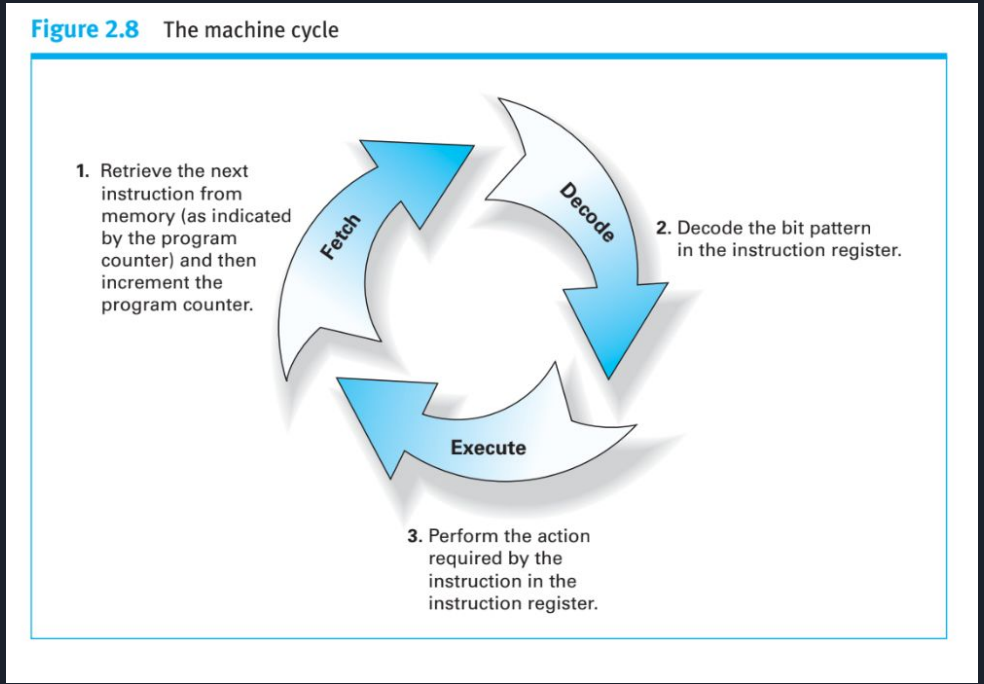
An Example of Program Execution

By Joseph Koop

The Machine Cycle



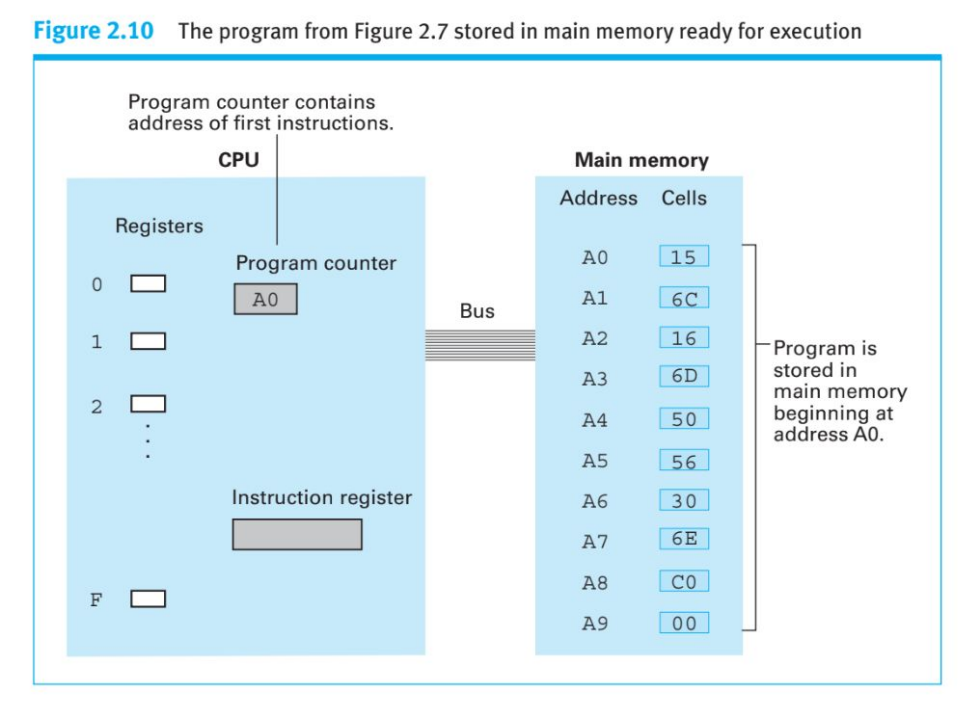
Machine Cycle: Fetch, Decode, Execute

Fetch step brings instructions from the main memory into instruction register, then increases program counter by 2

Decode step translates the instruction into machine code

Execute step activates the right circuitry to perform the instruction

Program Counter and Instruction Register



The program counter holds the address of the next instruction to carry out

The instruction register holds the current instructions that are being carried out

A program that adds two numbers

2.2 Adding values stored in memory

Step 1. Get one of the values to be added from memory and place it in a register.

Step 2. Get the other value to be added from memory and place it in another register.

Step 3. Activate the addition circuitry with the registers used in Steps 1 and 2 as inputs and another register designated to hold the result.

Step 4. Store the result in memory.

Step 5. Stop.

