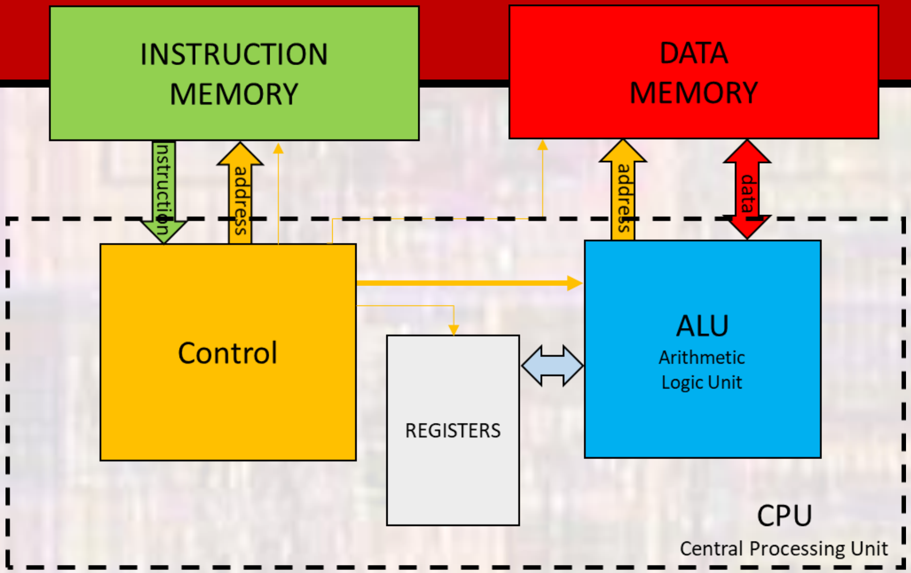
Computer Structure

Last updated 11/11/21

Structure



- Components
  - Instruction Memory
    - Long term storage of program
  - Data Memory
    - Long term storage of data
  - Registers
    - Short term storage of data
  - ALU
    - Arithmetic Logic Unit
    - Performs operations on register data
  - Control
    - Manages the operation of the ALU
    - Manages the flow of data to/from memory and registers

Structure

- 1 line of code

  ```
  a = b + c;
  ```

  - what are a, b, and c?
  - where did b and c get their values?
  - how do we add them?
  - what happens to the result

Structure

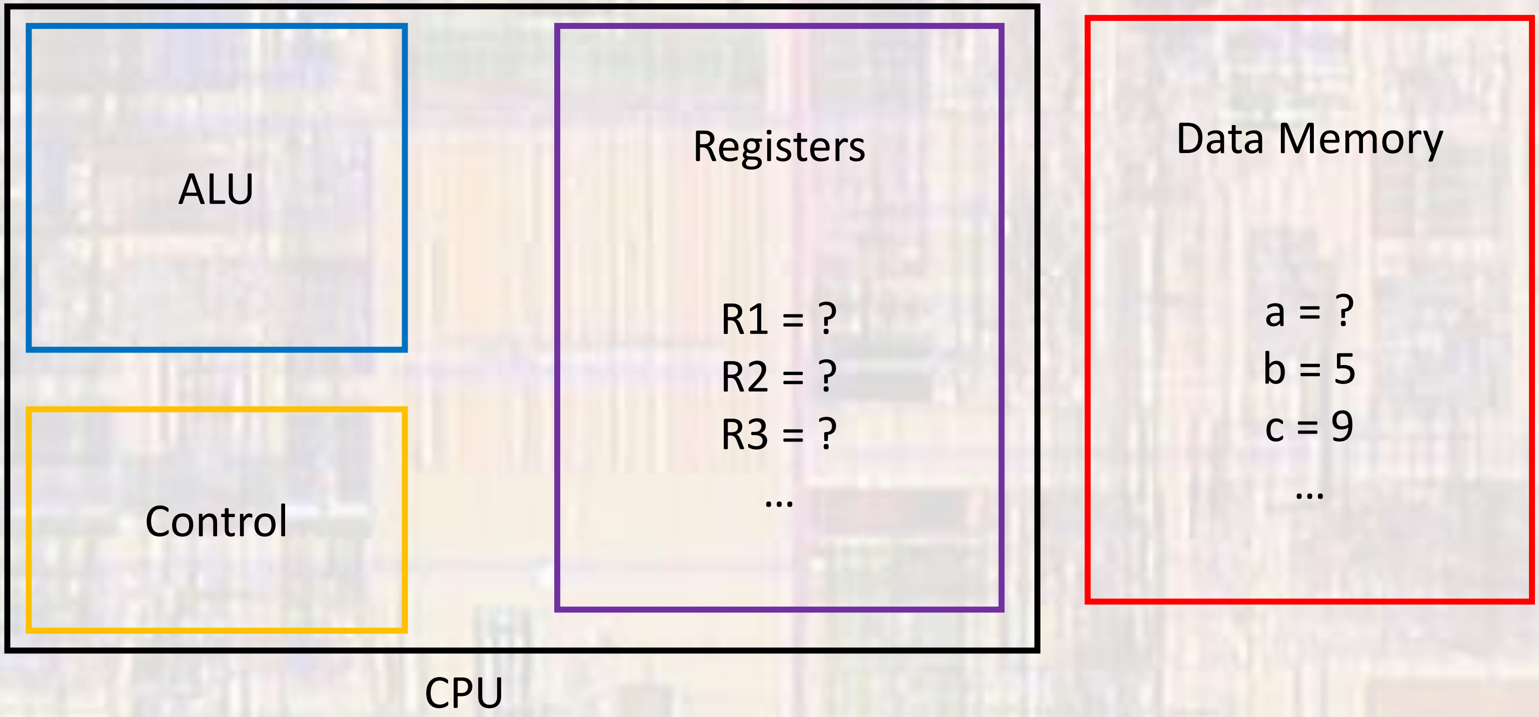
- 1 line of code
  a = b + c;

