Code

Algorithms
Syntax
Errors

to register clicker:
https://www.student.cs.uwaterloo.ca/~cs105/cgi-bin/clicker-form.cgi

activate clicker:
hold ON/OFF, wait for power light to flash, enter room code

Test your Clicker

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Credit: Wordless Diagrams
ingredients

- 1 cup olive oil
- 13 cloves garlic
- One 95-ounce can (or, if you can find it, 1-kg) or four 28-ounce cans Italian tomatoes
- Large pinch of red pepper flakes
- 2 teaspoons fine sea salt

preparation

1. Combine the olive oil and garlic in a large deep saucepan and cook over medium-low heat for about 10 minutes, stirring or swirling occasionally, until the garlic is deeply colored—striations of deep brown running through golden cloves—and fragrant. If the garlic starts to smell acidic or sharp or is taking on color quickly, pull the pan off the stove and reduce the heat.

2. While the garlic is getting golden, deal with the tomatoes: Pour them into a bowl and crush them with your hands. We like to pull out the firmer stem end from each of the tomatoes as we crush them and discard those along with the basil leaves that are packed into a can.

3. When the garlic is just about done, add the red pepper flakes to the oil and cook them for 30 seconds or a minute, to infuse their flavor and spice into the oil. Dump in the tomatoes, add the salt, and stir well. Turn the heat up to medium, get the sauce simmering at a gentle pace, not aggressively, and simmer for

Expressing Algorithms

Knit Pícks

LITTLE LEAVES DISHCLOTH

(by Jenny Rockefeller)

(yo and insert hook in st, yo and draw loop through st, yo and draw through first 2 loops on hook) 3 times all into the same st, yo and draw loop through all 4 loops on hook to complete the bobble.

DIRECTIONS

Loosely ch 40 stitches.

Row 1: work 1 bobble in 4th ch from hook, ch 1, *sk 1 ch, 1 bobble in next ch*, repeat to end, turn.

Row 2: Ch 3, *1 bobble in next 1-ch sp between bobbles of previous row, ch 1* repeat to end, working last bobble in tch, turn.

Repeat Row 2 until dishcloth measures approx. 10” in length.

http://www.knitpicks.com/patterns/Little_Leaves_Crochet_Dishcloth__D558320.html
Algorithm

An algorithm is a specific set of instructions for carrying out a procedure or for solving a problem.

- It must **produce a result**.
- It must be **achievable/possible**.
- It must be **expressed clearly**.

http://mathworld.wolfram.com/Algorithm.html
More Examples

- What are other examples of algorithms in daily life?

Algorithm Qualities

Algorithms *typically* ...
... make some **assumptions**.
... have **multiple** solutions.
... include **decisions**.
... are expressed in **modular** pieces.
Algorithm Clarity and Precision

Within four adjacent squares, each 4' by 4', four draftsmen will be employed at $4.00/hour for four hours a day and for four days to draw straight lines 4 inches long using four different colored pencils; 9H black, red, yellow and blue. Each draftsmen will use the same color throughout the four day period, working on a different square each day.

Sol LeWitt
Algorithm Clarity and Precision

Yoko Ono

Design an Algorithm

- Robot control
Computer Algorithm

An algorithm is a well-ordered collection of unambiguous and effectively computable operations that when executed produces a result and halts in a finite amount of time.

[Schneider and Gersting 1995]

1. Algorithms are well-ordered.
2. Algorithms have unambiguous operations.
3. Algorithms have effectively computable operations.
4. Algorithms produce a result.
5. Algorithms finish in a finite amount of time.

Computers aren’t really that smart.

- They do very simple things
  - arithmetic
  - follow a sequence of steps
  - make a decision when something is true or false
- They do exactly as they’re told.

But they do these things really, really fast and very, very consistently.

- This can make them appear intelligent:
  http://nlp-addiction.com/eliza/
How to Express a Computer Algorithm?

- Early computers used dials, switches, plug boards
How to Express a Computer Algorithm?

- Visual Programming Languages (e.g. Scratch)

![Scratch diagram](image)

How to Express a Computer Algorithm?

