CSE 390B, Spring 2023

Building Academic Success Through Bottom-Up Computing

Victory Lap & TA-led Activities

E-Portfolio Presentation Guidelines and Tips, CSE 390B Reflection and Victory Lap, TA Panel, Jeopardy Game

Lecture Outline

- **E-Portfolio Presentation Guidelines and Tips**
- CSE 390B Reflection and Victory Lap
  - Metacognitive Skills
  - Nand2Tetris Projects
- CSE 390B TA Panel
  - Class Recommendations, Extracurriculars, etc.
- CSE 390B Jeopardy Game
  - UW History, CSE 390B Course Staff, Seattle, Pop Culture

E-Portfolio Presentation Tips

- Think about who your audience is
  - Consider what your audience knows and doesn't know
- Ensure your E-Portfolio includes all the relevant information and reflection
  - That is, your presentation should supplement your E-Portfolio
- Avoid being verbose (keep presentation points concise)
  - Ensure your presentation is easy to understand
- Utilize and organize visuals from Tuesday
  - Provide different ways to engage your audience

E-Portfolio Presentation Tips

- Practice your E-Portfolio presentation
  - Rehearse with a peer or with a TA
  - Time yourself to ensure length of your presentation is appropriate
- Do your best to speak slowly and project your voice
  - Helps audience members further away or who are hard of hearing
- Aim to maintain eye contact with the audience
  - Helps slow down speech and makes you sound more authoritative
- Engage the audience with hand motions, questions, and your energy or enthusiasm

