

CSE 390B, Winter 2022

Building Academic Success Through Bottom-Up Computing

Course Wrap-up

Victory Lap, End of Quarter Activity

If joining virtually, please have your camera turned on if you can!



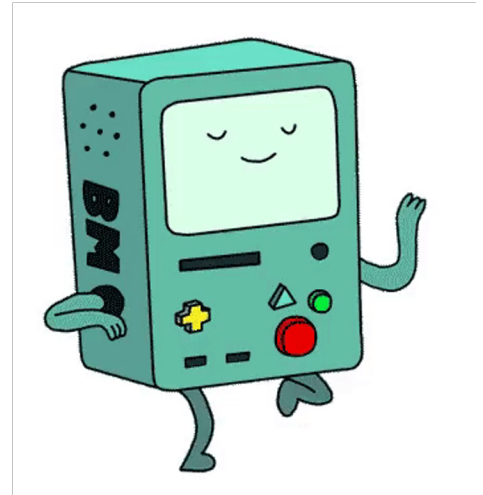
Lecture Outline

- ❖ **Victory Lap**
 - What have we learned in CSE 390B?

- ❖ End of Quarter Activity
 - Led by your incredible TAs

Nand2Tetris Projects

- ❖ By building a computer, you've accomplished something that very few others have done!
 - Many software writers consider building the computer as Somebody Else's Problem™
 - But so many technical skills and CSE courses tie in to this task
 - And even if you only write Java for the rest of time...
 - Understanding the “layer below” makes you a better engineer in the “layer above”!



Project 1 Example: Xor (cont'd)

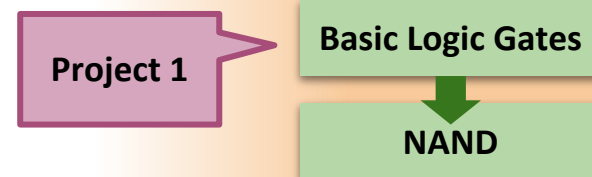
- ❖ Step 2: Use truth table to generate a Boolean function
 - Let's use the Boolean function synthesis strategy from the reading
 - Row 2 = NOT(A) AND B
 - Row 3 = A AND NOT(B)
 - A XOR B = Row 2 OR Row 3

$$= (\text{NOT}(A) \text{ AND } B) \text{ OR } (A \text{ AND NOT}(B))$$

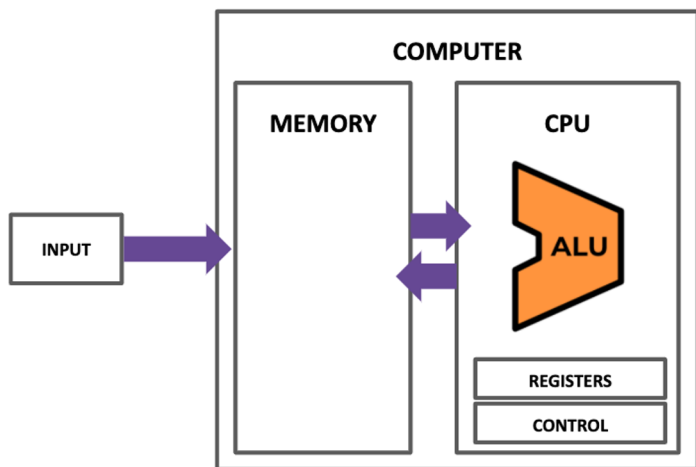
A	B	F	
0	0	0	(Row 1)
0	1	1	(Row 2)
1	0	1	(Row 3)
1	1	0	(Row 4)

$$F = A \text{ XOR } B$$

- ❖ Boolean function synthesis
- ❖ Practice with an unfamiliar, declarative style of programming

