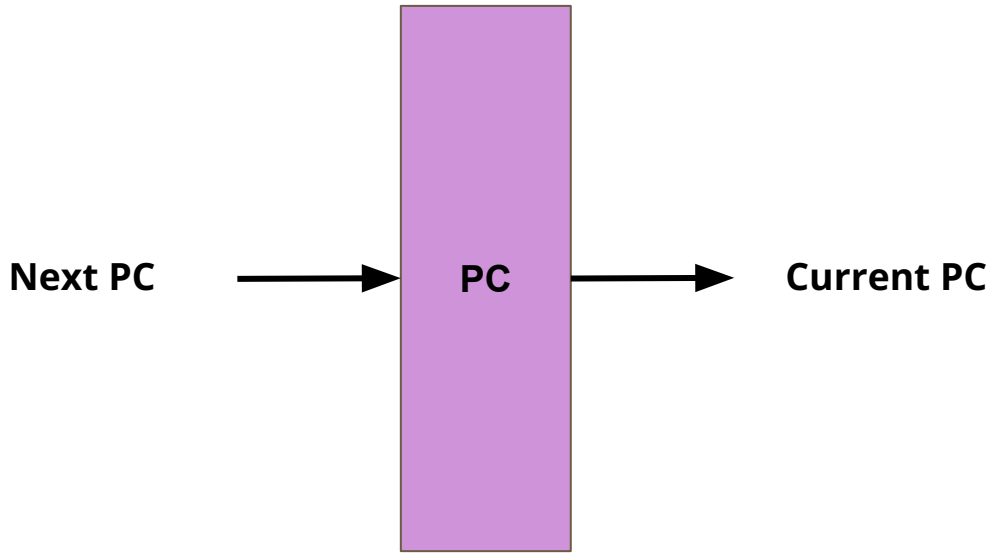
Bits of Architecture

Basic Processor Design

What Do We Need to Build a Processor?

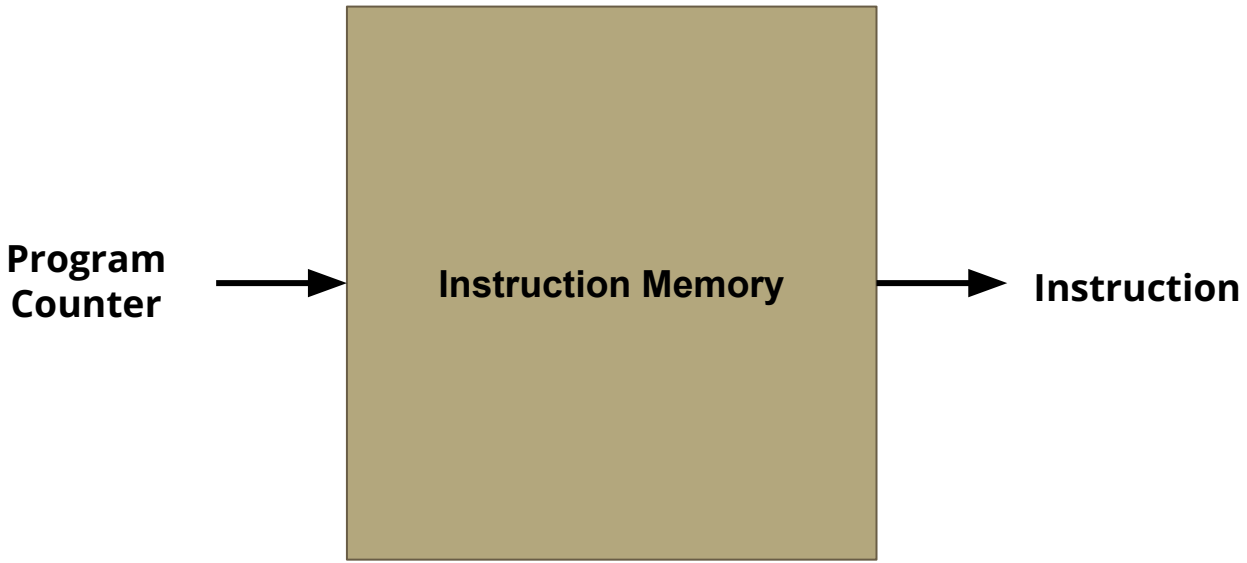
Program Counter

- How do we keep track of where we are in our program?
- Input
  - Next PC
- Output
  - Current PC