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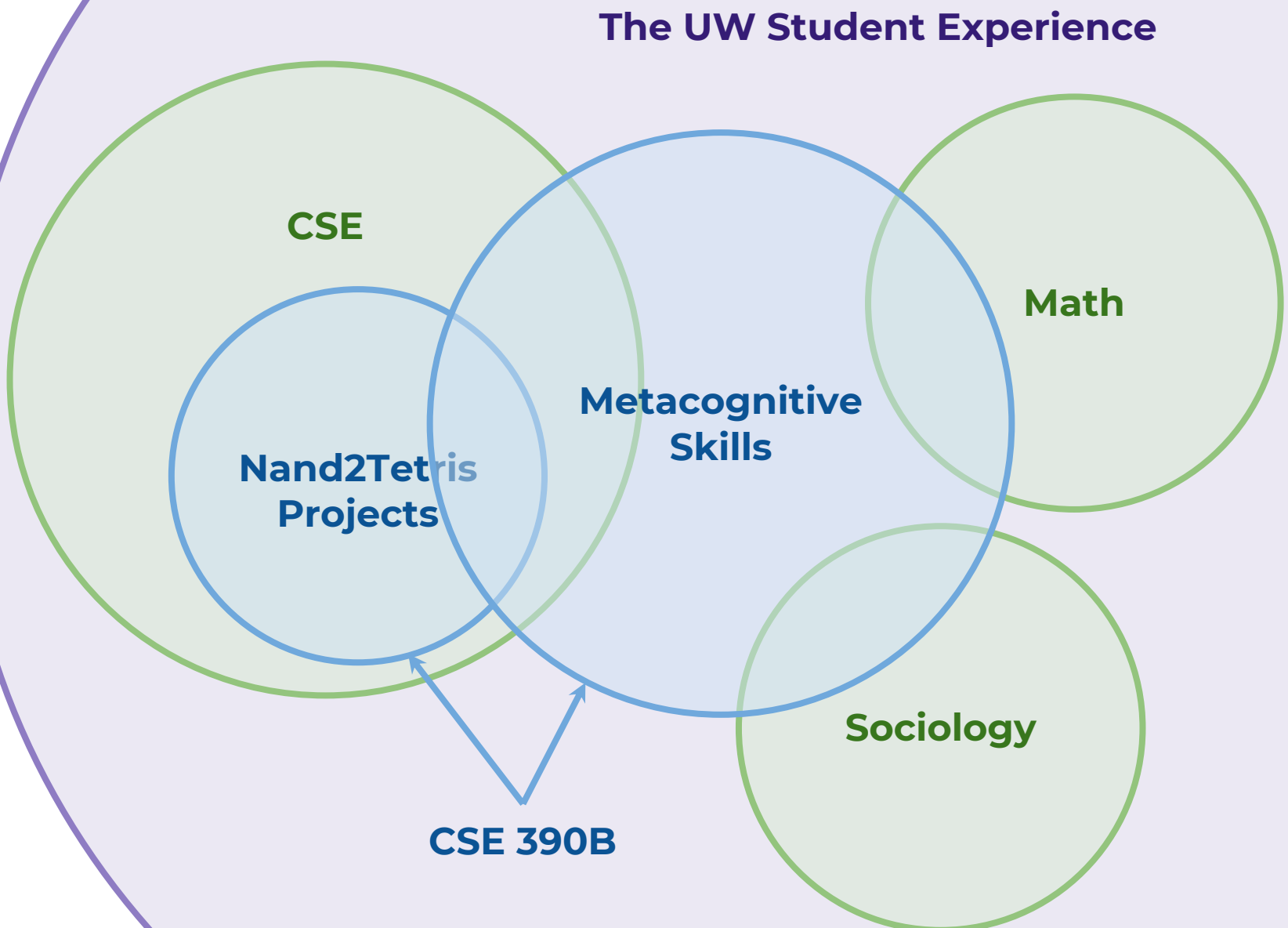
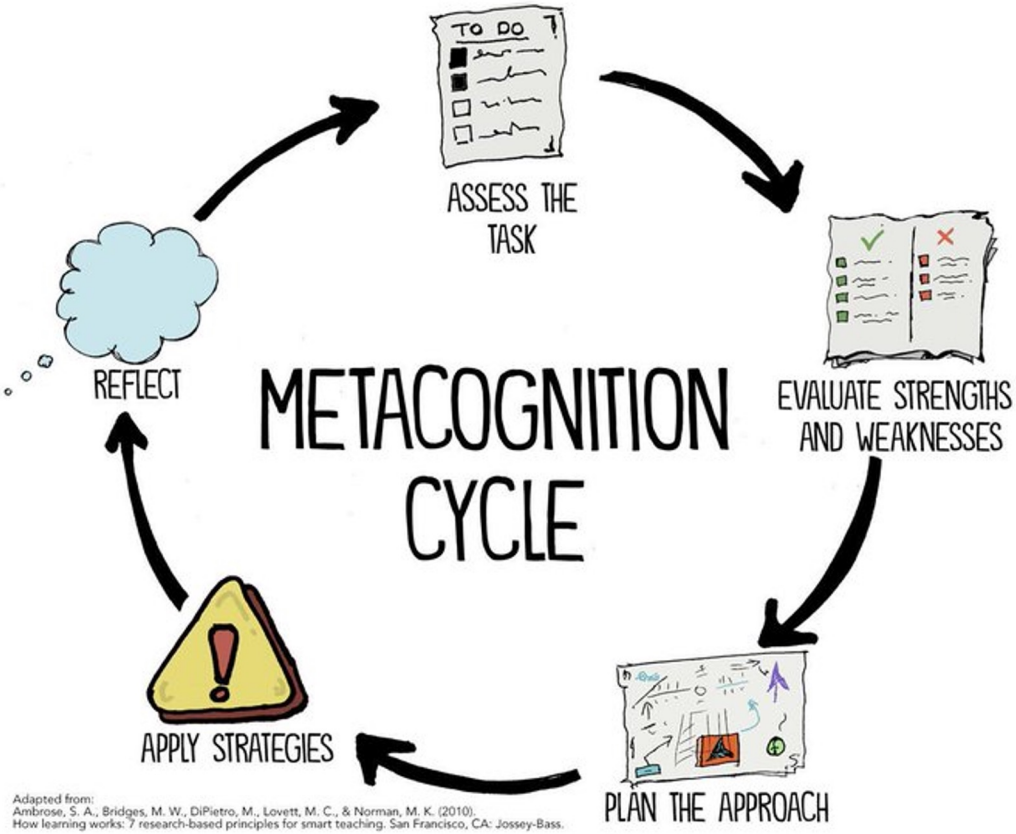
Remember this?