- Visual Programming Languages (e.g. MAX/MSP)

![MAX/MSP diagram](image)
Code

Codes can be for communication, clarification, obfuscation. Examples ...
- Morse Code (communication)
- Health Code (clarification)
- Secret Code (obfuscation)

We focus on code that communicates a set of instructions.

Mark Up Languages (e.g. HTML)

```html
<div id="site" class="page with-navigation clearfix">
  <div id="skip">
    <a href="#main" class="element-invisible element-focusable" accesskey="1">Skip</a>
    <a href="#footer" class="element-invisible element-focusable">Skip</a>
  </div>
  <div id="header">
    <div id="uw-header" class="clearfix">
      <a id="uw-logo" href="//uwaterloo.ca/" accesskey="1">University of Waterloo</a>
      <div id="uw-search">
        <form method="get" action="//uwaterloo.ca/search">
          <label id="uw-search-label" for="uw-
          <input id="uw-search-term" type="text"
          name="q" />
          <input id="uw-search-submit" class=""
          value="Search" tabindex="3" />
          <input type="hidden" name="client" value="proxystyl"
        </form>
      </div>
    </div>
  </div>
</div>
```
**Machine Code**

b8 6f 72 6c 64 #moving "orld" into eax
a3 08 10 00 06 #moving eax into next memory location
b8 6f 2c 20 57 #moving "o wo" into eax
a3 04 10 00 06 #moving eax into next memory location
b8 48 65 6c 6c #moving "hell" into eax
a3 00 10 00 06 #moving eax into next memory location
b9 00 10 00 06 #moving pointer to start into ecx
ba 10 00 00 00 #moving string size into edx
bb 01 00 00 00 #moving "stdout" number to ebx
b8 04 00 00 00 #moving "print out" syscall number to eax
cd 80 #calling the kernel to execute print stdout
b8 01 00 00 00 #moving "sys_exit" call number to eax
cd 80 #executing it via sys_call

(for Linux, example code is not strictly correct)

**Assembly Code**

; “hello world” program
section .text
global c3Start
c3Start:
    push dword msglen
    push dword mymsg
    push dwod 1
    mov eax, 0x4
    sub esp, 4
    int 0x80
    add esp, 20
    push dword 0
    mov eax, 0x1
    sub esp, 4
    int 0x80
section .data
    mymsg db “hello world”, 0xa
    msglen equ $-mymsg
Java

// “hello world” program
public class Hello {
    public static void main(String[] args) {
        System.out.println("hello world");
    }
}

JavaScript

<!DOCTYPE html>
<html>
    <script>
        // “hello world” program
        console.log("hello world");
    </script>
    <body>
    </body>
</html>
JavaScript using p5.js

// “hello world” program
function setup() {
    print("hello world");
}

Processing p5.js Demos

Tour of the Web Editor

Code Syntax

Code Semantics

Errors:

• Syntax
• Runtime
• Logic

https://editor.p5js.org/cs105/sketches/6k5r0IBZ1
Types of Programming Errors

- Syntax Errors:

- Runtime Errors:

- Logic Errors:

Coding Style

- Read introduction, semicolons, and basic in-line spacing in Code Style Guide (on LEARN)

- Style is part of your lab and assignment grade
Coding Style: Semicolons

- In JavaScript, ending a line with a semicolon is optional
  - If you leave them off, the compiler will guess and invisibly add them in (but the result doesn't always do what you want)
- Good style is to **always end a line with a semicolon**
  - All code in this class will have semicolons
  - All (?) code in the p5 references has semicolons
  - **You will lose style marks if you don’t end lines with semicolons**

Examples and Reference

- [https://p5js.org/examples/](https://p5js.org/examples/)
- [https://p5js.org/reference/](https://p5js.org/reference/)
Recommended Textbook

- [https://p5js.org/books/](https://p5js.org/books/)

Online Resources

- Learning Javascript using p5
  - [https://p5js.org/learn/](https://p5js.org/learn/)
  - [https://p5js.org/examples/](https://p5js.org/examples/)
Shifmann’s Coding Train Videos

- https://www.youtube.com/user/shiffman

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