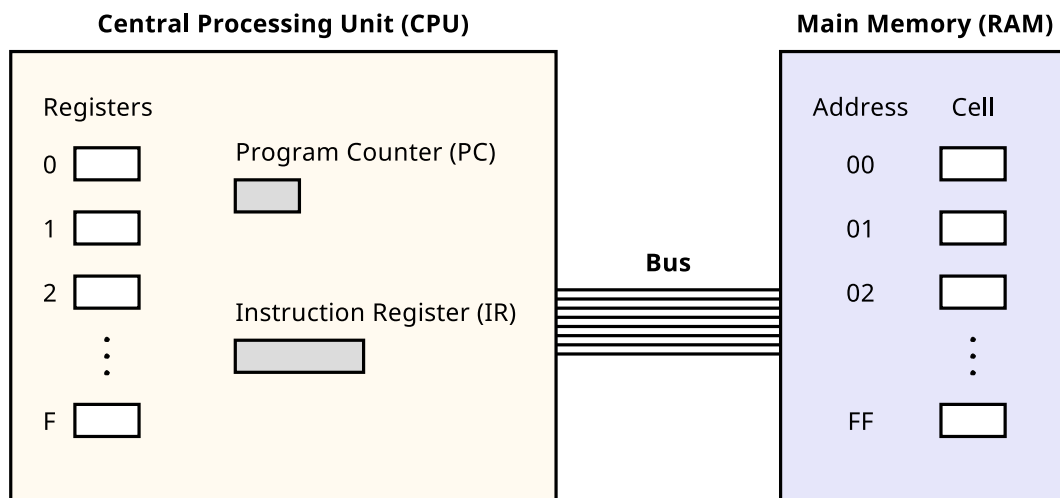


Activity 3: Hardware

Have you ever wondered what goes on inside your smartphone? Not just how the apps run, but how the hardware actually works? Last week you designed a simple circuit that adds two 4-bit numbers. With enough time and energy, you could learn to build an entire computer! But that's not the goal of this course, so we'll abstract those details. For now, let's take a look at how computers store and process information.

Model 1 Computer Architecture

Here is the 8-bit machine described in Appendix C of Brookshear and Brylow (2015):



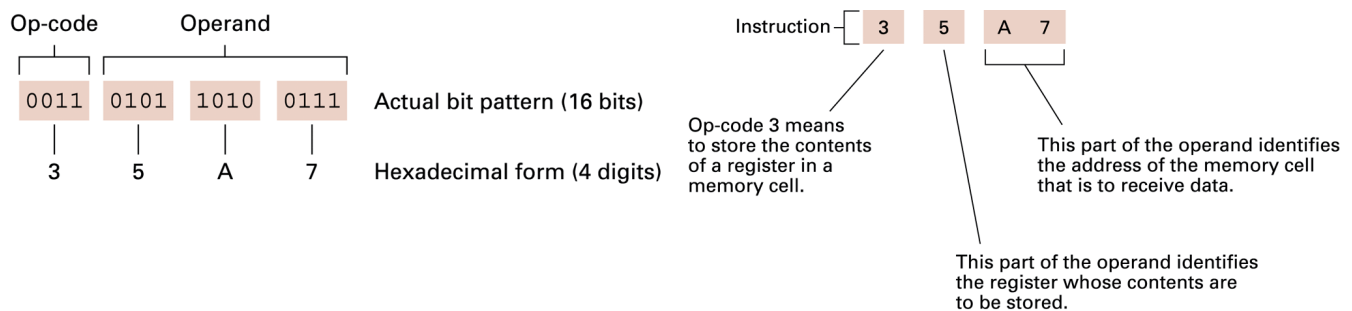
Questions (12 min)

Start time: _____

1. What are the three main components in the diagram? Based on its name, what do you think each hardware component does?
2. How many registers does the CPU have? How many memory cells are in RAM?
3. The CPU has circuits for adding the contents of two registers; think of registers as the "pins" in last week's lab. What is the largest number this machine can add without overflowing?

4. Common tasks the CPU performs include *loading* data from a memory cell into a register and *storing* data from a register into a memory cell. Describe what the CPU would need to do in order to add twenty numbers stored in memory.

Model 2 Machine Instructions



Questions (8 min)

Start time: _____

5. How many bits is the op-code? How many possible op-codes can the machine support?

6. The op-code for loading data from memory into a register is 1. Write an instruction (in hex) for loading data from address 3D into register 4.

7. Why is the instruction register in Model 1 twice as large as the other registers? How many memory cells are needed to store a single instruction?