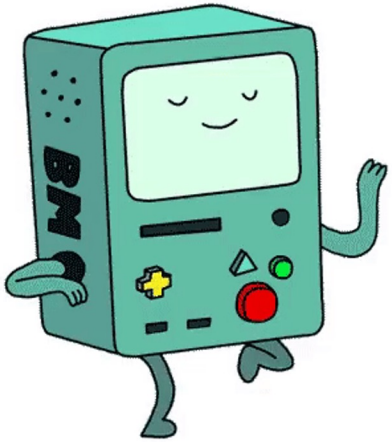


Metacognitive Skills Victory Lap!

- Time Management
- Note-Taking
- Annotation
- Exam Preparation
- Test-Taking
- Post-exam Reflection
- Debugging
- Working with Instructors & TAs
- Reflection on Metacognition



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 into 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)

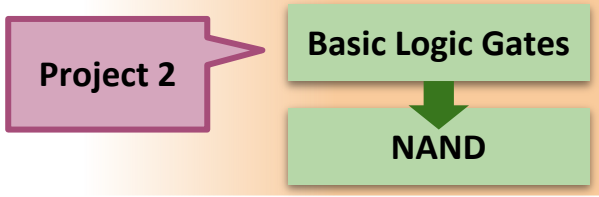
- Step 2: Use truth table to generate a Boolean function
  - Let's use the Boolean function synthesis strategy from the reading
  - Row 2 = NOT(A) AND B
  - Row 3 = A AND NOT(B)
  - A XOR B = Row 2 OR Row 3

= (NOT(A) AND B) OR (A AND NOT(B))

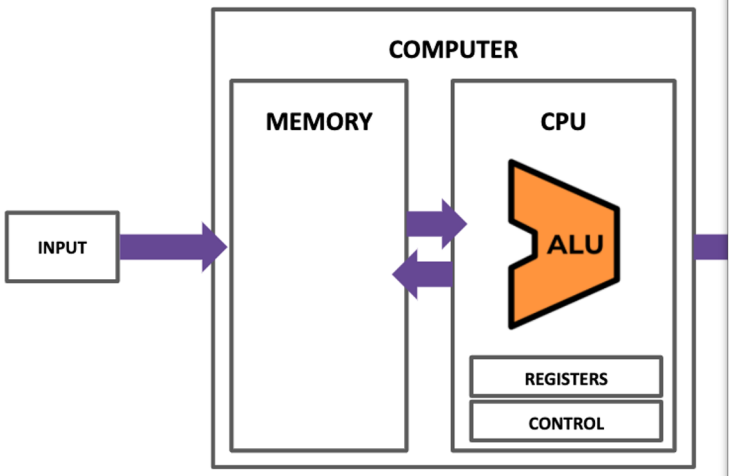
A	B	F	
0	0	0	(Row 1)
0	1	1	(Row 2)
1	0	1	(Row 3)
1	1	0	(Row 4)