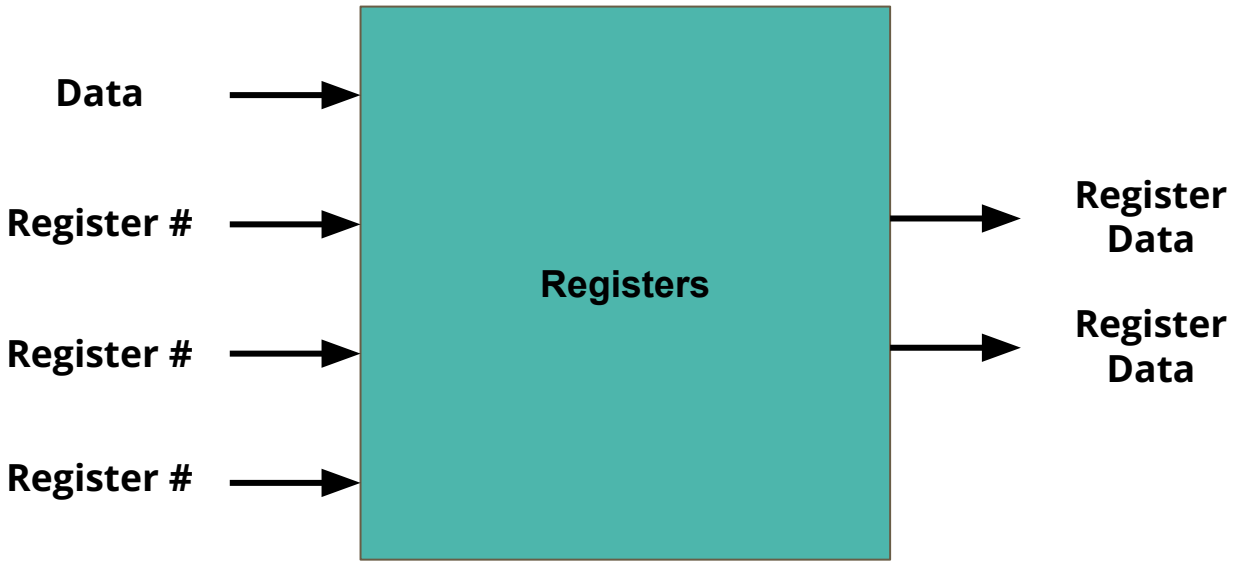
Instruction Memory

- Where do we keep our programs?
- Input
  - Program Counter
- Output
  - Instruction



