How the CPU executes program instructions

Let us examine the way the central processing unit, in association with memory, executes a computer program. Many personal computers can execute instructions in less than one-millionth of a second, whereas supercomputers can execute instructions in less than one-billionth of a second.

Before an instruction can be executed, program instructions and data must be placed into memory from an input device or a secondary storage device. The data will probably make a temporary stop in a register. Once the necessary data and instruction are in memory, the central processing unit performs the following four steps for each instruction:

1. The control unit fetches (gets) the instruction from memory.
2. The control unit decodes the instruction (decides what it means) and directs that the necessary data be moved from memory to the arithmetic/logic unit. These first two steps together are called instruction time, or I-time.
3. The arithmetic/logic unit executes the arithmetic or logical instruction. That is, the ALU is given control and performs the actual operation on the data.
4. The arithmetic/logic unit stores the result of this operation in memory or in a register.

Steps 3 and 4 together are called execution time, or E-time. The control unit eventually directs memory to release the result to an output device or a secondary storage device. The combination of I-time and E-time is called the machine cycle.

5. Read this text to find the answers to the following question.

a) What are the *Fetch* and *Decode* steps together called?

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b) Which steps together are called E-time?

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c) What must be put into memory before an instruction can be executed?

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d) Where will the data be stored temporarily?

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e) Where does the ALU store the results of its operations?

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f) What happens to the results eventually?

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g) What is the machine cycle?

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