F = A XOR B

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

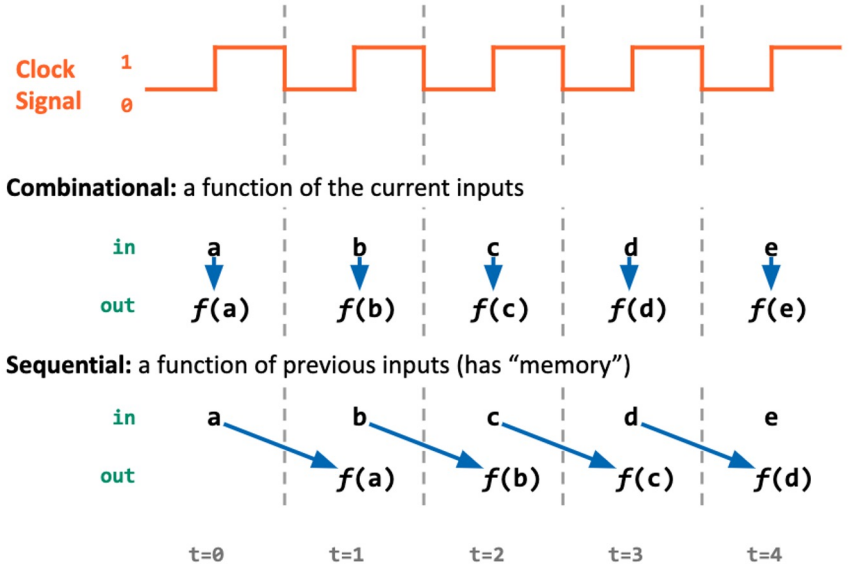


The Von Neumann Architecture

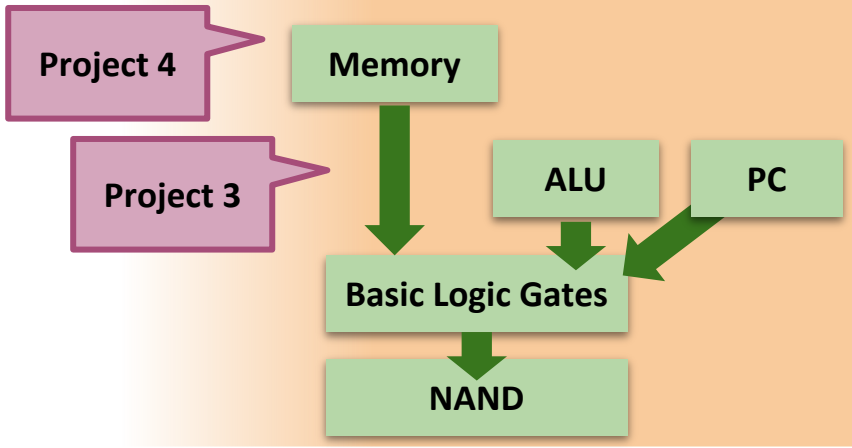


(This picture will get more detailed as we go!)

Combinational vs. Sequential Abstraction



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



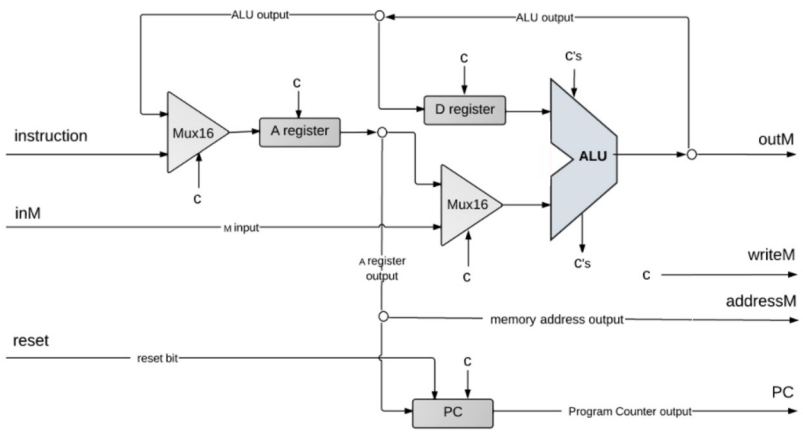
Hack: C-Instructions

Symbolic: `dest = comp ; jump`

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

- Family: C-Instruction
- unused
- Comp: ALU Operation (a bit chooses between A and M)
- Dest: Where to store result
- Jump: Condition for jumping

Hack CPU Implementation



(each "C" symbol represents a control bit)