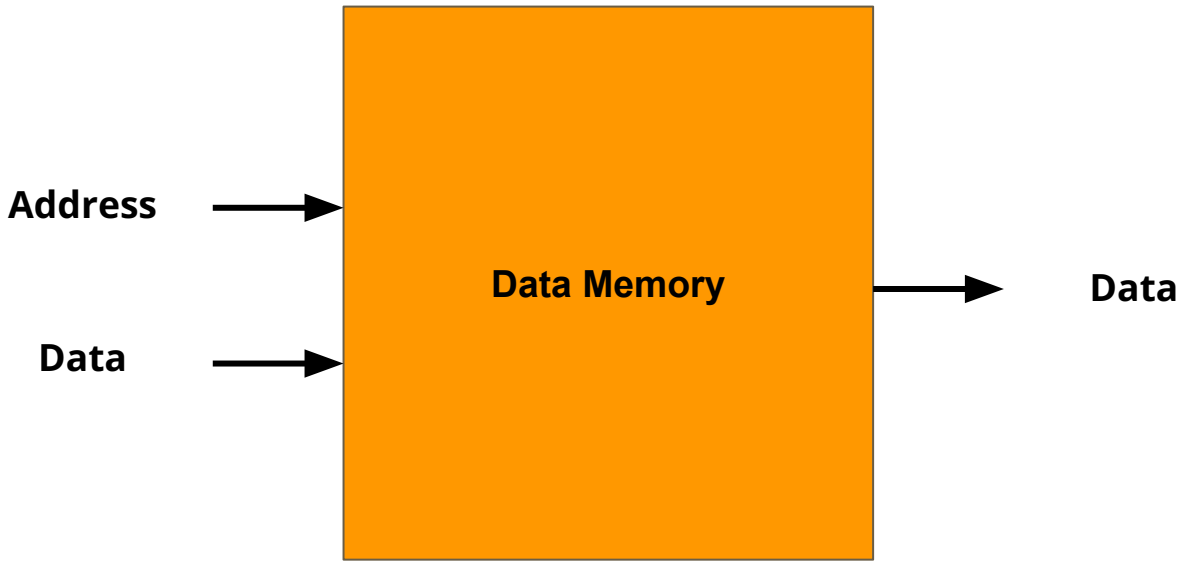
Registers

- Where do we store the data that our instructions operate on?
- Inputs
  - Register operand(s)
  - Register destination
  - Data
- Output
  - Register data



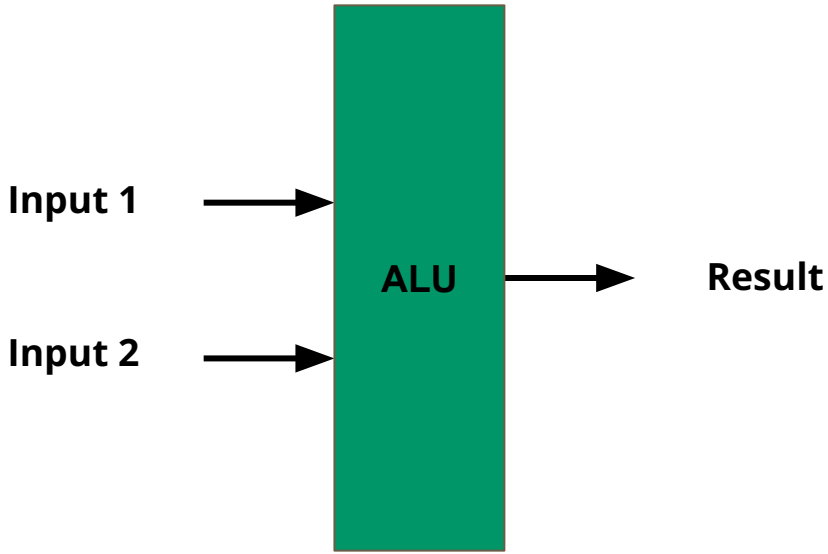
Data Memory

- Where is the majority of our data stored?
- Inputs
  - Address
  - Data (Store)
- Output
  - Data read from memory