Figure 2.7 An encoded version of the instructions in Figure 2.2

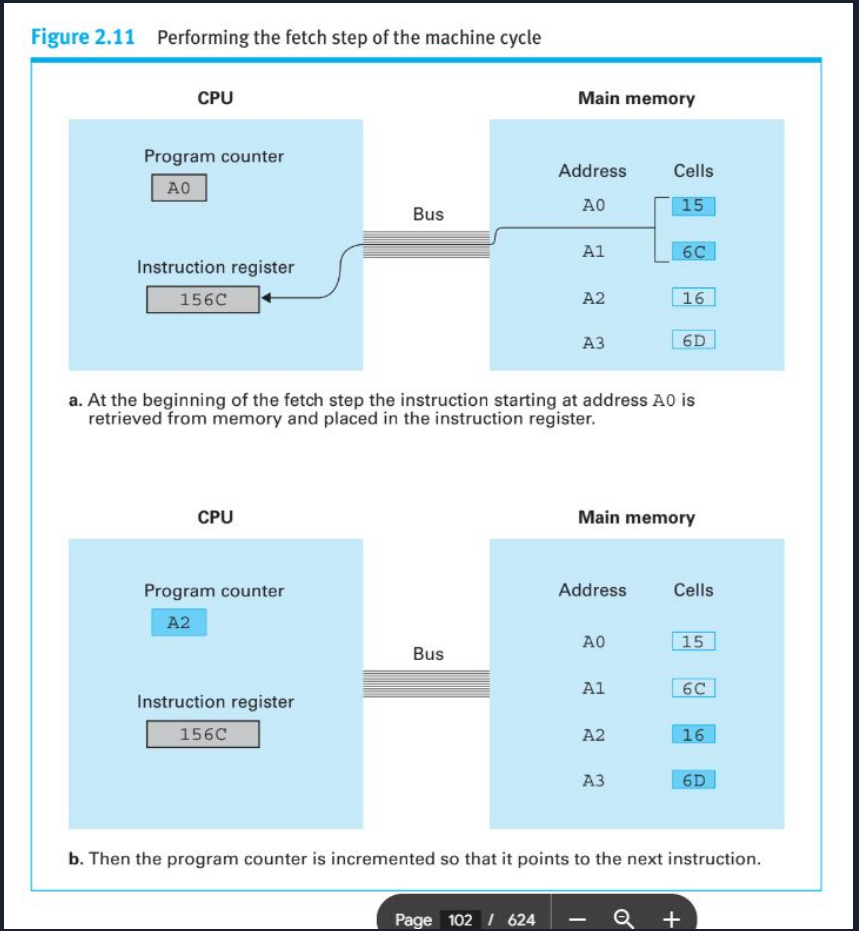
Encoded instructions	Translation
156C	Load register 5 with the bit pattern found in the memory cell at address 6C.
166D	Load register 6 with the bit pattern found in the memory cell at address 6D.
5056	Add the contents of register 5 and 6 as though they were two's complement representation and leave the result in register 0.
306E	Store the contents of register 0 in the memory cell at address 6E.
C000	Halt.

Fetch Step

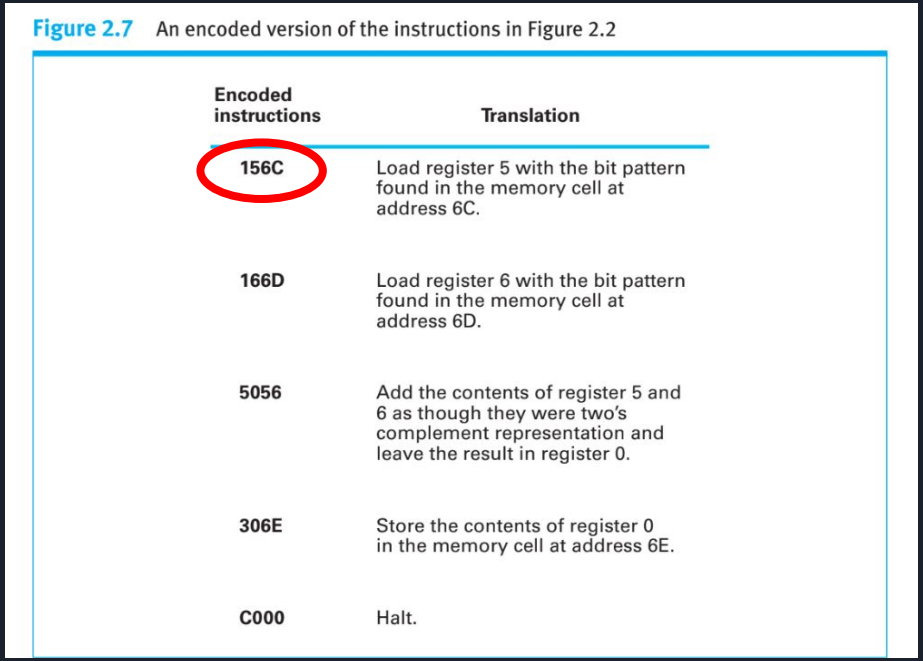
Starts at A0

Puts the contents of A0 and A1 into the instruction register

Changes program counter to A2



Decode Step



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156C

The first number indicates the operation

1 = Load

The second number indicates the CPU register to work with

5 = Load into register 5

The last two numbers indicate the address of the memory cell from which to take the number.

6C = Take the bit pattern from cell 6C

156C = Load the bit pattern from memory cell 6C into register 5.

Execute Step

Carries out the instruction by performing the required operation (Add, Subtract, Load, Move, Store, etc.)

Goes back to fetch step

Repeats the process until the end of the program

The End