专业英语系列教材

Computer English

计算机专业英语

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主编 郭涛

华中科技大学出版社
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内 容 提 要

本书主要介绍计算机领域相关的基础知识及其应用，不仅包括计算机发展、计算机系统结构、软件、硬件知识、程序开发和程序语言、网络通信及 Internet 等经典内容，还涉及许多反映 21 世纪计算机前沿技术的内容，如数据库与信息系统、图形与多媒体、虚拟现实、计算机安全等。全书以计算机领域的最新英语时文和原版教材为基础，配以适当的中文解释和课后练习，使读者通过学习掌握计算机专业英语的主要术语和词汇，提高阅读和检索计算机英文文献资料的能力。

本书可作为大专院校计算机专业信息技术导论双语教材，以及相关专业的专业英语教材，也可以作为相关专业的工程技术人员提高计算机英语水平的读物。

前　言

目前高校推行教育改革，要求部分专业课程采用双语教学，旨在提高学生的专业英语水平，培养和提高学生运用英语的能力。然而，在大量的双语教学实践中我们发现，教材的选取对教与学的效果至关重要。原版教材是双语教学的一个必要条件，它可以使教师和学生接触到"原汁原味"的英语，但这需要学生具有一定的专业英语词汇、专业英语理解和翻译能力。如果双语教学在专业英语薄弱的学生中采用原版教材，往往弊大于利。如果选用中文教材，教师课堂授课中穿插部分英语讲授，则不利于学生用外语去理解和掌握专业知识，也不利于培养学生用外语去思考问题、解决问题的能力。这样，双语教学就成了无源之水、无本之木，最终也就成了流于形式的教学方式。

鉴于在实施双语教学过程中存在的这些问题，我们结合多年双语教学的经验以及双语教学的教改项目的研究结果，按照学科教学计划的要求编写了本书。因此，本书具有以下特点。

1. 教材编写突出一个"新"字，内容涵盖面广。本书不仅包括计算机发展、计算机系统结构、软件、硬件知识、程序开发和程序语言、网络通信及 Internet 等经典内容，还提供了许多反映 21 世纪计算机前沿技术的内容，如数据库与信息系统、图形与多媒体、虚拟现实、计算机安全、计算机伦理道德等。

2. 教材组织以英文原文为主，适当对英文时文、原文进行改编、选编、切割或重新组合，对文中较难理解部分辅以一定的中文解释。

3. 教材中部分章节增加了前沿知识、相关人物、产品和公司介绍，以扩大读者的知识面。

4. 章节末对每章首次出现的与计算机相关的术语进行了中英文对照注释，使读者更好地理解基本概念。

5. 配合学习内容，每章后附一定题量的自测练习，以测试学生对各章节的理解情况。

6. 为增加章节内容的直观性，每章均附有相关内容的图、表，帮助读者更好地理解原文和提高学习兴趣。

本书在编写过程中，得到外籍教师 Lisa Johnson 和 Rob Gagnon 的大力帮助，在此致以衷心的感谢。由于编著者水平有限，如有疏漏和不当之处，恳请专家和广大读者批评指正。

编　者

2006 年 11 月

Contents

CHAPTER 1

Introduction to Computers

Objectives

After completing this chapter, you will be able to

- Understand computer-based information systems
- Distinguish the categories of computers
- Describe the milestones of the computer
- Describe the components of a computer
- Understand computer software
- Identify the characteristics of a computer

本章掌握要点

基于计算机的信息系统及信息系统各组成元素、计算机类型、计算机的发展历史、计算机组成、计算机软件及类型、衡量计算机功能的指标。

Nothing epitomizes modern life better than the computer. For better or worse, computers have infiltrated every aspect of our society. Today computers do much more than simply compute: supermarket scanners calculate our grocery bill while keeping store inventory; computerized telephone switching centers play traffic cop to millions of calls and keep lines of communication untangled; and Automatic Teller Machines (ATMs) let us conduct banking transactions from virtually anywhere in the world. But where did all this technology come from and where is it heading? To fully understand and appreciate the impact computers have on our lives and the promises they hold for the future, it is important to understand their evolution.

