Hardware Organization

- Components:

- CPU
  - ALU
  - Registers
  - Control Unit

Bus
- Input/Output Devices
- Main Memory
- Secondary Storage
Hardware Components

- Central Processing Unit (CPU)
  - Arithmetic Logic Unit (math, comparisons, etc)
  - Control Unit (processes instructions)
  - Registers (storage locations in processor)
- Main Memory (RAM): Storage for:
  - data
  - instructions (stored programs)
- Secondary Storage
- Input/Output Devices
- Bus: moves data one piece at a time (32/64 bits)

Registers

- Special purpose storage locations in processor
- Program Counter (PC)
  - Stores the memory address of the next instruction to be executed
- Instruction Register (IR)
  - Stores the current instruction
- Accumulator (ACC)
  - Where the results of all arithmetic operations and loads is stored.
Program

- Program is a set of instructions
- Stored in main memory
- Instructions are stored sequentially
- Instructions are in machine language (binary)

Instruction Cycle
(aka Execution Cycle)

- How does the computer execute a program?
- **Fetch** the next instruction from memory
  - then increment the program counter
- **Decode** the instruction
  - interpret components of the instruction
- **Execute**
  - set things up and send command to appropriate components (ALU, memory, etc)
- Repeat
Instruction types

- Data transfer
  - Move data to and from memory and registers
- Arithmetic/Logic:
  - perform operations that produce values (in accumulator)
- Comparisons:
  - sets bits of comparison register
- Branch/Jump:
  - set program counter to a different value to make the cycle continue in a different part of the program

Von Neumann Architecture

- The organization described here is called Von Neumann Architecture.
- Instructions are stored in memory with data
- Sequential execution of instructions
- Both data and instructions travel on same bus, which causes a bottleneck.