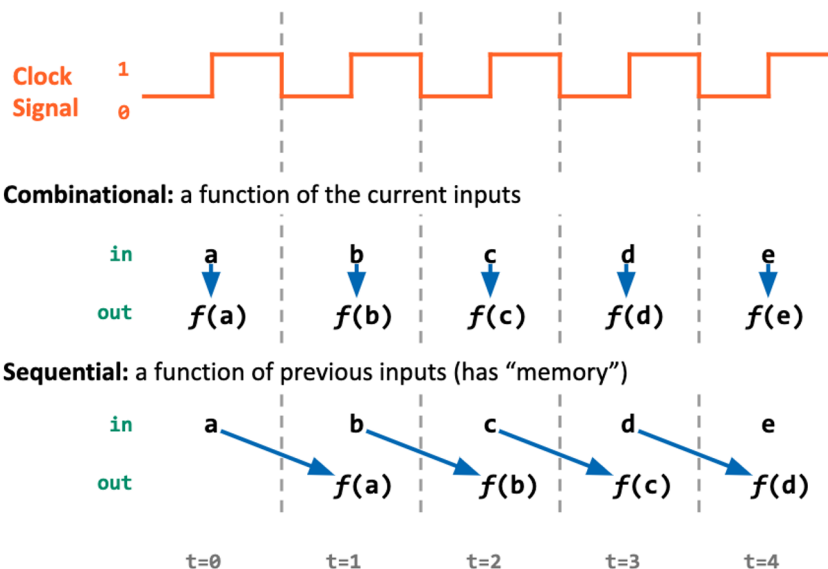


The Von Neumann Architecture

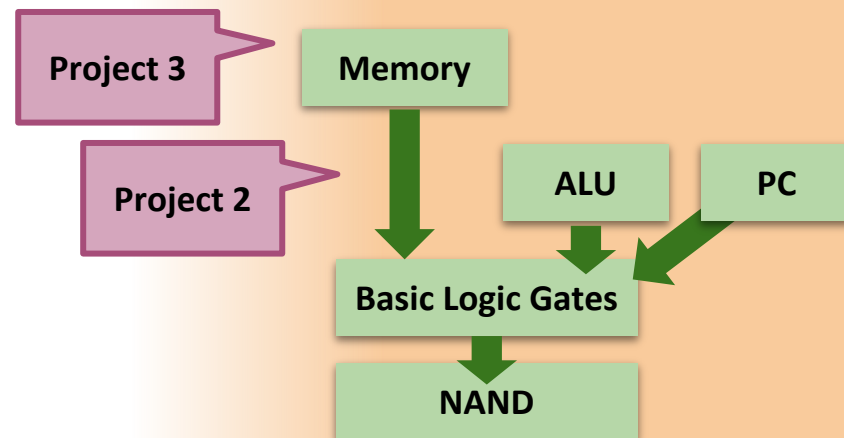


(This picture will get more detailed as we go!)

Combinational vs. Sequential Abstraction



- ❖ Components found in "real-world" computers: ALU, PC, Memory...
- ❖ Learning a mental model for sequential logic



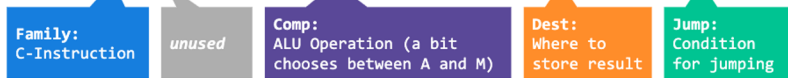
Hack: C-Instructions

Symbolic:

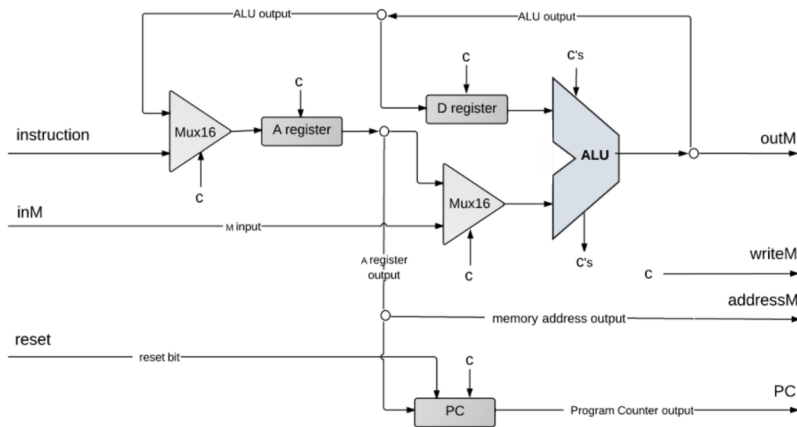
`dest = comp ; jump`

Binary:

`1 1 1 a c1 c2 c3 c4 c5 c6 d1 d2 d3 j1 j2 j3`



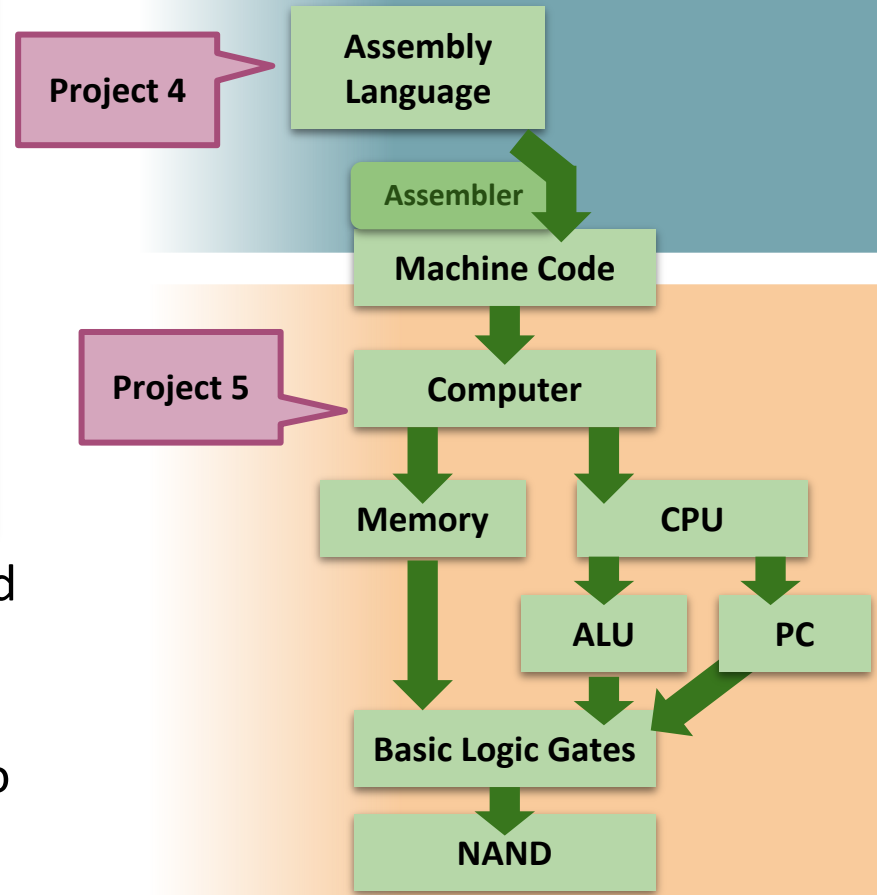
Hack CPU Implementation



(each "c" symbol represents a control bit)

26

- ❖ The connection between software and hardware through binary instructions
- ❖ What has to happen in a clock cycle to process one instruction



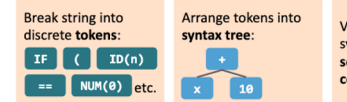
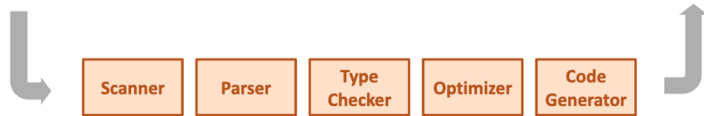
The Compiler: Implementation

```
public int fact(int n) {
    if (n == 0) {
        return 1;
    } else {
        return n * fact(n - 1);
    }
}
```

