SIRI COMPETITION? EVI

The success of Apple’s Siri (only available on the iPhone 4S) has sparked competition, to be sure. Google’s RS (Siri spelled backward, and now Evi available on both iOS and Android). The popularity has meant the servers are down (they didn’t use cloud storage clearly—we’ll learn about that later). Love where this is going!

www.technologyreview.com/computing/39560/

Generalization (in CS10)

- You are going to learn to write functions, like in math class:

\[ y = \sin(x) \]

- \( \sin \) is the function
- \( x \) is the input
- It returns a single value, a number

“Function machine” from Simply Scheme (Harvey)

Function basics

- Functions take in 0 or more inputs and return exactly 1 output
- The same inputs MUST yield same outputs.
  - Output function of input only
- Other rules of functions
  - No state (prior history)
  - No mutation (no variables get modified)
  - No side effects (nothing else happens)

More Terminology (from Math)

- Domain
  - The “class” of input a function accepts
- Examples
  - \( \text{Sqrt} \) of
    - Positive numbers
  - \( \text{Length} \) of
    - Sentence, word, number
    - ...<...
    - Both: Sentence, word, number
    - ... and ...
    - Booleans
    - Letter _ of _
    - Number from 1 to input length
    - Sentence, word, number
- Range
  - All the possible return values of a function
- Examples
  - \( \text{Sqrt} \) of
    - Non-negative numbers
  - \( \text{Length} \) of
    - Non-negative integer
    - ...<...
    - Both: Boolean (true or false)
    - ... and ...
    - Booleans
    - Letter _ of _
    - Letter

Types of input (there are more)

| Sentences | Words separated by N spaces, N ≥ 0
| Word      | Length ≥ 1, no spaces
| Character | Length = 1
| Digit     | 0-9 only

Why functions are great!

- If a function only depends on the information it gets as input, then nothing else can affect the output.
  - It can run on any computer and get the same answer.
- This makes it incredibly easy to parallelize functions.
  - Functional programming is a great model for writing software that runs on multiple systems at the same time.
**Scratch → BYOB (Build Your Own Blocks)**

- **Scratch**
  - Invented at MIT
  - Maintained by MIT
  - Large community
  - Sharing via Website
  - No functions
  - Scratch 2.0 in Flash
  - No iOS devices
  - scratch.mit.edu

- **BYOB (to be “Snap!”)**
  - Based on Scratch code
  - Maintained by jens & Cal
  - Growing community
  - No sharing (yet)
  - Functions! “Blocks”
  - BYOB 4.0 in HTML5
  - All devices
  - byob.berkeley.edu

---

**Why use functions? (1)**

The power of generalization!

---

**Why use functions? (2)**

They can be composed together to make even more magnificent things.

They are literally the building blocks of almost everything that we create when we program.

We call the process of breaking big problems down into smaller tasks functional decomposition.

---

**Types of Blocks**

- **Command**
  - No outputs, meant for side-effects
  - play drum for 10 beats

- **Reporter (Function)**
  - Any type of output
  - join hello world

- **Predicate (Function)**
  - Boolean output
  - true or false

---

**Quick Preview: Recursion**

Recursion is a technique for defining functions that use themselves to complete their own definition.

We will spend a lot of time on this.

---

**Functional Programming Summary**

- **Computation is the evaluation of functions**
  - Plugging pipes together
  - Each pipe, or function, has exactly 1 output
  - Functions can be input!

- **Features**
  - No state
  - E.g., variable assignments
  - No mutation
  - E.g., changing variable values
  - No side effects

- Need BYOB not Scratch

---

- Quick Preview: Recursion

---

- Functional Programming Summary

---

- Why use functions? (1)

---

- Why use functions? (2)

---

- Types of Blocks

---

- Quick Preview: Recursion

---

- Functional Programming Summary