The Beauty and Joy of Computing

Lecture #4: Functions

THE FUTURE OF VIDEO GAMES?
Valve (video game makers of Half Life) believes the future of video games may not be in the input device(s) like the Wii remotes or your body ala Kinect, but the output device! What is shown on the right is an augmented reality device, layering 3D content onto the real world.


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

More Terminology (from Math)

- **Domain**
  - The "class" of input a function accepts
  - Examples
    - Sqrt of
      - Positive numbers
    - 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
    - Sqrt of
      - Non-negative numbers
    - Length of
      - Non-negative integer
    - _ <=_
      - Boolean (true or false)
    - and
      - Boolean (true or false)
    - Letter _ of_
      - Letter

Types of input (there are more)

<table>
<thead>
<tr>
<th>Sentences</th>
<th>Words separated by N spaces, N &gt; 0</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>E.g., CS 10 is great</td>
</tr>
<tr>
<td>Word</td>
<td>Length = 1, no spaces</td>
</tr>
<tr>
<td></td>
<td>E.g., A, Z, 0</td>
</tr>
<tr>
<td>Character</td>
<td>Length = 1</td>
</tr>
<tr>
<td></td>
<td>E.g., A, 3, #</td>
</tr>
<tr>
<td>Digit</td>
<td>0-9 only</td>
</tr>
<tr>
<td></td>
<td>E.g., 7</td>
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</tbody>
</table>

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.
Why use functions? (1)

Why use functions? (2)

Types of Blocks

Quick Preview: Recursion

Functional Programming Summary