

Paul Mickey

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### How a Computer Program Operates

Computers so are common in 2018 that one may not know how a computer program works. A computer program operates in what is called an instruction cycle. First, the computer fetches the program. Next, the computer decodes the program. Then the computer executes the program. Finally, the computer stores the data. The example used in this paper will be the math problem  $2+2$  because computer programs are essentially calculators.

First, the computer fetches the program instructions. This step happens when a user starts a program. Then the program is retrieved from cold-storage and then loaded into memory. After loading the first instruction, the program preloads the next instruction in the program, so the user does not have to wait. Having a multi-core processor in a computer is helpful in 2018 to the end user due to how “multi-threaded” programs are made. Most programmers will know how to optimize for specific processors to run the program instructions most efficiently. After executing, the program will then also increase the program counter which keeps track of what function has run in a program. This step would be loading  $2+2$  into memory.

Next, the computer decodes the program. This step translates the instructions from assembly language into machine language. This step is critical because the Central Processing Unit (CPU) reads electrical pluses also known as binary. This step will then give the opcode (what the instruction does) to the program. The example problem  $2+2$  would be translated into binary (00110010 00101011 00110010) with an opcode (also in binary) that then tells the computer to add the function. (Opcodes varies by system.)

Finally, the computer executes the program. This step involves having the CPU run the instructions to produce a result that is then saved into memory and then sent to an output device (if applicable). This procedure explains how a computer calculating  $2+2$  and then saves the output (4) into memory and displays on the screen.

The next step would be to store the data. The data could be cached in short-term in memory (as mentioned in the previous step) or in long-term on a hard disk. This step could also be known as the “save” function in a program for long-term storage. If the problem  $2+2=4$  if were to be saved, it would happen, and the data then be written to a storage medium.

This process is critical for computers and will repeat many times (almost instantly) in a program until it stops (usually done by a stop instruction), although the user may not know it. The steps fetch, decode, execute, and store are critical for a functioning computer program. Without this process, the computer may not exist today due to how fundamental this cycle is to a computer.