Department of Computer Engineering Techniques (Stage: 4)
Advance Computer Technologies

INSIDE THE COMPUTER

Bit				0
Nibble				0000
Byte			0000	0000
Word	0000	0000	0000	0000

A *kilobyte* is 2^{10} bytes, which is 1024 bytes. The abbreviation K is often used. For example, some floppy disks hold 356K bytes of data. A *megabyte*, or meg as some call it, is 2^{20} bytes. That is a little over 1 million bytes; it is exactly 1,048,576. Moving rapidly up the scale in size, a *gigabyte* is 2^{30} bytes (over 1 billion), and a *terabyte* is 2^{40} bytes (over 1 trillion). As an example of how some of these terms are used, suppose that a given computer has 16 megabytes of memory. That would be 16×2^{20}, or $2^4 \times 2^{20}$, which is 2^{24}. Therefore 16 megabytes is 2^{24} bytes.

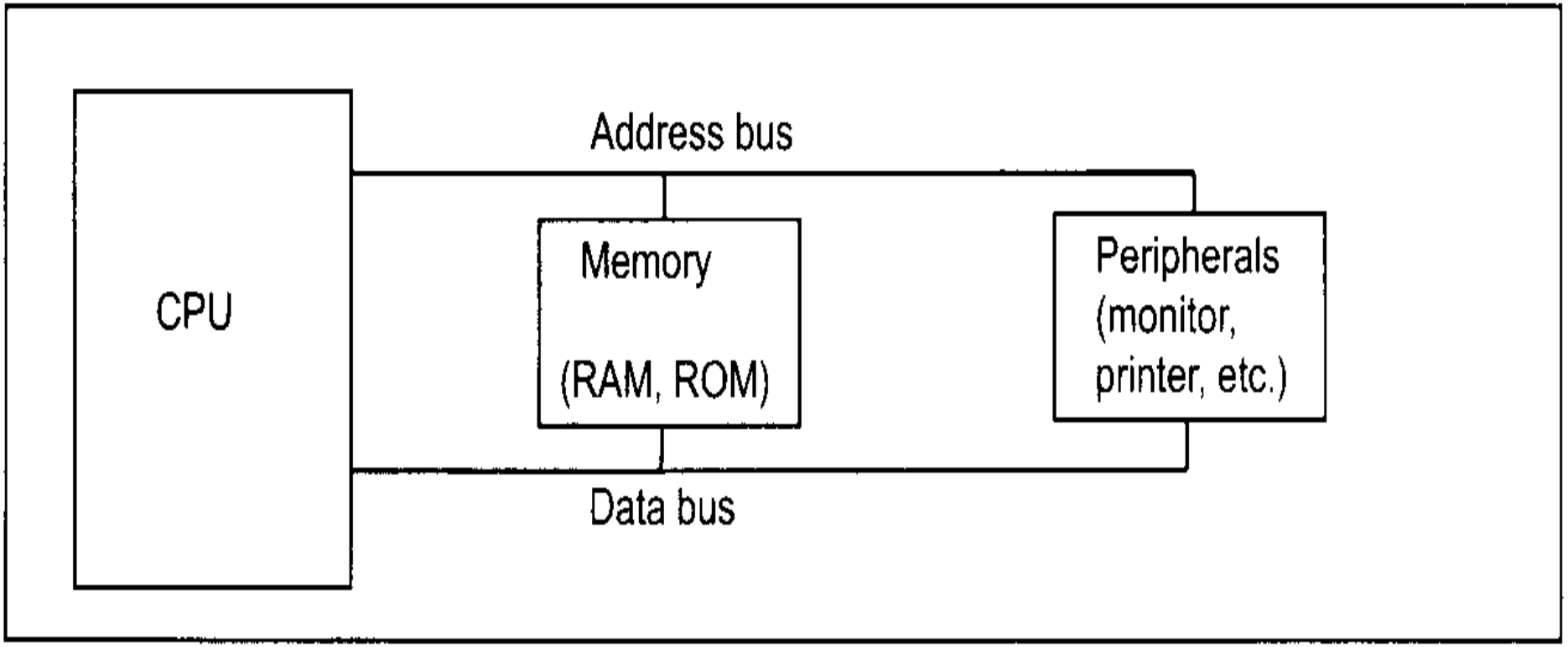

Figure 0-3. Inside the Computer

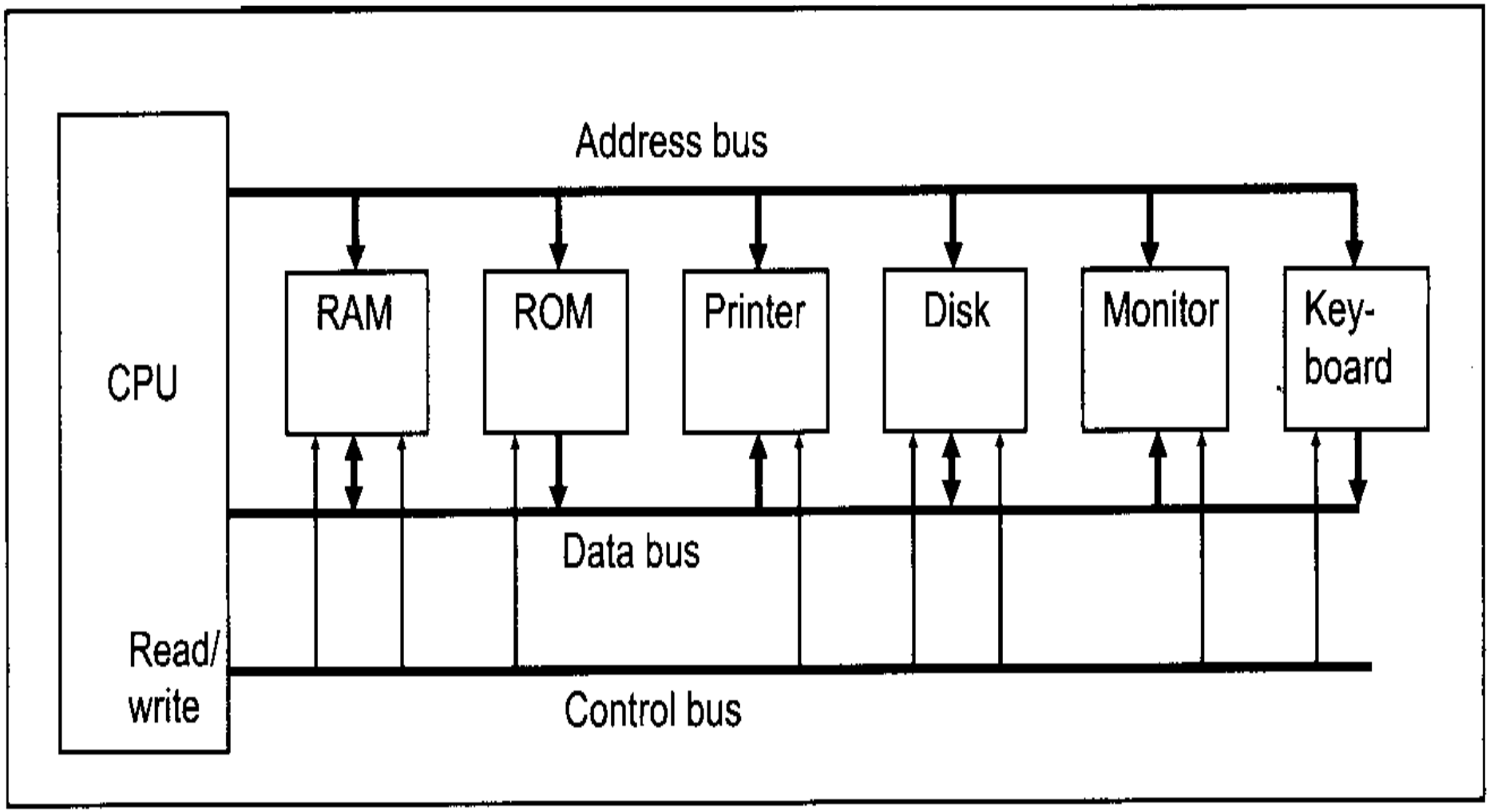