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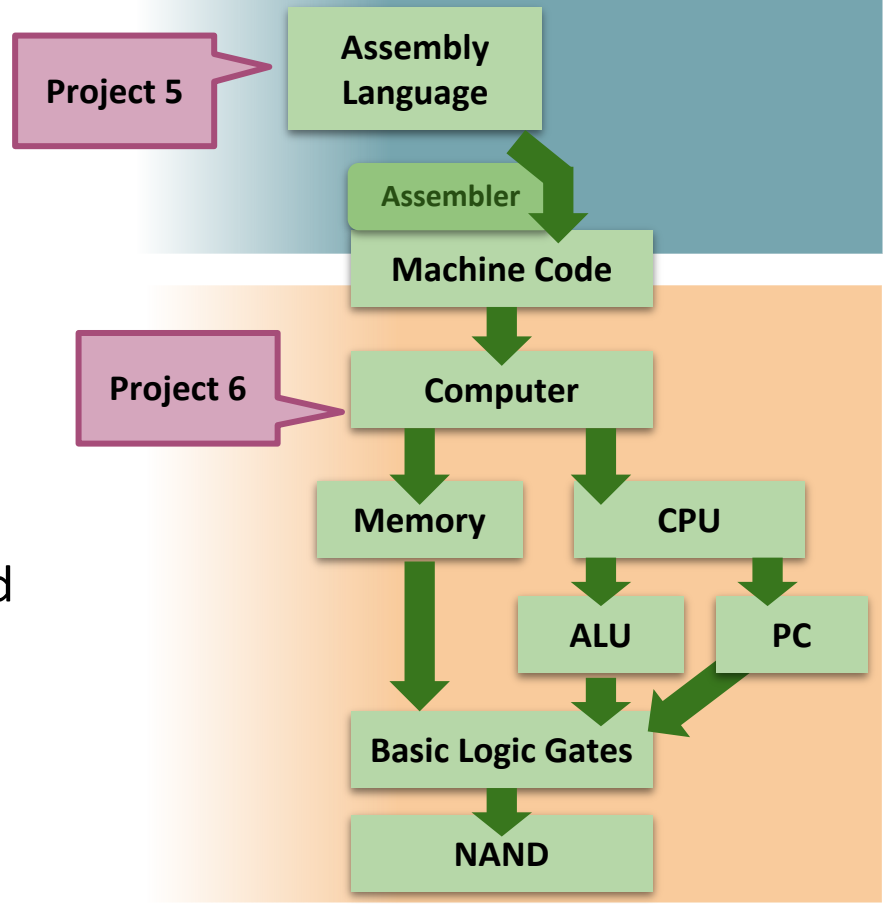

- The connection between software and hardware through binary instructions
- What must happen in a clock cycle to process one instruction

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

Scanner | Parser | Type Checker | Optimizer | Code Generator

Break string into discrete **tokens**: IF (ID(n) == NUM(0) etc.

Arrange tokens into **syntax tree**: + (x, 10)

Describing a Programming Language

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

Symbolic Example	General Definition of an `if` Statement	Token Stream Definition
`if (x == 0) { x = y; }`	`if ( EXPRESSION ) { STATEMENT STATEMENT ... }`	IF LPAREN EXPRESSION RPAREN LCURLY STATEMENT STATEMENT ... RCURLY