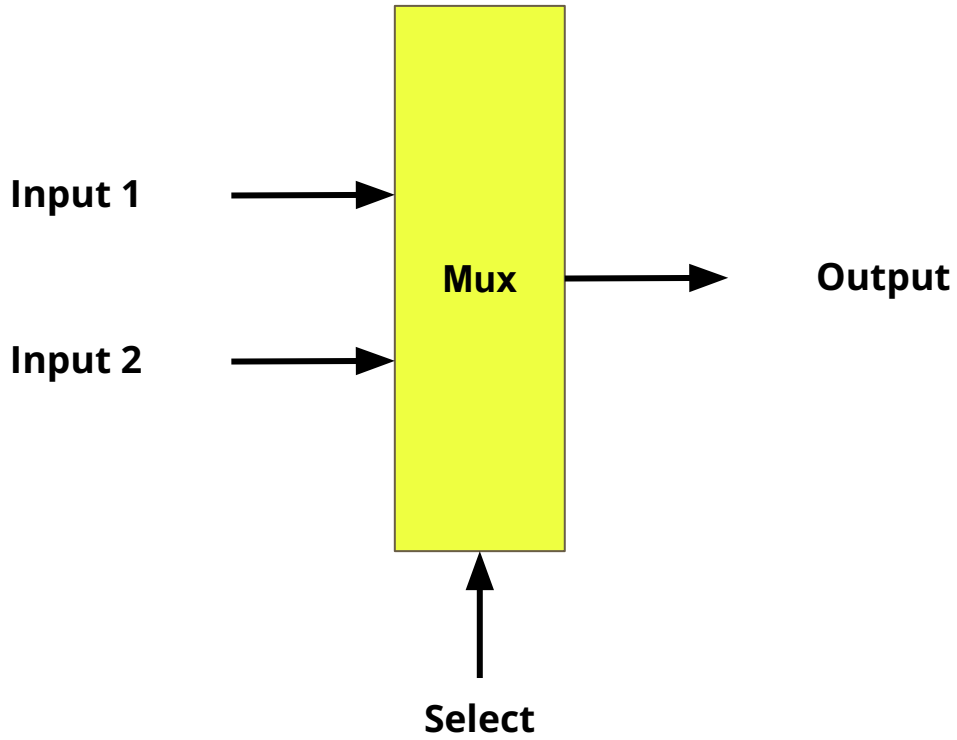
Arithmetic Logic Unit (ALU)

- How do we perform arithmetic operations?
  - Manipulate internal state
  - Modify register data
- Inputs
  - Input 1
  - Input 2
- Outputs
  - Result



Multiplexor (Mux)

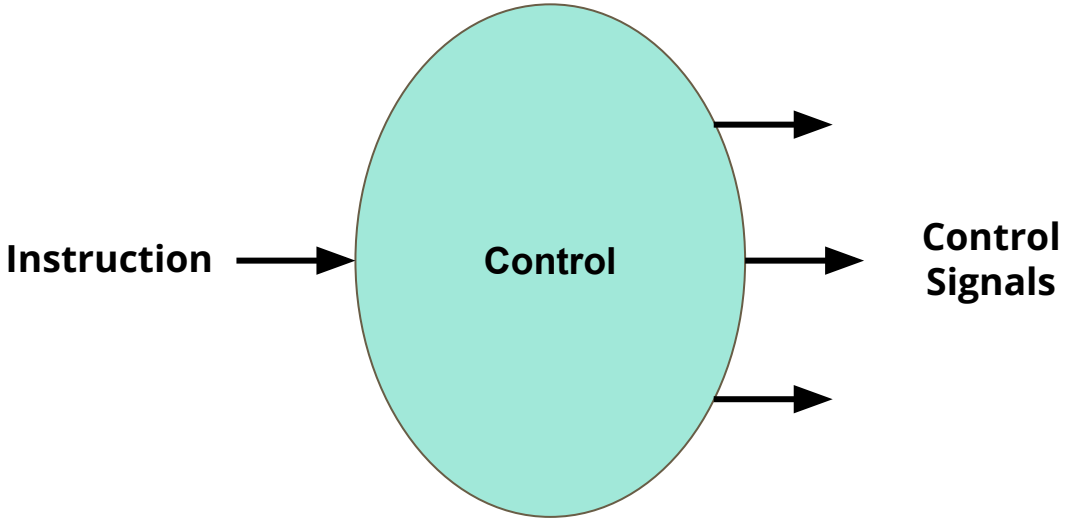
- How do select between different inputs?
- Inputs
  - Input 1
  - Input 2
  - Select
- Output
  - Output