Figure 0-4. Internal Organization of Computers

Inside CPUs

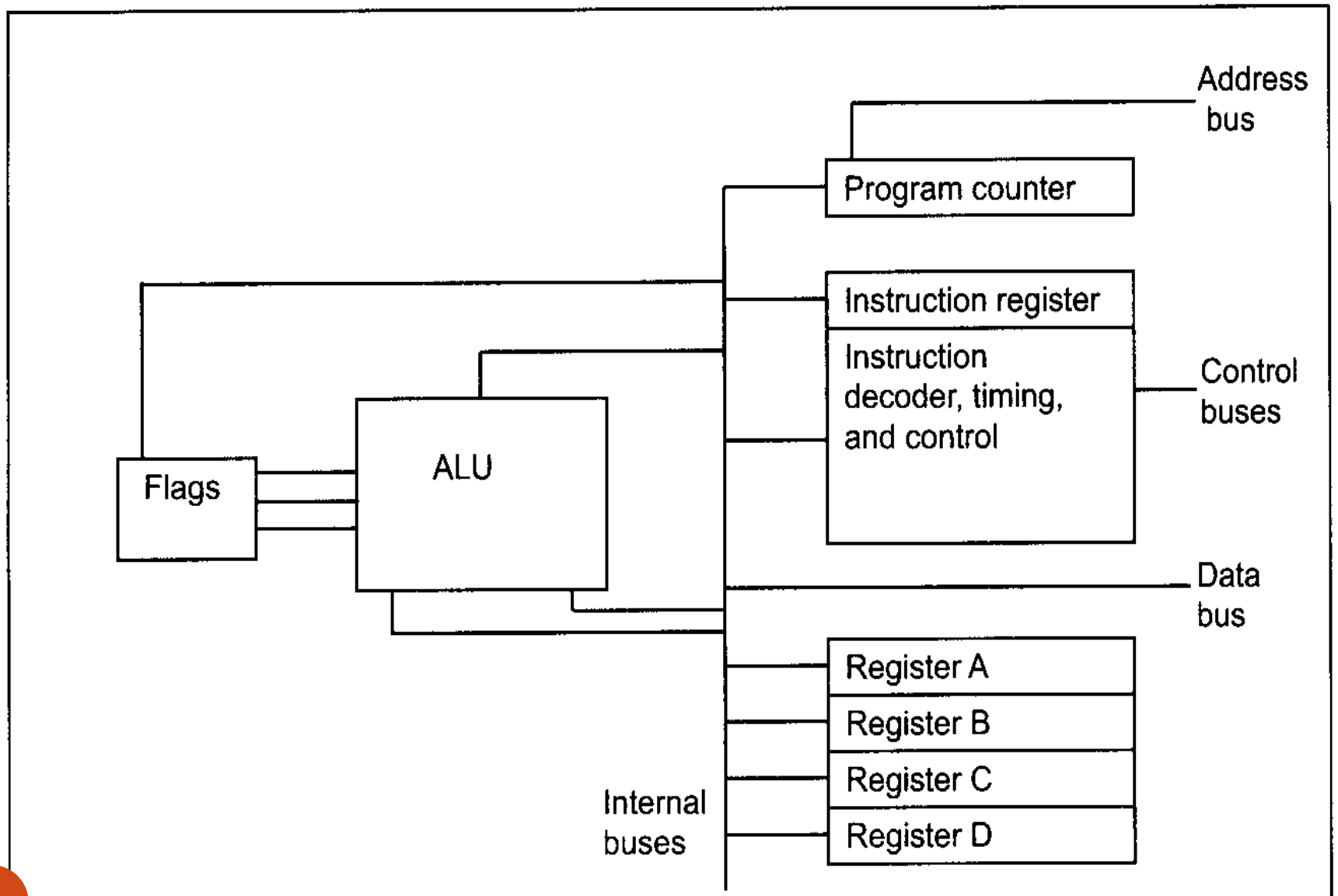

Figure 0-5. Internal Block Diagram of a CPU

CISC vs. RISC

Until the early 1980s, all CPUs, whether single-chip or whole-board, followed the *CISC* (complex instruction set computer) design philosophy. CISC refers to CPUs with hundreds of instructions designed for every possible situation. To design CPUs with so many instructions consumed not only hundreds of thousands of transistors, but also made the design very complicated, time-consuming, and expensive. In the early 1980s, a new CPU design philosophy called *RISC* (reduced instruction set computer) was developed. The proponents of RISC argued that no one was using all the instructions etched into the brain of CISC-type CPUs. Why not streamline the instructions by simplifying and reducing them from hundreds to around 40 or so and use all the transistors that are saved to enhance the power of the CPU? Although the RISC concept had been explored by computer scientists at IBM as early as the 1970s, the first working single-chip RISC microprocessor was implemented by a group of researchers at the University of California at Berkeley in 1980. Today the RISC design philosophy is no longer an experiment limited to research laboratories. Since the late 1980s, many companies designing new CPUs (either single-chip or whole-board) have used the RISC philosophy. It appears that eventually the only CISC microprocessors remaining in use will be members of the 80x86 family (8086, 8088, 80286, 80386, 80486, 80586, etc.) and the 680x0 family (68000, 68010, 68020, 68030, 68040, 68050, etc.). The 80x86 will be kept alive by the huge base of IBM PC, PS, and compatible computers, and the Apple Macintosh is prolonging the life of 680x0 microprocessors.