1.1 Milestones in Computer Development

The Evolution of Computers

The abacus (See Figure 1.1), which emerged about 5,000 years ago in Asia Minor and is still in use today, may be considered the first computer. This device allows users to make computations using a system of sliding beads arranged on a rack. Early merchants used the abacus to keep track of trading transactions. But as the use of paper and pencil spread, particularly in Europe, the abacus lost its importance. It took nearly 12 centuries, however, for the next significant advance in computing devices to emerge. In 1642, Blaise Pascal (1623—1662), the 18-year-old son of a French tax collector, invented what he called a numerical wheel calculator to help his father with his duties. This brass rectangular box, also called a Pascaline (See Figure 1.2), used eight movable dials to add sums of up to eight figures. Pascal's device used a base of ten to accomplish this. In 1694, a German mathematician and philosopher, Gottfried Wilhem von Leibniz (1646—1716), improved the Pascaline by creating a machine that could also multiply. Like its predecessor, Leibniz's mechanical multiplier worked by a system of gears and dials. Partly by studying Pascal's original notes and drawings, Leibniz was able to refine his machine. The centerpiece of the machine was its stepped-drum gear design, which offered an elongated version of the simple flat gear. It wasn't until 1820, however, that mechanical calculators gained widespread use. Charles Xavier Thomas de Colmar, a Frenchman, invented a machine that could perform the four basic arithmetic functions. Colmar's mechanical calculator, the arithmometer, presented a more practical approach to computing because it could add, subtract, multiply and divide. With its enhanced versatility, the arithmometer was widely used until the First World War. Although later inventors refined Colmar's calculator, together with fellow inventors Pascal and Leibniz, he helped define the age of mechanical computation. However, the birth of the true electronic computer did not occur until the mid-1900s.

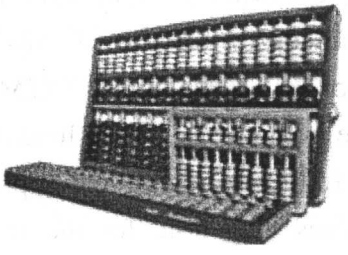


Figure 1.1 Abacus

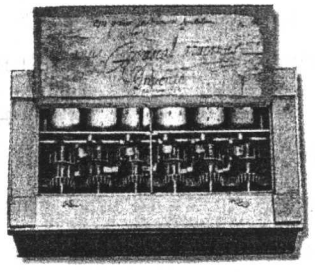


Figure 1.2 Pasicaline

The Development of Computers

The first large-scale electronic computer was Electrical Numerical Integrator And Calculator (ENIAC), which became operational in 1946 (See Figure 1.3). It was originally developed during Word War Ⅱ to perform complex trajectory calculations, but the war ended before the machine was operational. After the war, it continued to be used, performing calculations for the design of the hydrogen bomb, weather prediction, cosmic-ray analysis, thermal ignition, random

numbers, and wind-tunnel design. The ENIAC contained 17,468 vacuum tubes, along with 70,000 resistors, 10,000 capacitors, 1,500 relays, 6,000 manual switches and 5 million soldered joints. It covered 1,800 square feet of floor space, weighed 30 tons, and consumed 160,000 Watts of electrical power, making the lights in Philadelphia go dim each time it was powered up.

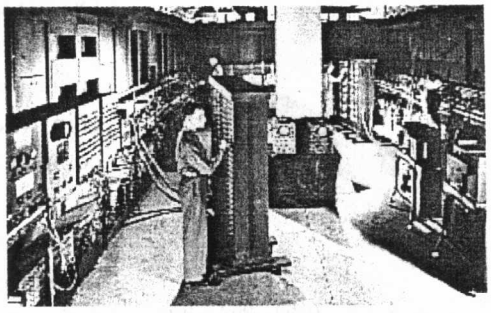


Figure 1.3 ENIAC

First Generation——1940—1956: Vacuum Tubes

In the earliest general-purpose computers, most input and output media were punched cards and magnetic tapes. Vacuum tubes were used for circuitry and magnetic drums for memory. These computers were somewhat unreliable because the vacuum tubes failed frequently. They were very expensive to operate and in addition to using a great deal of electricity, they generated a lot of heat, which often caused malfunctions. First generation computers relied on machine language to perform operations, and they could only solve one problem at a time. ENIAC, used by the U.S. Bureau of the Census from 1951 to 1962, is an example of first-generation computers.

Second Generation——1956—1963: Transistors

Transistors replaced vacuum tubes and ushered in the second generation of computers. The transistor (See Figure 1.4) was invented in 1947, but did not see widespread use in computers until the late 1950s. The transistor was far superior to the vacuum tube, allowing computers to become smaller, faster, cheaper, more energy-efficient and more reliable than their first-generation predecessors. Though the transistor still generated a great deal of heat that subjected the computer to damage, it was a vast improvement over the vacuum tube. Second-generation computers still relied on punched cards for input and printouts for output. Second-generation computers moved from cryptic binary machine language to symbolic, or assembly languages, which allowed programmers to specify instructions in words. High-level programming languages were also being developed at this time, such as early versions of COBOL and FORTRAN. The first computers of this generation were developed for the atomic energy industry. They stored their instructions in their memory, which moved from a magnetic drum to magnetic core technology.

