CSC104 winter 2013
Why and how of computing
week 2

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Text: Picturing Programs
could algorithms run the world?

Spectacular algorithm success leads to questions:

- Is there, potentially, an algorithm to solve every problem?

- If there are two or more algorithms solving the same problem, how do you choose?

- How do you discover new algorithms?
problems without an algorithm

before electronic, programmable computers
Alonzo Church and Alan Turing showed there were many unsolvable problems

Classic example: Halting Problem
another example

If there an algorithm for each problem, how about one to decide whether declarative English sentences are true? How about:

This statement is false.

What should the algorithm that verifies (or not) sentences do?
algorithms that take too long

An algorithm may exist, but take too long to be feasible:

(define (fib n)
  (if (< n 2)
      n
      (+ (fib (- n 1)) (fib (- n 2))))

Of interest from rabbit-breeding to biology to computer science (see Vi Hart), calculating Fibonacci sequence this way gets slow for numbers over 40.
Before on-line dictionaries, it was common to look up definitions in a paper-and-ink dictionary. There are (at least) two different, correct ways to find the leaf (2-sided sheet) with the word you’re looking for (or conclude it’s not in the dictionary).

- linear search
- binary search
Clearly there’s no fool-proof method, but there’s some techniques that often make progress. It helps to write down the whole process:

- Understand the problem
- Devise (one or more) plan(s)
- Try the plan
- Look back
paper folding?
try it out

- Understand the problem (what’s given, what’s required)?
- Devise a plan
- Try at least one plan (be ready to abandon it too)
- Look back