BRIEF HISTORY OF THE CPU

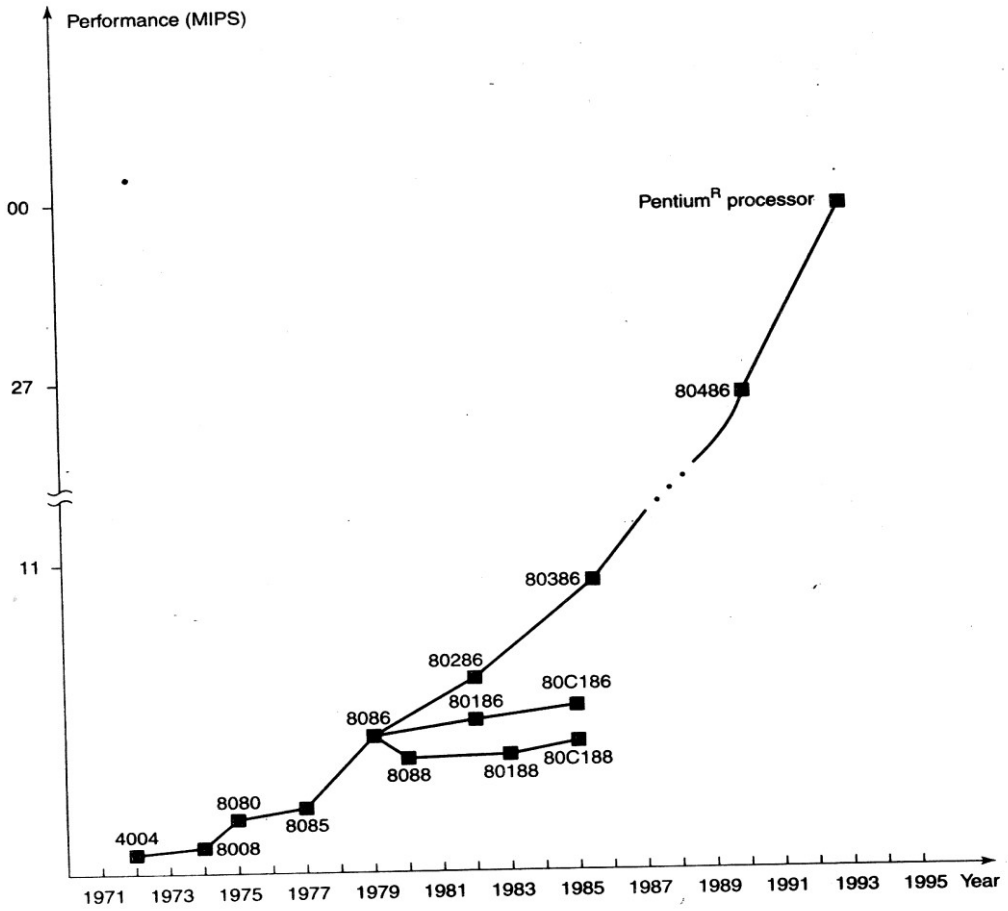

Figure 1.7 Evolution of the Intel microprocessor architecture.

Table 1-1: Evolution of Intel's Microprocessors

Product	8080	8085	8086	8088	80286	80386	80486
Year introduced	1974	1976	1978	1979	1982	1985	1989
Clock rate (MHz)	2 - 3	3 - 8	5 - 10	5 - 8	6 - 16	16 - 33	25 - 50
No. transistors	4500	6500	29,000	29,000	130,000	275,000	1.2 million
Physical memory	64K	64K	1M	1M	16M	4G	4G
Internal data bus	8	8	16	16	16	32	32
External data bus	8	8	16	8	16	32	32
Address bus	16	16	20	20	24	32	32
Data type (bits)	8	8	8, 16	8, 16	8, 16	8, 16, 32	8, 16, 32

Review Questions

1. Name three features of the 8086 that were improvements over the 8080/8085.
2. What is the major difference between 8088 and 8086 microprocessors?
3. Give the size of the address bus and physical memory capacity of the following:
   (a) 8086 (b) 80286 (c) 80386
4. The 80286 is a _____-bit microprocessor, whereas the 80386 is a _____-bit microprocessor.
5. State the major difference between the 80386 and the 80386SX.
6. List additional features introduced with the 80286 that were not present in the 8086.
7. List additional features of the 80486 that were not present in the 80386.