  - what are a,b, and c?
    - values stored in memory or a register
      - what is a memory or register?
        - locations to store binary bits
  - where did b and c get their values?
    - previous instructions
  - how do we add them?
    - The CPU has an Arithmetic Logic Unit (ALU)
      - How does this work?
        - It grabs value from 2 registers and adds them
          - How did they get into the registers?
            - We load them from memory into the register (LOAD)
  - what happens to the result
    - The result is written back to a register
      - Does it ever get stored back to a memory?
        - Yes – when we need to use the register for something else (STORE)

Structure

- 1 line of code – simplified version

  a = b + c;



ALU

Control

Registers

R1 = ?
R2 = ?
R3 = ?
…

CPU

Data Memory

a = ?
b = 5
c = 9
…

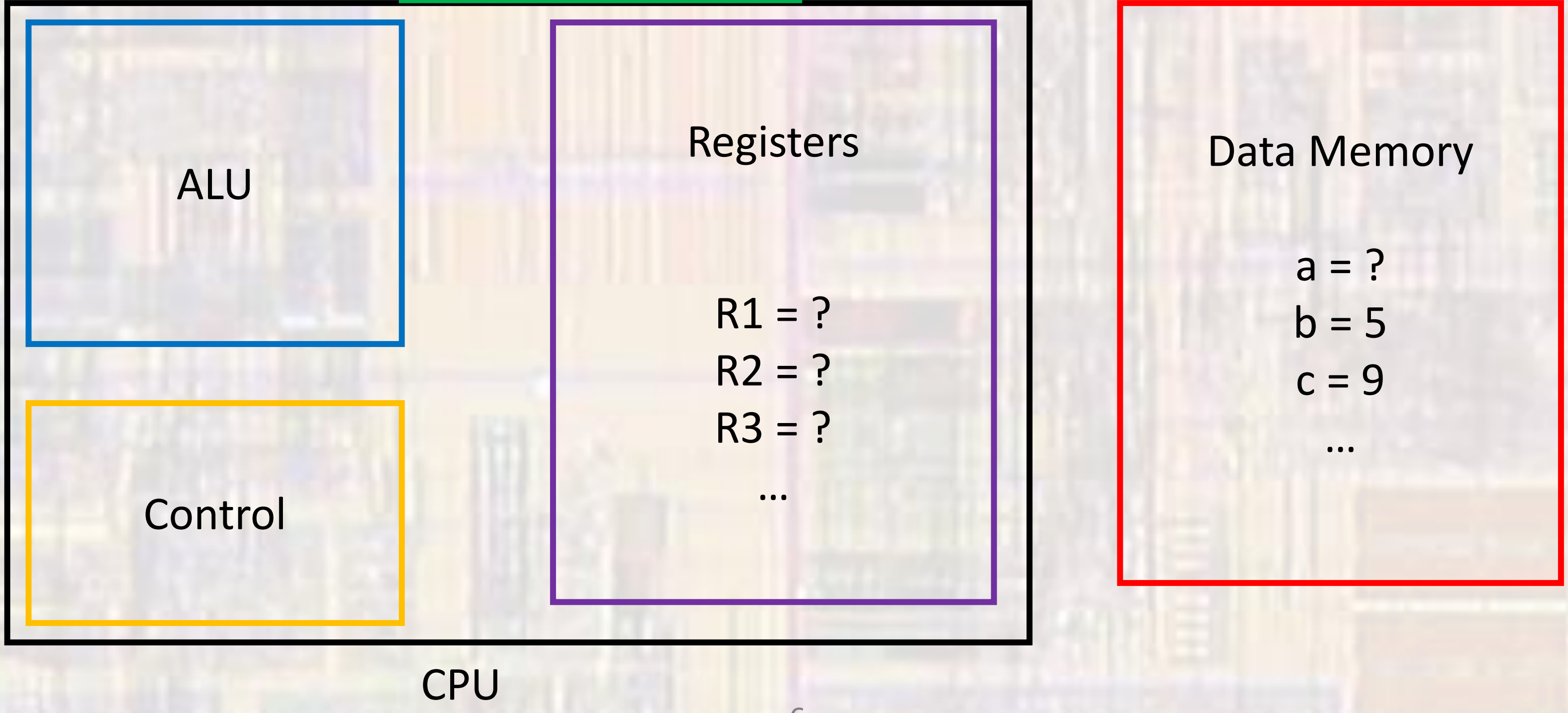
Structure

- 1 line of code – simplified version

a = b + c; →

```
ld R1, mem(b)
ld R2, mem(c)
add R3, R1, R2
st mem(a), R3
```

Instruction Memory



Structure

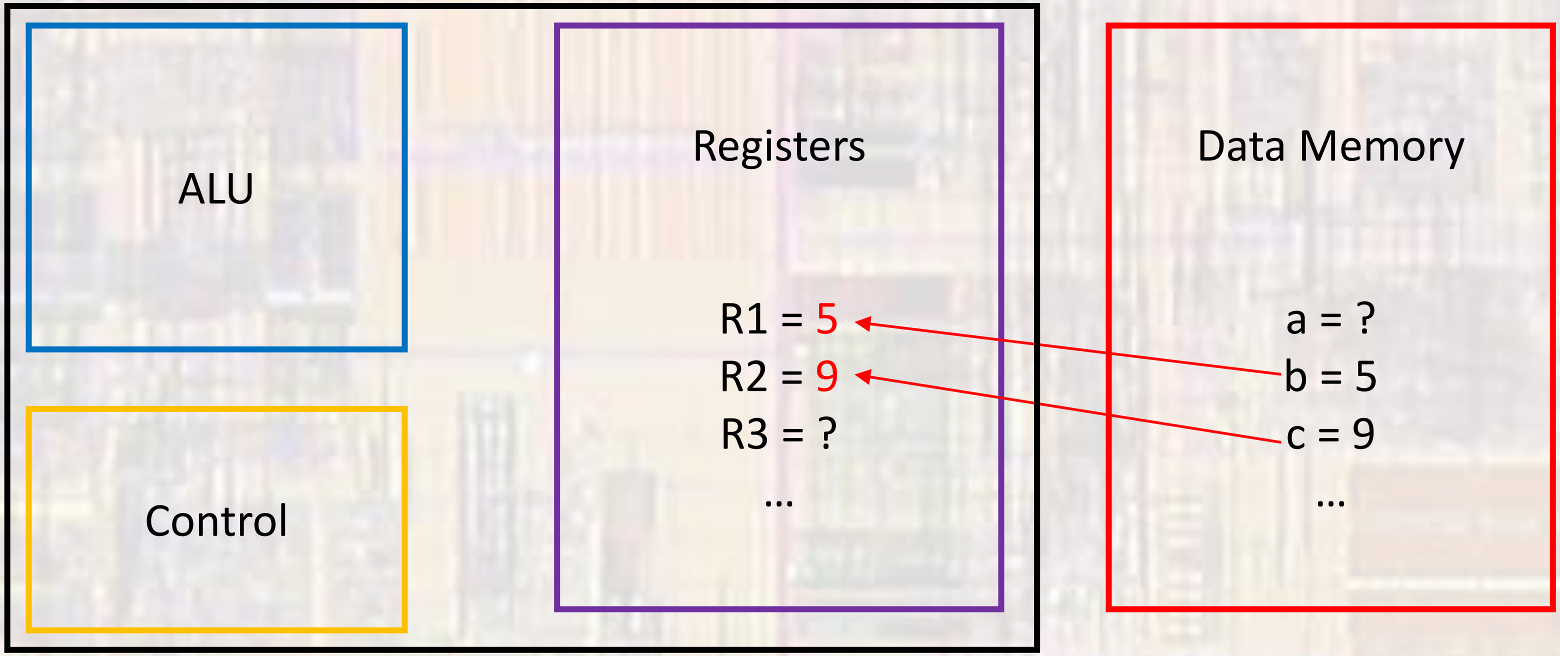
- 1 line of code – simplified version

a = b + c; →

```
ld R1, mem(b)
ld R2, mem(c)
add R3, R1, R2
st mem(a), R3
```

Instruction Memory

first need to get the values into the registers (LOAD)



