Programming and Algorithms

How computers think.

What is Programming?

- It’s the way we can tell computers to do what we want.
- Whenever you use a computer, you run one or more *programs.*
- Examples: Internet Explorer, Microsoft Word, Photoshop
- You can also write your own programs using *programming languages*.

Programming Languages

- To tell the computer what to do, we need to speak a language that it understands. Such languages are called *programming languages.*
- Examples of programming languages:
  - Logo
  - Scheme
  - C/C++
  - BASIC
  - Java

Human Language

- When people talk, they often say things they don’t mean
  - “It’s raining cats and dogs.”
- Humans are also vague.
  - “Could you hand me that thing over there?”
- Computers can’t fill in what we’ve left out, so we have to be very clear.

Languages

- All languages, both for humans and computers, have *grammar* and *syntax.*
- Grammar is the structure of the words in sentences or statements. It tells us what order words come in and what kinds of words go where.
- Syntax is the punctuation of a language.
  - Sarah youre—standing right? There: hand! me, that—marker,
  - If the syntax is wrong, things won’t make sense.

More on Grammar

- In English, we have different parts of speech, such as nouns, verbs, adjectives, adverbs, pronouns, and articles.
- In programming languages, we have parts of speech such as numbers, procedures (aka functions, subroutines, and methods), keywords, and strings of text.

Beyond Grammar

- We have to have the grammar and syntax correct for the computer to understand us, but programming is much more than that.
- What's most important is the *algorithm*.

algorithm. *noun*
A step-by-step procedure for solving a problem or accomplishing some end, especially by a computer.

Example Algorithms

- A recipe in a cookbook is an algorithm.
  - Ingredients:
    - 1/2 cup of butter
    - 1 cup of white sugar
    - 2 eggs
    - 1 teaspoon of vanilla
    - 1/3 cup of cocoa
    - 3/4 cup of flour
    - 1/2 teaspoon of baking powder
    - 1/4 teaspoon of salt

  - Directions:
    - Mix butter and sugar and beat well until fluffy.
    - Beat in the eggs and vanilla
    - Sift cocoa with the flour, baking powder & salt. Work into the creamed mixture.
    - Spoon this into a 8x8x2 inch pan and bake for 30-35 minutes at 350 degrees.

Example Algorithms

- To get to the CIT from 95:
  - Take Exit 20 onto 195 East (Cape Cod).
  - Take Exit 2 to WICKENDEN Street.
  - Turn LEFT at the light on to WICKENDEN and LEFT at the 2nd light on to BROOK St.
  - Continue on Brook for several blocks to a traffic light.
  - Our red brick building is on your left.
  - The front of our building is on the other side, facing a quadrangle.

Procedures

- Once we've written a procedure, we can re-use it whenever we want.
- For example, say we defined a procedure for getting to Brook Street from 95.
- Our directions now look like:
  - From 95, get onto Brook Street.
  - Continue on Brook for several blocks to a traffic light.
  - Our red brick building is on your left.
  - The front of our building is on the other side, facing a quadrangle.
- Is there anything we left out from these directions?

Back to Languages

- What do algorithms have to do with programming languages?
- Answer: An algorithm is a series of steps. A language is the way we describe these steps.

Parameters

- Suppose we want to write an algorithm for making cookies, but we don’t know how many to make.
- We can generalize our algorithm with *parameters* (also called *arguments*).
- Can you think of a place where you’ve seen parameters before?

Making Your Own

- When you write your own algorithm, think about what steps you need to take.
  - What order should they come in?
- Be careful not to leave anything out.

Ice Cream Sundaes

- Your job now is to write an algorithm for making an ice cream sundae.
- What are the different steps you'll want in your language?
- Write your algorithm down on paper. We'll be collecting your algorithms.