Figure 1.4 Transistors

Third Generation——1964—1971: Integrated Circuits

The development of the Integrated Circuit (IC) was the hallmark of the third generation of computers. Transistors were miniaturized and placed on silicon chips, called semiconductors, which drastically increased the speed and efficiency of computers. Instead of punched cards and printouts, users interacted with third generation computers through keyboards and monitors and interfaced with an operating system, which allowed the device to run many different applications at one time with a central program that monitored the memory. Computers for the first time became accessible to a mass audience because they were smaller and cheaper than their predecessors.

Fourth Generation——1971—Present: Microprocessors

The microprocessor brought the fourth generation of computers, as thousands of integrated circuits were built onto a single silicon chip. Large-Scale Integrated (LSI) and Very-Large-Scale Integrated

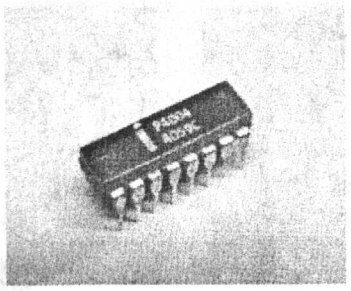


Figure 1.5 Intel 4004 Chip

(VLSI) circuits were developed that contained hundreds to millions of transistors on one tiny chip. What, in the first generation, filled an entire room could now fit in the palm of the hand. The Intel 4004 chip (See Figure 1.5), developed in 1971, located all the components of the computer—from the central processing unit and memory to input/output controls—on a single chip. In 1981 IBM introduced its first computer for the home user, and in 1984 Apple introduced the Macintosh. Microprocessors also moved out of the realm of desktop computers and into many areas of life as more and more everyday products began to use microprocessors. As these small computers became more powerful, they could be linked together to form networks, which eventually led to the development of the Internet. Fourth generation computers also saw the development of Graphic User Interfaces (GUIs), the mouse and handheld devices.

In fourth generation, computers' main memory capacity increased and cost decreased, which directly affected the types and usefulness of software that could be used. Software applications like word processing, electronic spreadsheets, database management programs, painting and drawing programs, desktop publishing and so forth become commercially available.

Fifth Generation——Present and Beyond: Artificial Intelligence

Fifth generation computing devices, based on artificial intelligence, are still in development, though there are some applications, such as voice recognition, that are being used today. The use of parallel processing and superconductors is helping to make artificial intelligence a reality. Quantum computation and molecular and nanotechnology will radically change the face of computers in years to come. The goal of fifth-generation computing is to develop devices that respond to natural language input and are capable of learning and self-organization.

KNOWLEDGE EXPANSION

DNA Computer

Researchers have created a "DNA computer" made of strands of synthetic DNA, and have used it to solve complex problems. While others have already had success with DNA computing, studies show that it can be scaled up and moved out of test tubes onto the solid surfaces needed to make it practical. Much more development will be required before DNA molecules replace silicon chips. However, as one gram of DNA can hold the information-equivalent of a trillion CDs, scientists are looking to use DNA's amazingly designed information storage capacity (able to hold the "blueprints" of life) to overcome looming limits to microchip power. Also, as the fledgling DNA computer solves problems in far fewer steps than a conventional computer, the researchers expect biocomputers to be capable of dealing with problems of greater complexity while using less space.

Progress Check

1. Describe the five generations of the computer.

1.2 Computer-based Information Systems

What Is a Computer?

要点提示

计算机是在内存操作指令的控制下，对数据进行输入、处理、存储和输出操作的电子设备。

A computer is an electronic device that operates under the control of instructions stored in its own memory, which can accept data, manipulate the data according to specified rules, produce results, and store the results for future use. A computer has four functions.

Input is supplied to the computer with the use of a keyboard, a mouse, or other input devices. Input devices translate data and programs that humans can understand into a form that the computer can process. These input devices may be called peripheral devices.

Processing is done inside the computer in an area called the central processing unit (CPU). Processing is the conversion of input to output.

Storage refers to holding information somewhere. Random Access Memory（RAM）is a short-term memory. It is volatile memory because it is automatically "erased" when the power is turned off or interrupted. The RAM memory is located inside the computer case on the motherboard. A motherboard holds RAM memory, electronic circuits and other computer parts including the central processing unit. Read-Only-Memory (ROM) is not volatile, meaning the memory is still there when power is interrupted or turned off. When the computer is turned back on again, ROM memory is still in storage on the internal hard disk.

