

## The Journey Inside<sup>SM</sup>: Microprocessors Student Handout: Fetch, Decode, and Execute

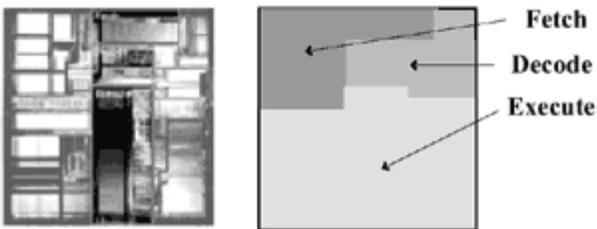
### Fetch, Decode, and Execute

One chip is central to a personal computer. It is called a microprocessor. Sometimes a microprocessor is called "a computer on a chip." Many microprocessors are smaller than a dime, yet they play an essential role in making the computer work.



A microprocessor compared in size to a dime.

A microprocessor contains several circuit groupings. With all the circuit groups of the microprocessor working together, the computer is able to do the tasks that the software instructs it to do. The microprocessor repeats three steps—fetch, decode, and execute—over and over again to complete whatever task the computer is required to do. Particular areas of the microprocessor are designed to complete these three steps.



The surface of a Pentium® microprocessor with the fetch, decode, and execute areas indicated.

A desktop computer can be used for word processing and creating graphics. It can be used to play games or to solve math problems. The same hardware is used for all these purposes. It is only necessary to change the software to give the computer the ability to do all these different tasks.

The hardware of a computer is built so that it can follow a variety of instructions. It can add, subtract, multiply, and divide numbers. It can compare two numbers to see if one is larger than the other. It can work with letters and words once they have been transformed into a binary representation.

Regardless of the type of information entered into the machine or the task being completed, the microprocessor uses its special circuit groups to carry out the three-step process:

1. **Fetch:** gets an instruction from memory
2. **Decode:** decides what the instruction means
3. **Execute:** performs the instruction

The circuitry of a computer is built to follow these steps rapidly and accurately. A desktop computer does these three steps hundreds of millions of times in a second as it completes any given task.

## Activities

1. Your teacher has prepared a set of instructions written on index cards. You are to get one of these cards from the instruction box, read the card, and then perform the instruction that is on the card.

Think about what you are doing as you and your classmates follow these instructions. Explain the similarities and differences between what you did and the fetch-decode-execute cycle that is used by microprocessors.

2. Suppose that there are a million instruction cards. Suppose it takes you about 30 seconds to read an instruction and carry it out. Approximately how long would it take you to process one million instructions? First, find the answer in seconds. Then convert the answer to minutes, hours, days, or even weeks, if necessary.