CPU

Structure

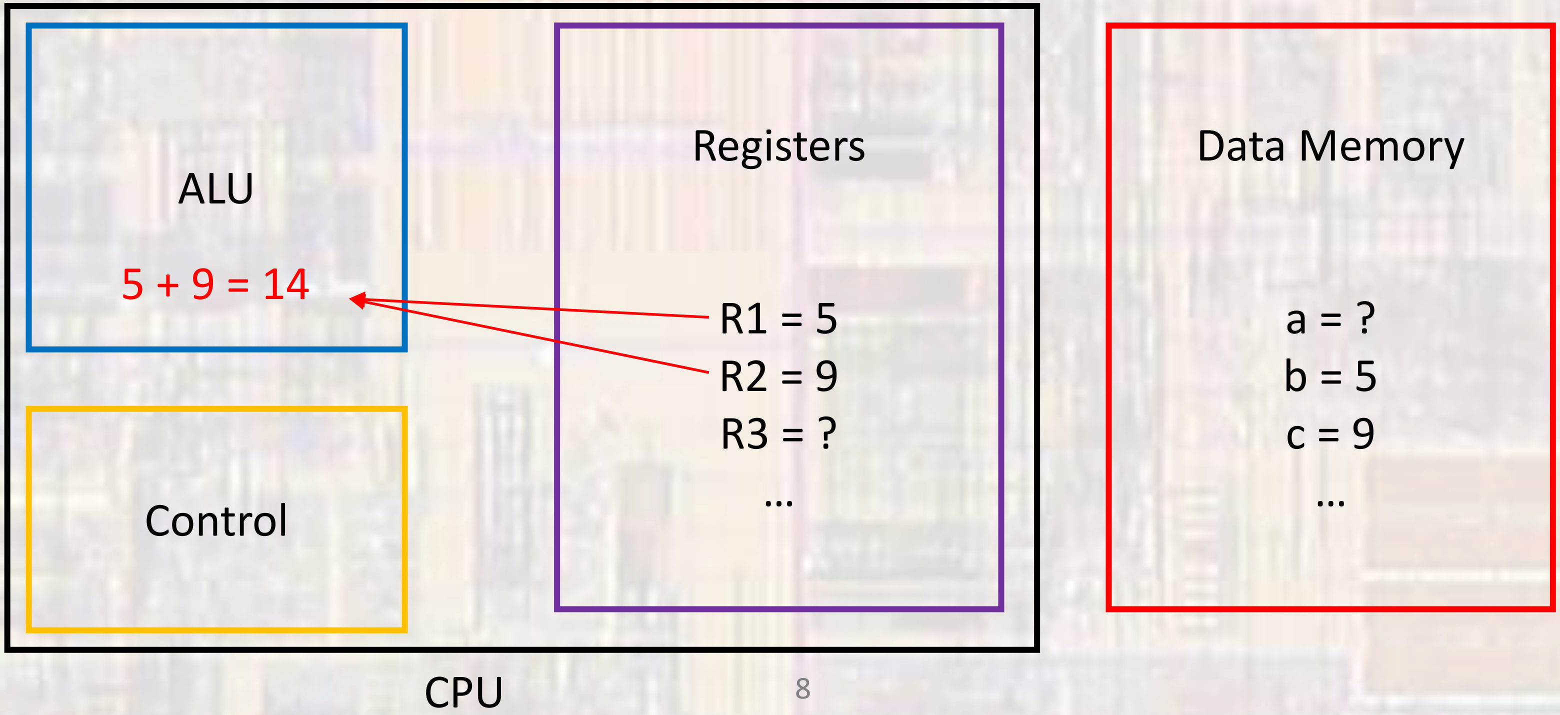
- 1 line of code – simplified version

a = b + c; →

ld R1, mem(b)
ld R2, mem(c)
add R3, R1, R2
st mem(a), R3

Instruction Memory

ALU adds the 2 values (execute)