High-Level Language

```
(fact)
@R0
M=M+1
@R1
D=A
@ifbranch
D;JEQ
```

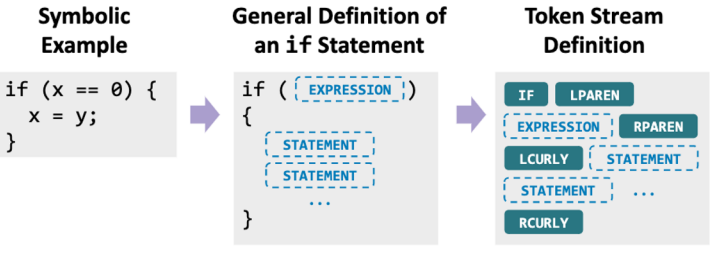
Assembly Language



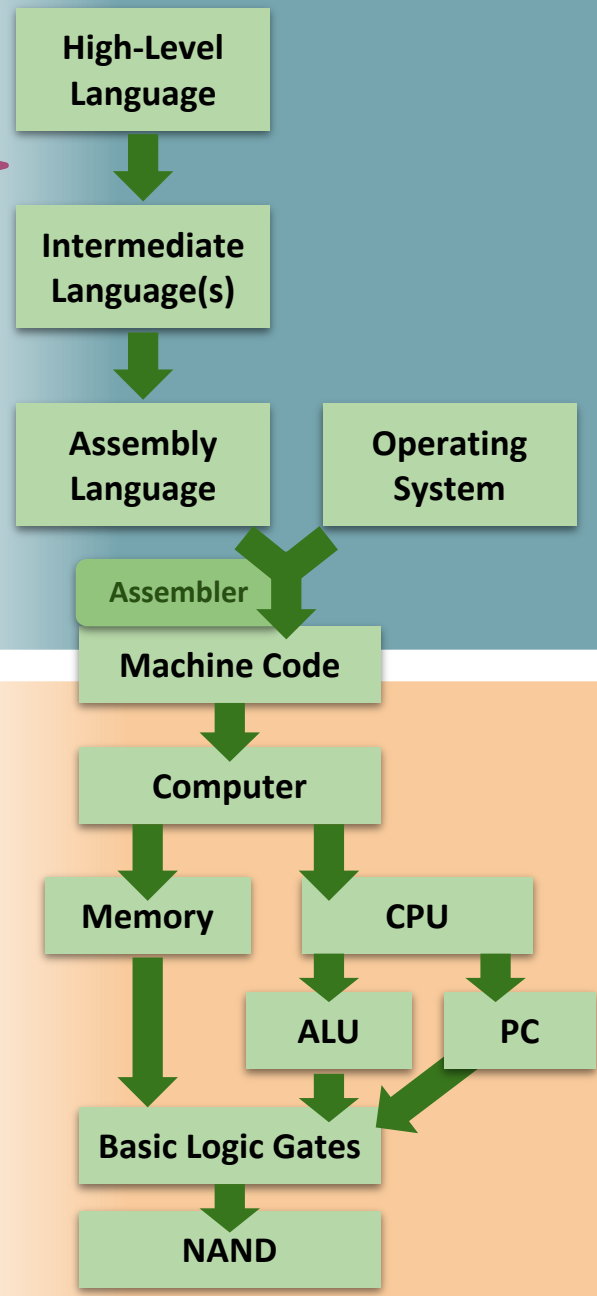
Project 7

Describing a Programming Language

- These broad categories lend themselves well to recursive definitions
 - Easily express all possible configurations of the language constructs

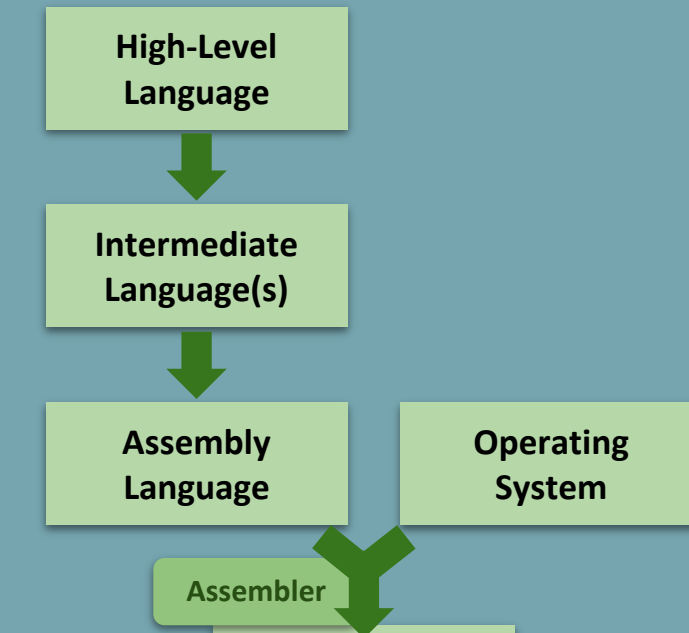


- ❖ What actually happens when you click that green run button?
- ❖ Programs can read in programs and then spit out equivalent programs

