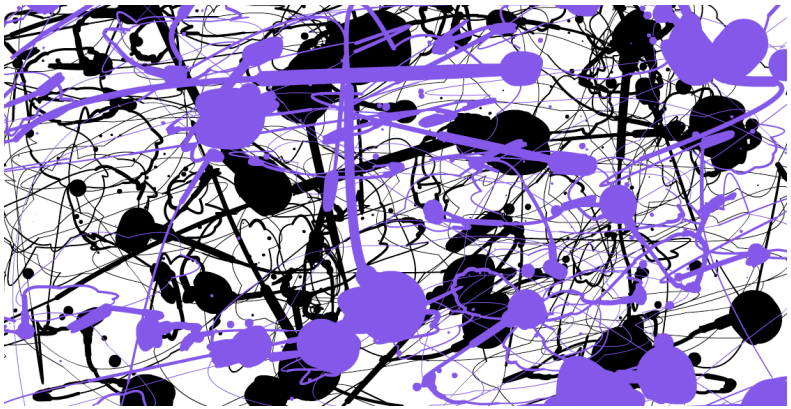
Compare Watson, Deep Blue

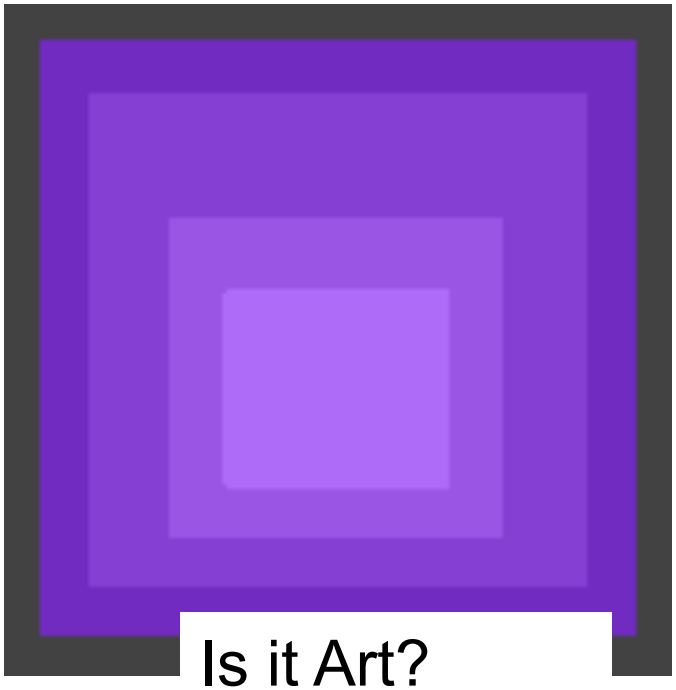
- Chess seems harder, but it's not
  - Chess has fixed rules, little real world data needed
  - Jeopardy, more free form using only real data
- Other differences
  - In chess the "problem" is known beforehand, but in Jeopardy, someone else sets up the problem
  - In chess, decisions are based on a formula, but in Jeopardy many forms of evaluation are needed (a problem solved by probabilities)
  - In chess there is very little pre-planning, but in Jeopardy, organizing the data is the key

Being Creative

- Computers do things deemed creative in past
  - Create designs in the style of Piet Mondrian, Jackson Pollack or Josef Albers …







Is it Art?
Is it Creative?

Definition of Creativity

- Creativity has two forms: "flash out of the blue" and "incremental revision"
  - "Flash," i.e. inspiration, is rare; is it just luck?
  - "Revision", i.e. hard work, is common and to a large degree algorithmic

Advertising agencies are famous for creativity, but in a recent study, 89% of all *award-winning* ads were an application of one of six templates -- design algorithm

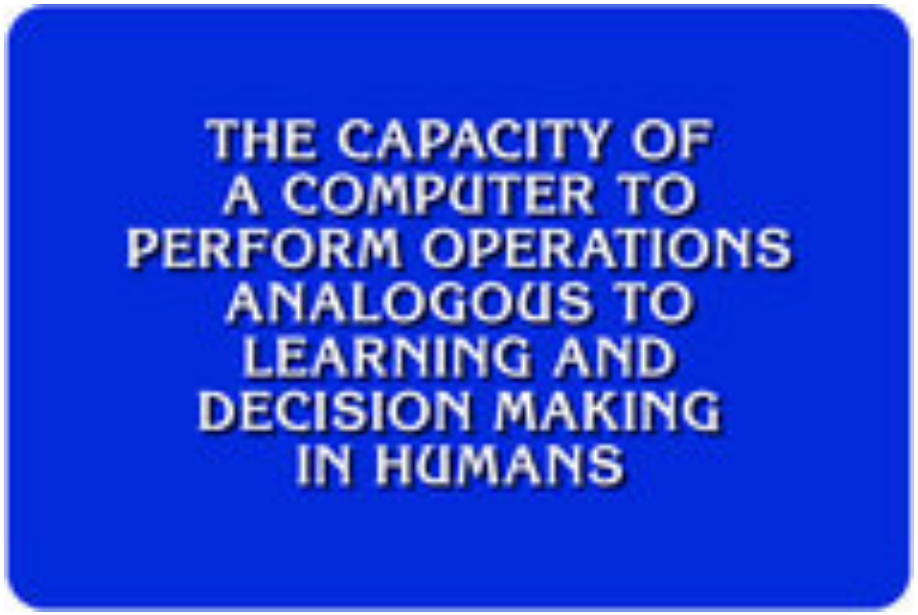
Composing Music

- An experiment at the U. of Oregon … compose music in the style of Bach
- Three participants: Bach, U of O Professor, EPI program
- And the winner is …

Audience Thought:	Bach's work was Professor	Professor's work was EPI program	EPI's work was Bach

Summary

- Watson looks to be a major advance in AI and a big step towards answering Turing's Test



What is Watson?