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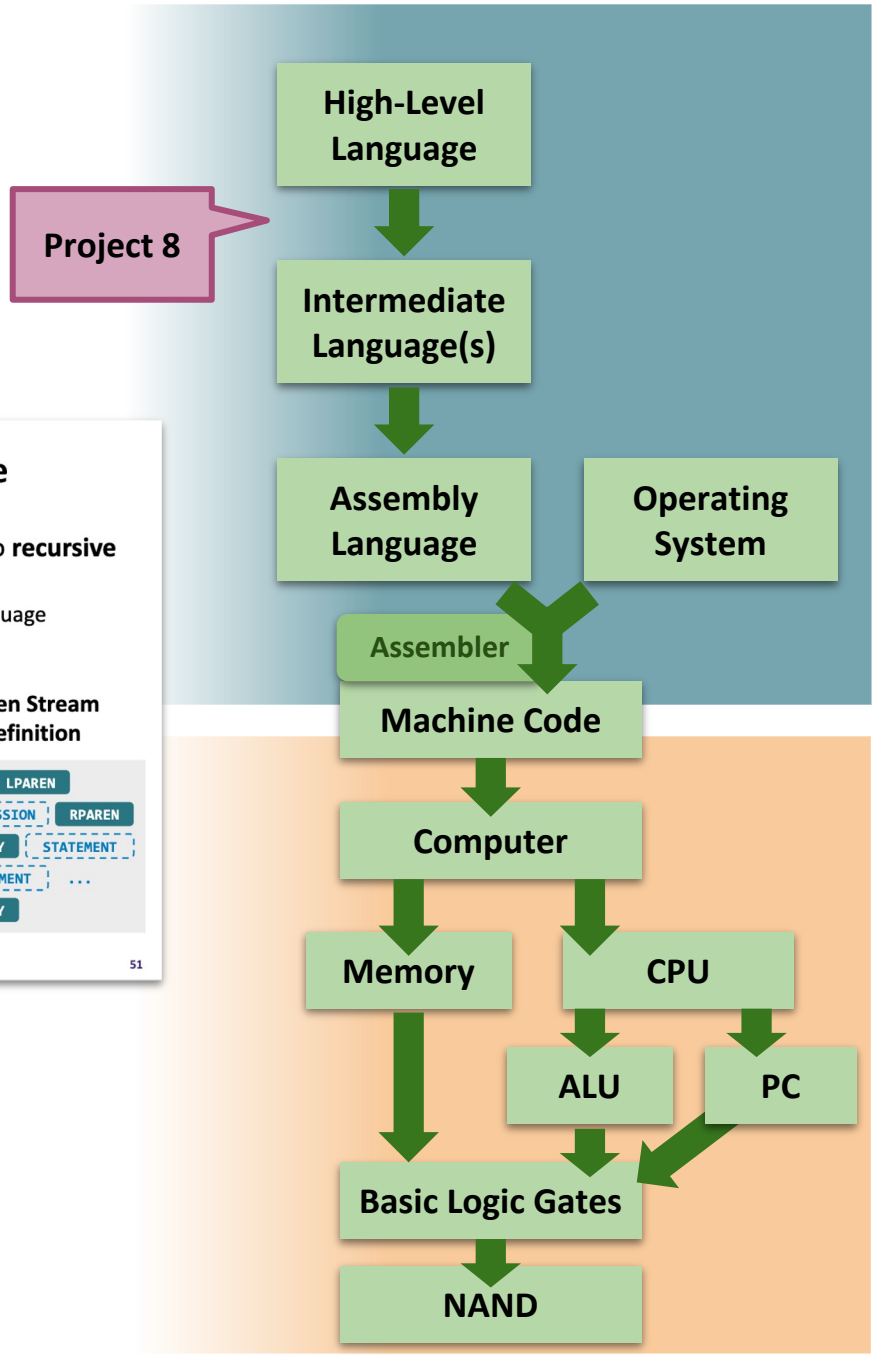