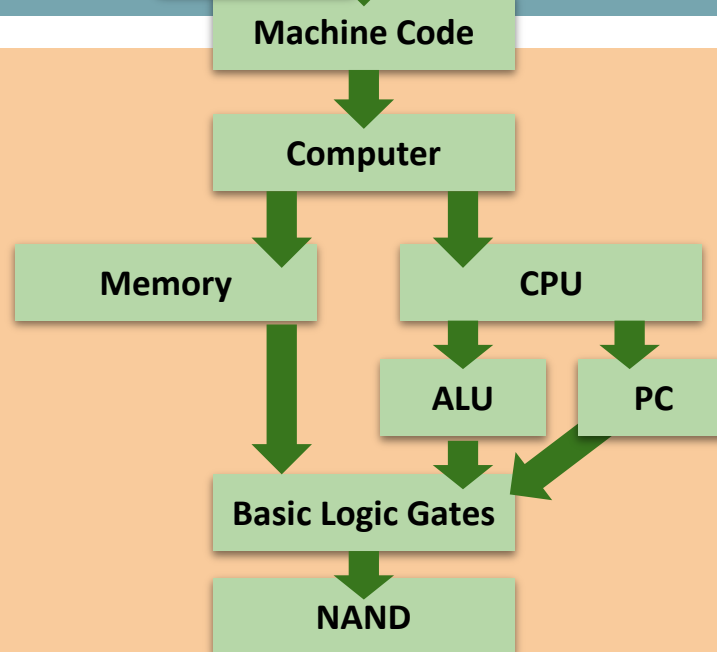


Roadmap

SOFTWARE

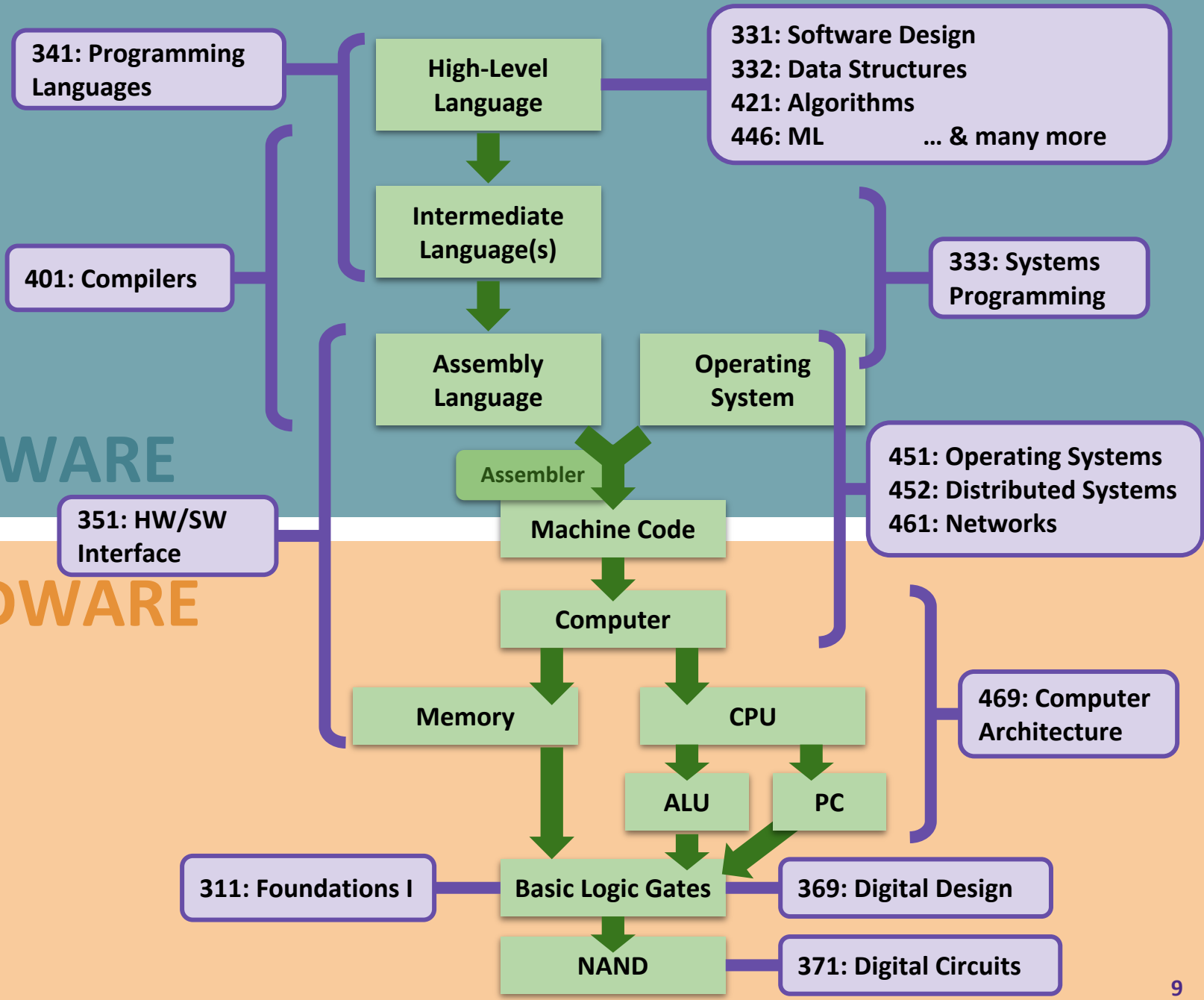


HARDWARE



SOFTWARE

HARDWARE



Takeaways: Why Build a Computer?

❖ **A significant engineering effort**

- You practiced so many skills and programmed