The *bus interface unit* links the microprocessor to the bus. The bus is the system of connections that links the microprocessor to the RAM, ROM, and input and output ports. Anything that goes in or out of the microprocessor passes through the bus interface unit. You will learn more about the bus later in this section.

The instructions that the microprocessor is following are stored in either RAM or ROM. It is the job of the *instruction fetch unit* to get the instructions from RAM or ROM.

Once an instruction is brought into the microprocessor by the instruction fetch unit, the *instruction decode unit* determines what must be done to get the instruction processed. Some instructions need other data pulled out of RAM. Some instructions can be executed as they are. Once the instruction is decoded, the execution unit actually carries out the instruction.

The *execution unit* is made up of three main parts:

1. the control unit
2. the arithmetic and logic unit
3. registers.

The *control unit* coordinates the activity of the execution unit. To successfully execute an instruction, the parts of the execution unit must do their job quickly and precisely. You can think of the control unit as the manager of the execution unit.

The *arithmetic and logic unit (ALU)* is the calculator and decision maker in the microprocessor. The actual data processing takes place in the ALU. Even though the ALU performs only simple math and comparisons, these operations are the building blocks for every other operation—regardless of complexity.

The ALU works closely with the *registers.* A register is a memory circuit that holds data that is being manipulated by the execution unit. There are a number of registers in the execution unit, and each has its own purpose. For example, when the ALU is performing addition, the values to be added are placed in registers and so is the result of the addition.

Other registers keep track of important locations in memory. For example, microprocessors have a register devoted to referencing where the next instruction to be executed is located.

What Is a CPU?

You have probably heard the term CPU used when describing computers. CPU is an acronym for ***central processing unit.*** *The CPU is the part of the computer where the processing takes place. Unfortunately, people have a hard time deciding what to include in the definition of CPU. Some call the entire metal case that holds the disk drives, power supply, and circuitry the CPU. Some say the CPU is the microprocessor chip only.*

So who is right? It is a matter of opinion. The important thing is that you are familiar with the term and that you know that it gets used to mean slightly different things. In this book, we will use more specific terms, rather than "CPU," to help avoid confusion.

MICROPROCESSOR SPEED AND CISC VS. RISC

The speed of a microprocessor is controlled by a device called a *clock.* The clock produces a signal that turns on and off millions of times per second. This signal that the clock generates is like a heart beat for the computer. The timing of the computer's operations is controlled by the beat of the clock.

Clock speeds are measured in *megahertz,* abbreviated as MHz, which means millions per second. For example, a microprocessor running at 66 MHz has a clock that sends 66 million signals per second.

There are two categories of microprocessors: CISC and RISC. ***CISC*** is an acronym for Complex Instruction Set Computer. ***RISC*** is an acronym for Reduced Instruction Set Computer.

A RISC processor typically accepts fewer commands than a CISC processor, but the RISC's commands are fundamental operations that can be combined to do any complex task that the CISC processor can do.

Computer scientists have discovered that a microprocessor with an instruction set of less complexity (a RISC processor) can generally run programs more quickly than a microprocessor with a complex instruction set (a CISC processor), even though the RISC processor may have to execute more instructions to do the same job.

CISC vs. RISC in the Real World

Until 1994, almost all microcomputers used CISC microprocessors. The Intel 8088, 8086, 80286, 80386, 80486, and Pentium microprocessors are all examples of CISC processors. The Motorola 68000 series of microprocessors used in all of the pre-1994 Macintoshes are also CISC processors. In 1994, the PowerPC microprocessor became the first widely-used RISC processor in microcomputers when Apple released the Power Macintosh.

TAKING THE BUS

As mentioned earlier, the microprocessor is connected to the RAM, ROM, and other devices by a system of wires called a *bus.* In most computers the wires that make up the bus are not actually individual wires, but lines etched on a circuit board.

The bus is composed of four different kinds of lines: power, data, address, and control. Figure 1-10 shows how the data lines, address lines, and control lines connect the microprocessor, ROM, and RAM.

The power lines carry power to the devices connected to the bus. The data lines carry data between input devices, the microprocessor, the storage devices, and the output devices.

The address lines make sure the data goes to or comes from the correct place. Each device in the computer has an address, like every house on a street. The

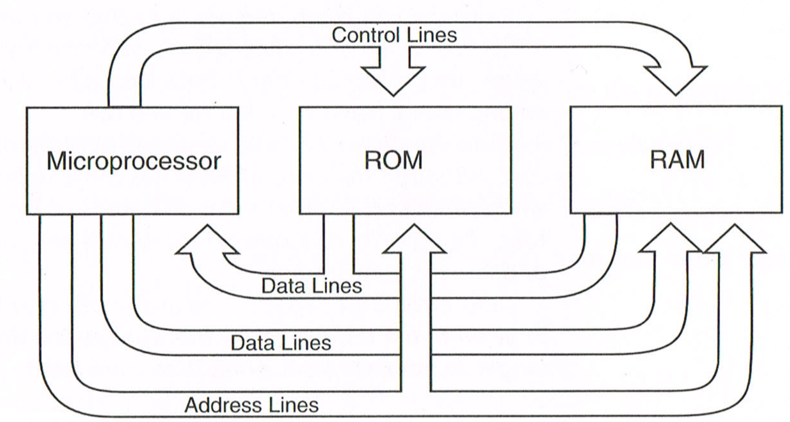

FIGURE 1-10
The bus connects the microprocessor to the RAM, ROM, and other devices.