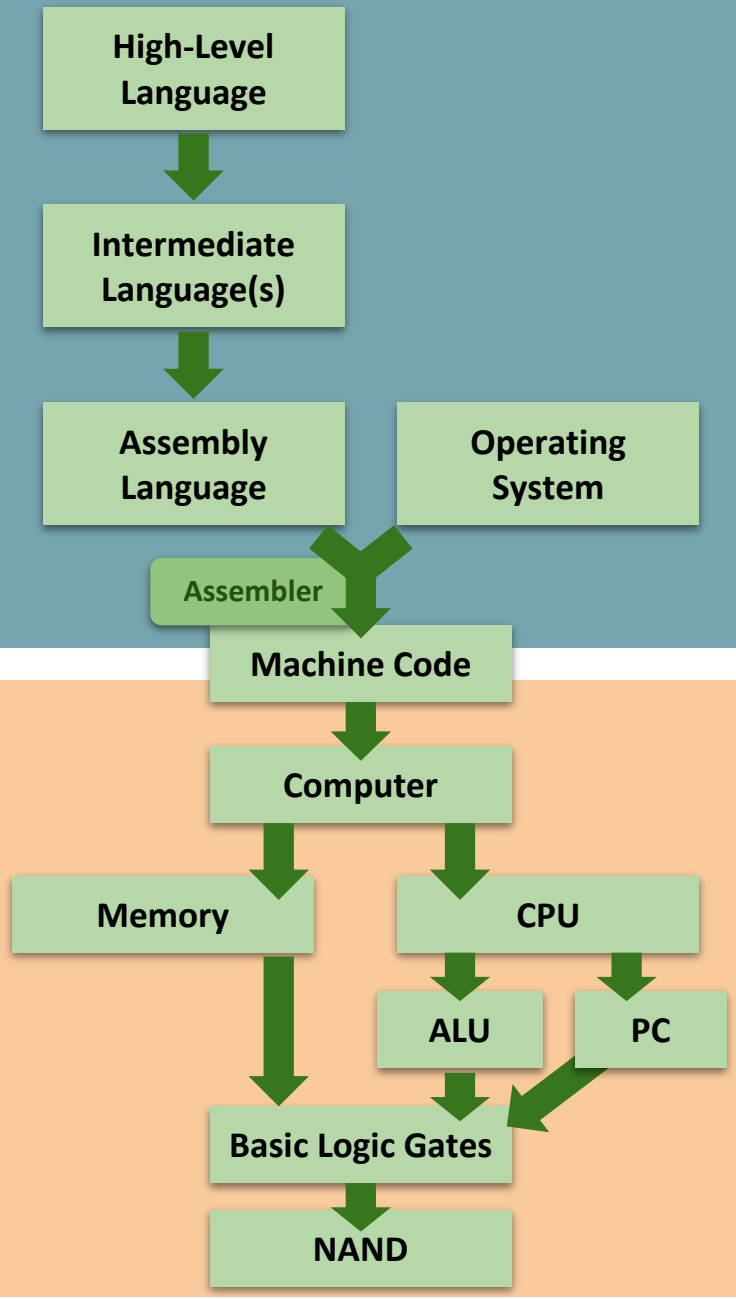
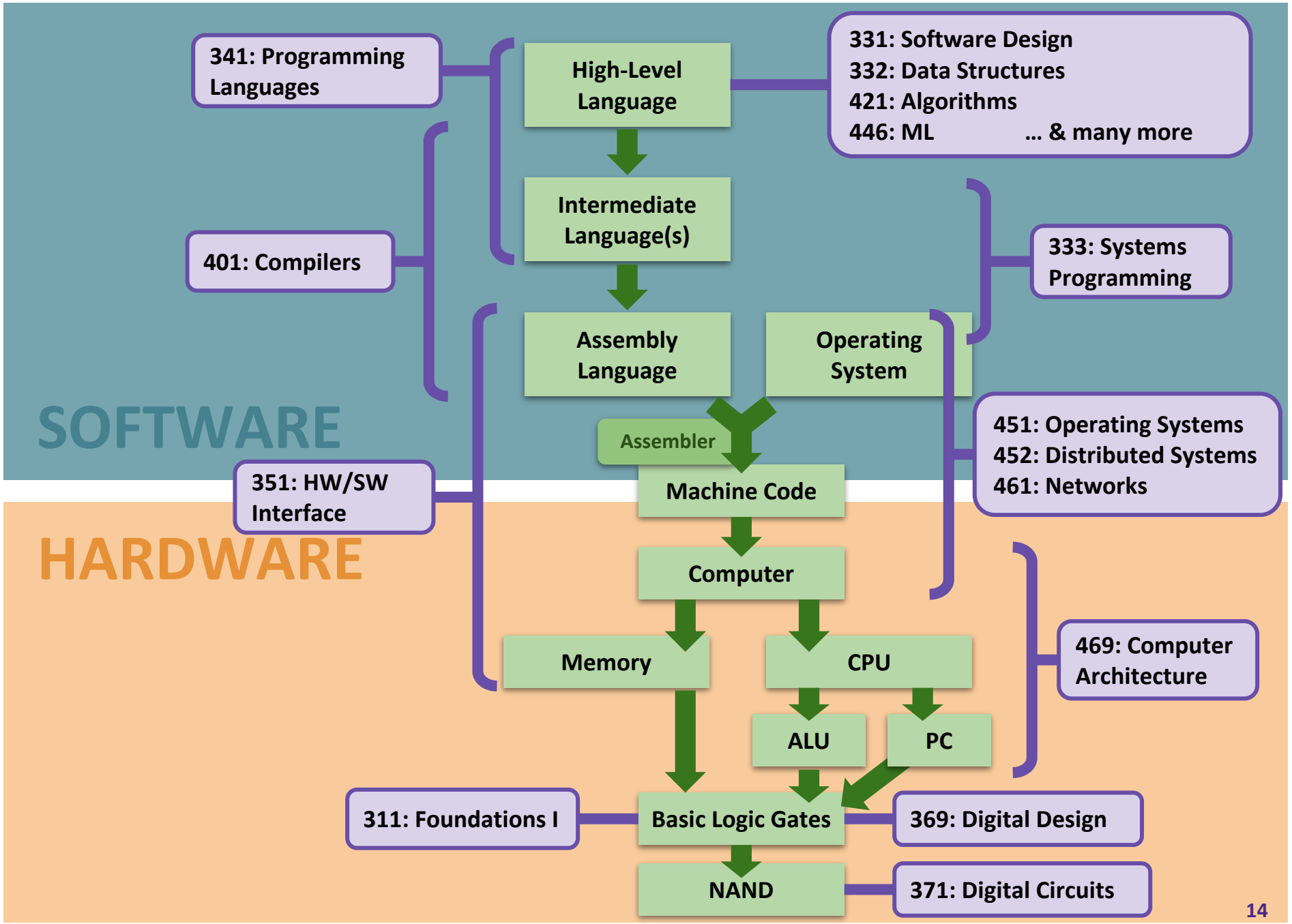