with so many different languages, tools, & paradigms—and you can do it again!

❖ **We hope this was a demystifying experience**

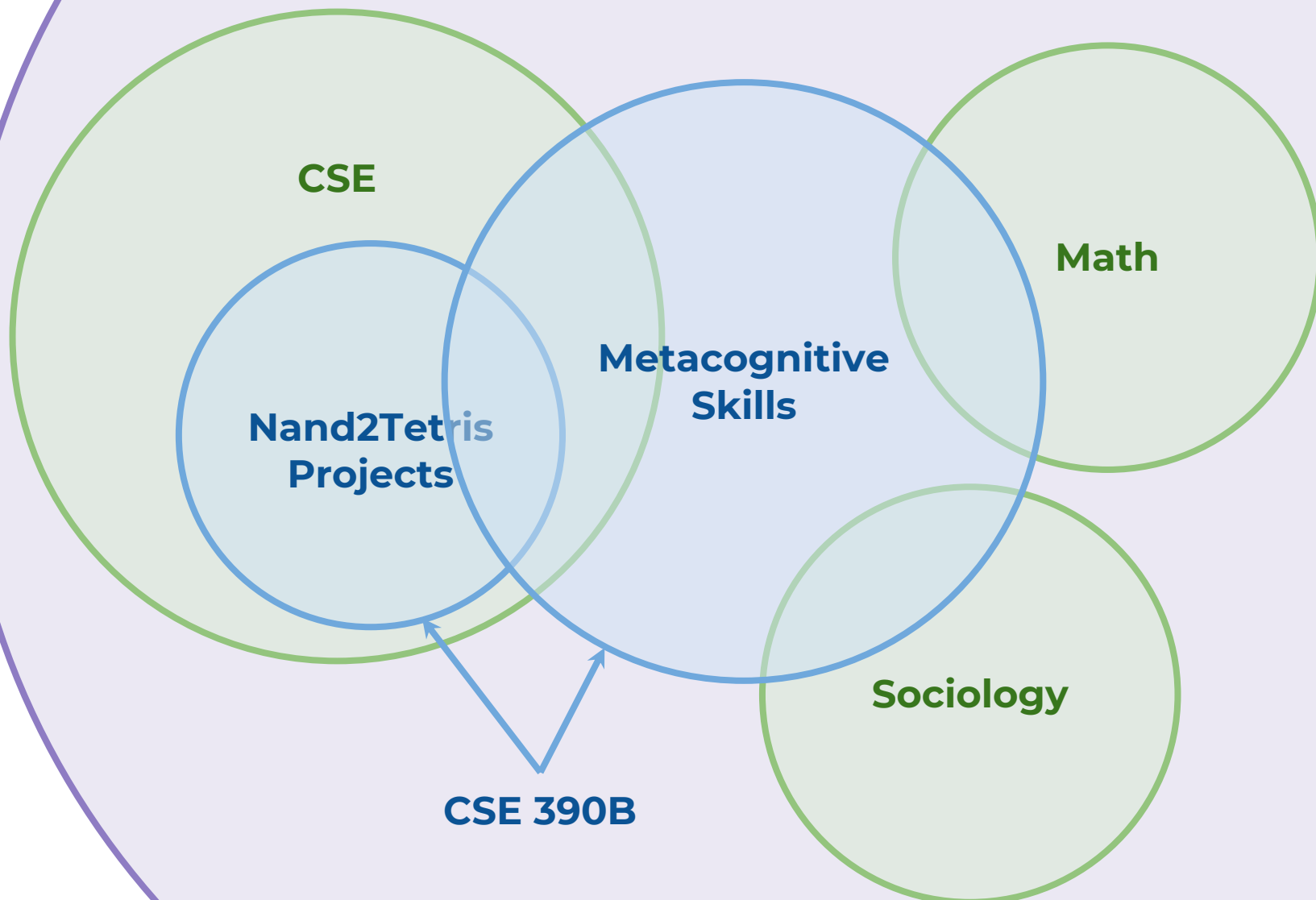
- To see CSE not as isolated courses, but as a big interconnected jigsaw puzzle