Structure

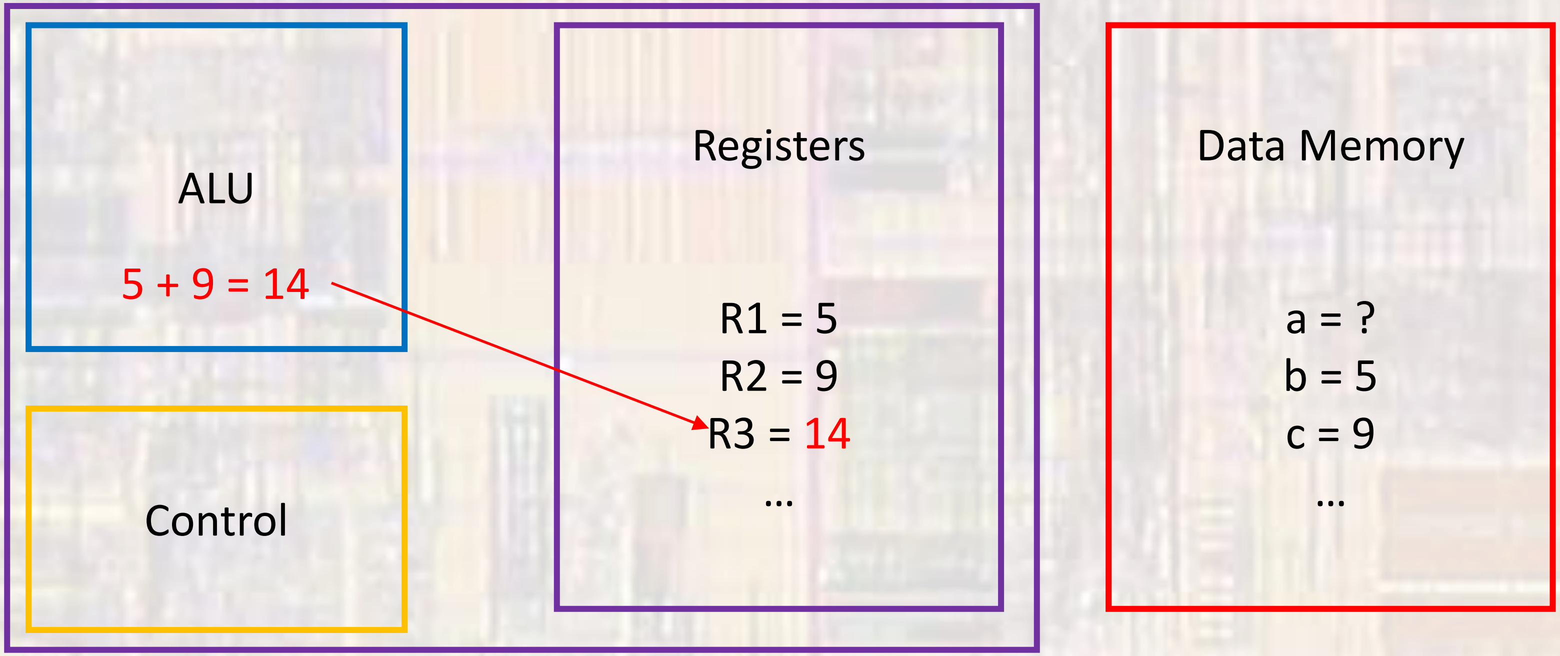
- 1 line of code – simplified version

a = b + c; →

```
ld R1, mem(b)
ld R2, mem(c)
add R3, R1, R2
st mem(a), R3
```

Instruction Memory

ALU places the value back into a register (writeback)