Output is the result of a computer process. Output may be viewed on a monitor screen, heard through speakers, printed on printers, and so forth. Output devices may be considered hardware and are also considered to be peripheral devices.

Six Elements of an Information System

要点提示

信息系统的六个组成元素：硬件、软件、数据/信息、人、操作指南和通信。

When you think of a microcomputer, perhaps you think of just the equipment itself. That is, you think of the monitor or the keyboard. Yet, there is more to it than that. The way to think about a microcomputer is as part of an information system. An information system has six parts: hardware, software, data/information, people, procedures and communications (See Figure 1.6).

Hardware

Hardware refers to the physical equipment that can perform the basic functions contained within the data processing cycle. The hardware may consist of the computer itself plus many auxiliary hardware devices including the keyboard, mouse, monitor, system unit, and other devices. Hardware is controlled by software.

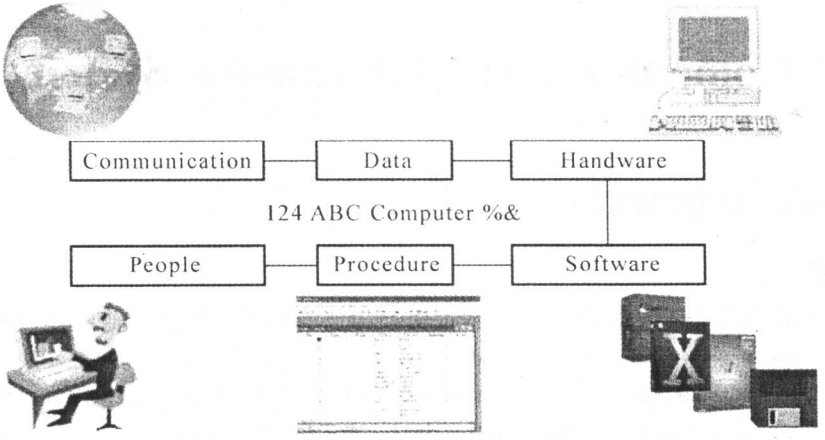


Figure 1.6 Six Elements of an Information System

Software

Software is also called programs. A computer program is a sequence of detailed instructions designed to direct a computer to perform certain functions. These pre-written stored programs enable a computer to receive input, store information (data), make decisions arithmetically, and manipulate and output data in the correct sequence and format. These programs are referred to as software. Software is generally categorized as either system software or application software.

Data/Information

Data consists of the raw facts and figures that are processed into information. Information is summarized data or otherwise manipulated (processed) data. For example, the raw data of students' courses taken and their subsequent grades are processed by a computer into the information of final credits hours.

People

It is easy to overlook as one of the six parts of a microcomputer system. However, they are the most important component of the computer system. People operate the computer hardware, they create and use the computer software, and they face ethical issues and decisions regarding the use of information technology. They enter the data and use the information the system generates.

Procedure

This refers to the rules and guidelines people follow when using software, hardware, and processing the data. Procedures for computer systems appear in documentation, manuals, sometimes known as reference manuals and user guides, which contain instructions, rules, and guidelines to follow when using hardware and software.

Communication

Communication also called connectivity. It is an element of the computer-based information system where one computer system is set up to share data and information with another computer system. It allows computers to connect and share information. They can be connected by telephone lines, by cable, or through the air. This allows users to greatly expand the capability and usefulness of their information system.

Progress Check

1. What are the four basic functions of a computer?
2. What are the six elements of an information system?

1.3 Computer Hardware

Types of Computer Systems

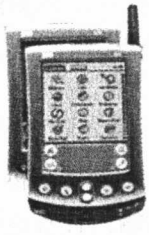
要点提示

计算机按规模可分为微型计算机、小型计算机、大型计算机以及超级计算机。

There are four major categories of computers: microcomputer, minicomputer, mainframe computer, and supercomputer. These categories are based on the differences in the size, speed, processing capabilities, and price of computers.

Microcomputers, also called personal computers, are designed for general use by a single person. A microcomputer can perform all of its input, processing, output, and storage activities by itself. It contains at least one input device, one output device, one storage device, memory, and a processor. There are two popular series of personal computers: PC and Apple Macintosh (Mac). These two types of computers have different processors and use different operating systems. The PC and compatibles use the Windows operating system. The Apple Macintosh uses the Macintosh operating system. Today, the terms PC and compatible refer to any personal computer that is based on specifications of the original IBM personal computer. Categories of microcomputer include desktop and notebook (See Figure 1.7).