- What happens when you click that compile button?
- Programs can read in programs and then spit out equivalent programs

Roadmap


High-Level Language
Intermediate Language(s)
Assembly Language
Operating System
SOFTWARE
Assembler
Machine Code
HARDWARE
Computer
Memory
CPU
ALU
PC
Basic Logic Gates
NAND


341: Programming Languages
High-Level Language
331: Software Design
332: Data Structures
421: Algorithms
446: ML
… & many more
Intermediate Language(s)
401: Compilers
333: Systems Programming
Assembly Language
Operating System
SOFTWARE
Assembler
451: Operating Systems
452: Distributed Systems
461: Networks
351: HW/SW Interface
Machine Code
HARDWARE
Computer
Memory
CPU
469: Computer Architecture
ALU
PC
311: Foundations I
Basic Logic Gates
369: Digital Design
NAND
371: Digital Circuits

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 not see CSE courses as isolated but as interconnected puzzle pieces
- **We hope you had fun in this learning journey!**
  - The computing field is broad and has much for you to explore
  - We are hopeful you found a topic you want to pursue further, both technically and metacognitively

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CSE 390B TA Panel

Ask us about:

- Classes
  - Recommendations for easy, hard, useful, etc. classes
  - What classes go well with each other
- Extracurricular activities
  - TAing
  - Research
  - Allen School RSOs
  - UW RSOs
- Internships

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CSE 390B Jeopardy Game

- Organize into teams of 3-4 students
- The first group to raise their hand and answer the question wins that round and chooses the next question
- The group with the greatest number of points wins the game

Post-Lecture 20 Reminders

- Office hours and student-TA 1:1 meetings end this week
  - Course staff open to meeting during finals week by appointment

- Project Reminders
  - **Final Project, Part II: Final E-Portfolio due next Tuesday (6/6) at 4pm**
  - If you have any uncompleted projects, the last day to turn them in is the last day of the quarter (Friday, 6/9 at 11:59pm)

- Please fill out course evaluations if you haven't already