Structure

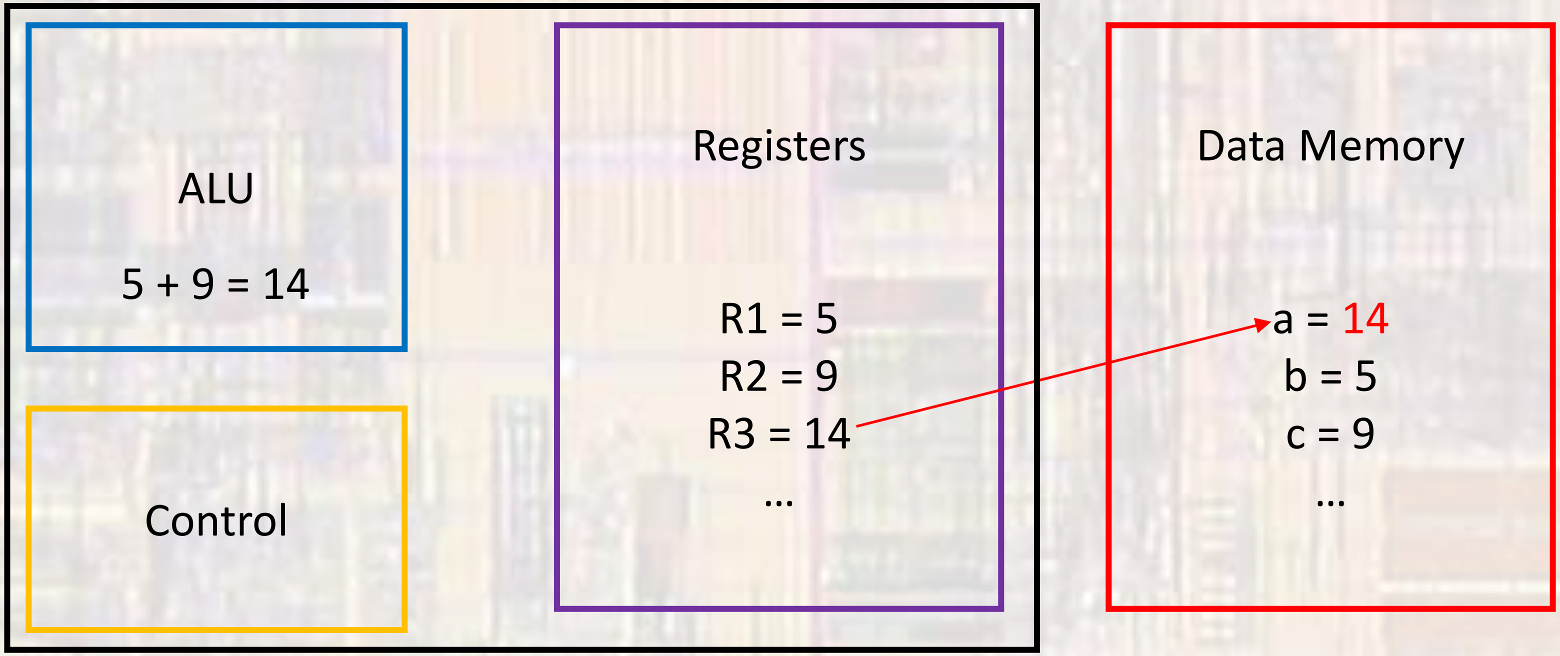
- 1 line of code – simplified version

a = b + c; →

```
ld R1, mem(b)
ld R2, mem(c)
add R3, R1, R2
st mem(a), R3
```

Instruction Memory

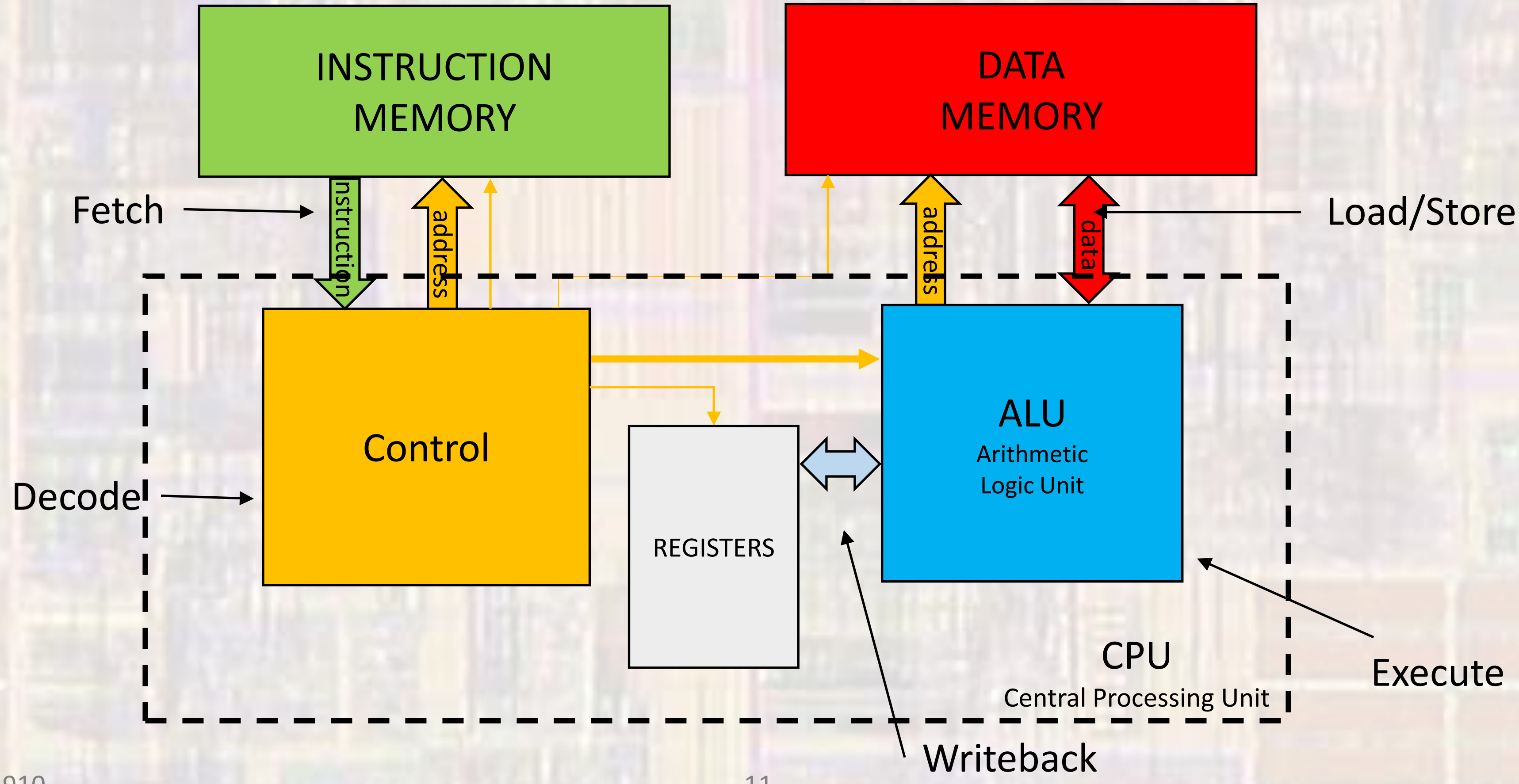
At some later time the value may be stored in memory (STORE)



CPU

Structure

- Processor Structure


INSTRUCTION MEMORY
DATA MEMORY
Fetch
instruction
address
address
data
Load/Store
Control
ALU
Arithmetic Logic Unit
REGISTERS
Decode
Execute
CPU
Central Processing Unit
Writeback