6.00 Introduction to Computer Science and Programming

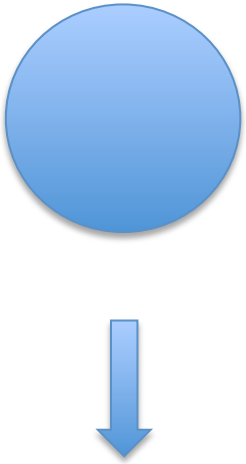
- Goal:
  - Become skillful at making a computer do what **you** want it to do
  - Learn computational modes of thinking
  - Master the art of computational problem solving

What does a computer do?

- Fundamentally a computer:
  - Performs calculations
  - Remembers the results
- What calculations?
  - Built in primitives
  - Creating our own methods of calculating

Is that all it does?

- A billion calculations per second



- 100s of gigabytes of storage

Are simple calculations enough?

- Searching the World Wide Web
- Playing chess
- Good algorithm design also needed to accomplish a task!

45B
1K 10 ops/word
5.2 days

35 moves
1.8B
100 ops/move
1/2 hour

Experts say
10^123 different chess games are available.
See:
https://en.wikipedia.org/wiki/Shannon_number

10^80 atoms in the observable universe.
See:
https://en.wikipedia.org/wiki/Observable_universe#Matter_content

… so are there limits?

- Despite its speed and storage, a computer does have limitations
  - Some problems still too complex
    - Accurate weather prediction at a local scale
    - Cracking encryption schemes
  - Some problems are fundamentally impossible to compute
    - Predicting whether a piece of code will always halt with an answer for any input

    Turing's Halting Problem
    See: https://en.wikipedia.org/wiki/Halting_problem