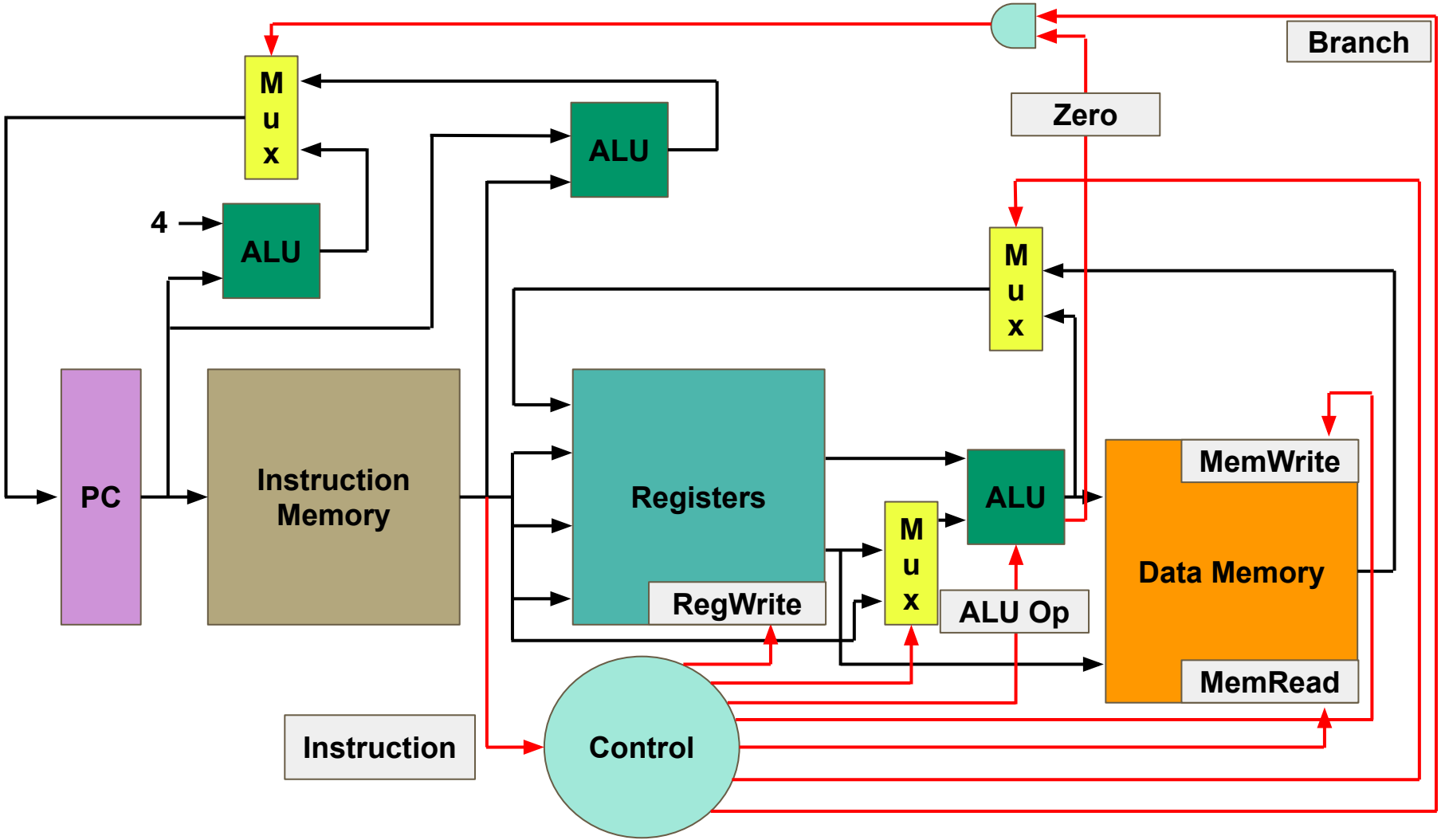
But Wait - Aren't We Forgetting Something?

Control Signals

- How do we tell our components what to do?
- Control signals
  - Based on instruction
- Examples
  - What operation should an ALU perform?
  - Are we doing a read/write?
  - Mux select lines



Putting it All Together


Branch
M
u
x
Zero
ALU
4
ALU
M
u
x
PC
Instruction
Memory
Registers
RegWrite
M
u
x
ALU
MemWrite
Data Memory
MemRead
ALU Op
Instruction
Control