❖ **We hope you had fun in this learning journey!**

- The computing field is incredibly broad
- We are hopeful you found a topic you want to pursue further, both technically and metacognitively

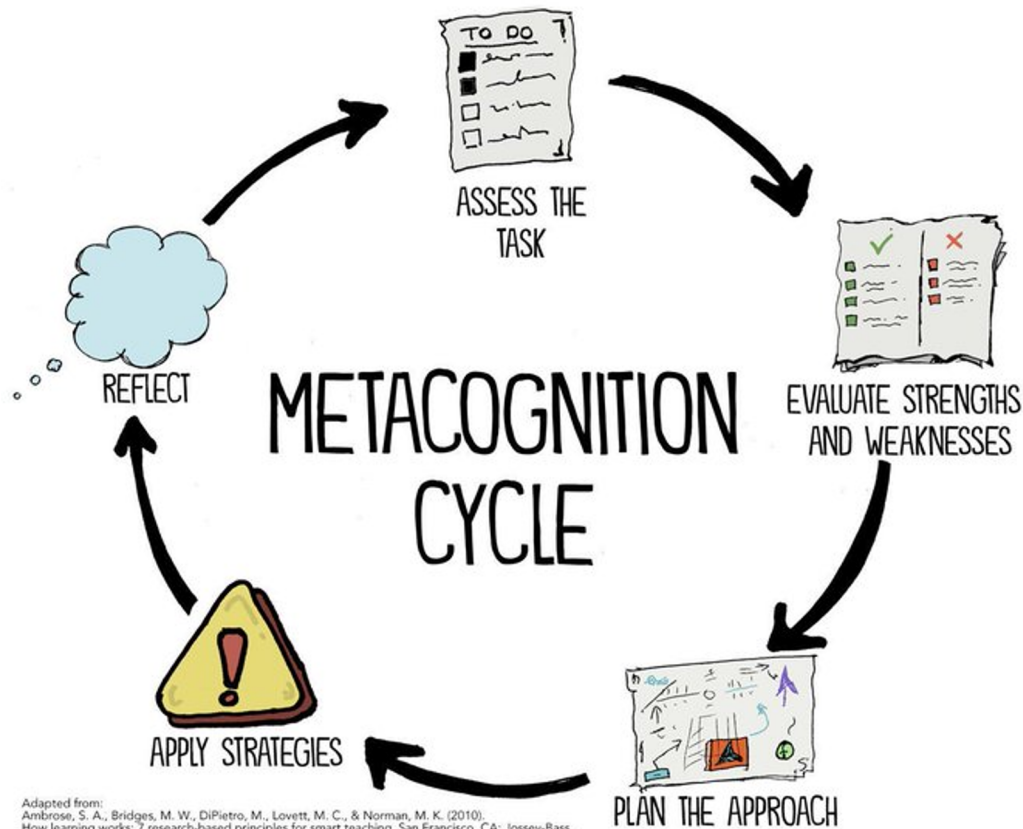
Remember this?

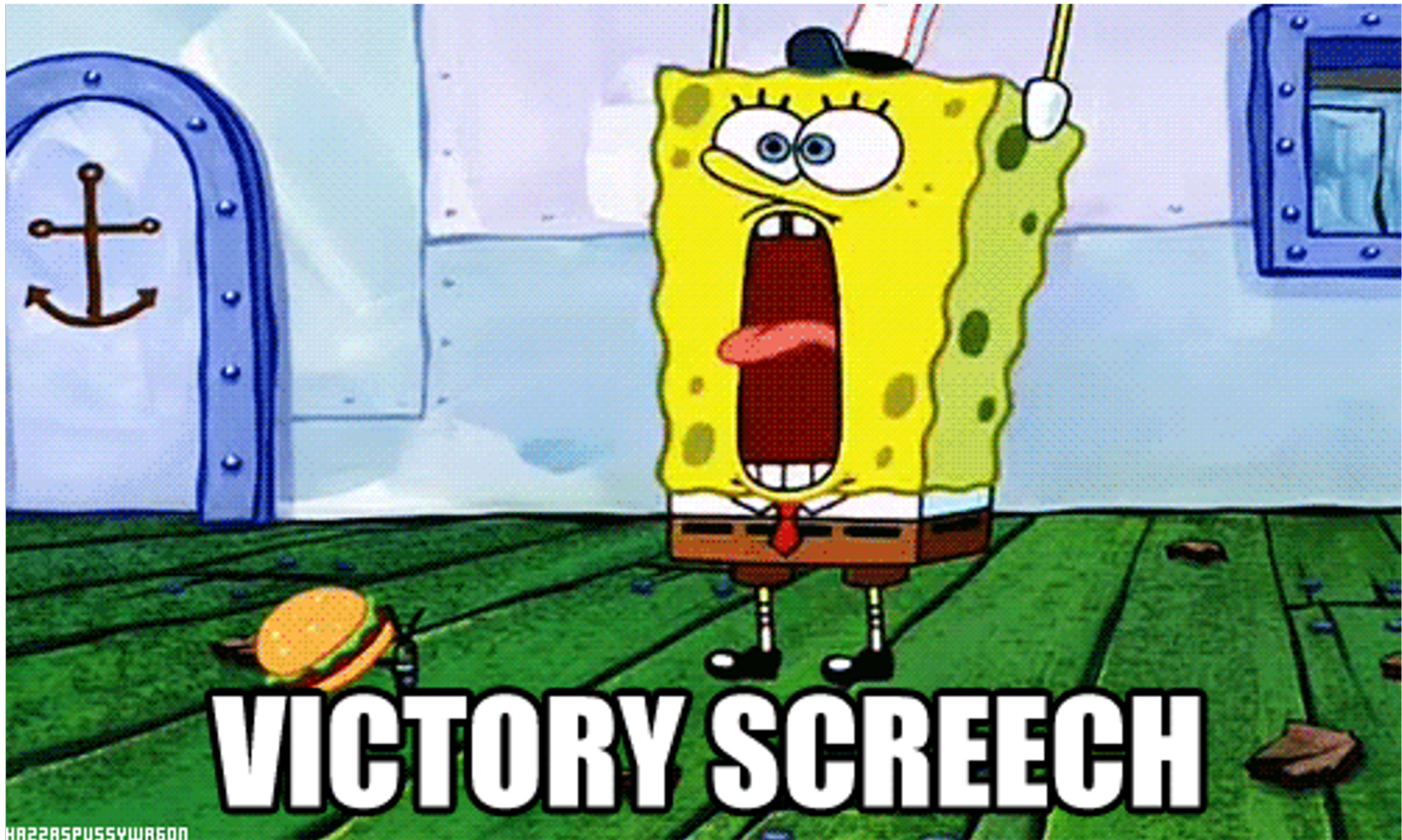
The UW Student Experience



Metacognitive Skills Victory Lap!

- ❖ Time Management
- ❖ Note-Taking
- ❖ Annotation
- ❖ Exam Preparation
- ❖ Test-Taking
- ❖ Debugging
- ❖ Working with Instructors & TAs
- ❖ Design Decisions
- ❖ Oral Communication





Lecture Outline

- ❖ **Victory Lap**
 - What have we learned in CSE 390B?

- ❖ **End of Quarter Activity**
 - Led by your incredible TAs

Ask Us Anything!

- ❖ Ask us about...
 - Classes
 - Recommendations for easy, hard, useful, etc classes
 - What classes go well with each other
 - Extracurricular activities
 - TAing
 - Allen School RSOs
 - UW RSOs
 - Internships
 - How we feel about CS...

Jeopardy!

- ❖ Organize into two or three teams
- ❖ Have one person from each team join zoom!
- ❖ The first person who types in the chat can guess the answer to the question

Post-Lecture 20 Reminders

- ❖ Office Hours ending this week
 - Course staff open to meeting during finals week by appointment
- ❖ Final Project Part I: Project Outline
 - Due tonight (3/8) at 11:59pm PST
- ❖ Final Project Part II: Mock Presentation Peer Feedback
 - Due this Sunday (3/13) at 11:59pm PST
- ❖ Final Project Part III: E-Portfolio Presentations
 - Presentations on Monday (3/14) from 1-2:20pm PST