Desktop



Personal Digital Assistant

Notebook Computer

Figure 1.7 Types of Computers

- **Desktop computers** are designed so the system unit, input devices, output devices, and any other devices fit entirely on or under a desk or table. Variations of desktop computers include:
  - ❑ **tower models** (computers with tall and narrow system units that can sit vertically on the floor),
  - ❑ **all-in-one computers** (less expensive computers that combine the monitor and system unit into a single device), and
  - ❑ **workstations** (more expensive and powerful computers designed for work that requires intense calculation and graphics capabilities).
- **Notebook computers** are portable personal computers small enough to fit on your lap. Notebook and desktop computers are used at home or in the office to perform application software-related tasks or to access the Internet.
- **Handheld computers** are small computers that fit in your hand. Handheld computers can perform specific, industry-related functions, or can be general-purpose. A Personal Digital Assistant (PDA)

is a handheld computer that provides personal organizer functions, such as a calendar, appointment book, and notepad.

Minicomputers are a largely obsolete class of multi-user computers which make up the middle range of the computing spectrum, in between the largest multi-user systems (mainframe computers) and the smallest single-user systems (microcomputers or personal computers).

Mainframes are very large and expensive computers capable of supporting hundreds, or even thousands, of users simultaneously. In the hierarchy that starts with a simple microprocessor (in watches, for example) at the bottom and moves to supercomputers at the top, mainframes are just below supercomputers. In some ways, mainframes are more powerful than supercomputers because they support more simultaneous programs. However supercomputers can execute a single program faster than a mainframe. The distinction between small mainframes and minicomputers is vague, depending on how the manufacturers want to market their machines.

Supercomputers are the most powerful type of computers. Supercomputers are very expensive and are employed for specialized applications that require immense amounts of mathematical calculations. For example, weather forecasting requires a supercomputer. Other uses of supercomputers include animated graphics, fluid dynamic calculations, nuclear energy research, and petroleum exploration.

Components of a Computer

A computer consists of a variety of hardware components that work together with software to perform calculations, organize data, and communicate with other computers. These components falls into five basic categories: system units, input/output devices, storage devices, and communications devices. Chapter 2 will cover more details for each device.

要点提示

计算机系统由以下部分组成。

- 输入设备：将计算机外部数据传入计算机系统的设备。
- 输出设备：将经过计算机处理过的数据输出计算机系统的设备。
- 系统单元：又叫主机，外部通常由金属或塑料制成。系统单元中的电路通常是主板的一部分或与主板相连。主板上有两个主要器件：中央处理器和内存，分别用于解释、执行计算机的基本指令，以及临时存储数据和指令。
- 存储器：这里指辅助存储器，是长期存放数据、指令和信息的设备。
- 通信设备：帮助计算机之间以及计算机网络之间相互连接的设备。此设备便于计算机硬件和软件资源的共享。

Input devices are used to bring data into the system. Some input devices are: keyboard, mouse, microphone, scanner, digital camera, and bar code reader.

Output devices are used to send data generated by a computer out of the system. Some output devices are: monitor, printer, and speaker.

System unit, sometimes called a chassis, is a box-like case made from metal or plastic that protects the internal electronic components of the computer from damage. The circuitry in the system unit usually is part of or is connected to a circuit board called the motherboard. Two main components on the motherboard are the central processing unit and memory (primary memory or main memory).

- **Central processing unit**, sometimes called the processor, is the electronic device that interprets

and carries out the basic instructions that operate the computer.

- **Memory** is a temporary holding place for data and instructions. There are two basic references to memory in computer, logical and physical. Logical memory is patterns in the way memory is accessed and stored, which could be pictured as a flow chart, while physical memory is the actual hardware. System memory is used by the operating system as it's main workspace or desktop. Read Only Memory (ROM) provides the instructions, which the computer uses each time it boots; some ROM is fixed as firmware, some is programmable such as EPROM. Cache is used by the CPU for very short term quick storage, like a shelf above a desk. Random Access Memory (RAM) is the main location for most operations performed by the computer as directed by the CPU, and user input.

Storage devices, also called secondary storage devices, refers to backing up or keeping digital data in a secure place for future use. Storage devices differ from memory, in that they can hold these items permanently. Typical data storage types are hard disks, floppy disks, as well as optical disks. Some types of optical disks can read and write data. Some types can be written to only one time. The best-known type of optical disk, however, can only be read from. These are called CD-ROM for compact disk-read only memory and DVD-ROM for digital versatile disk-read only memory.

Communication devices are used to facilitate the connections between computers and between groups of connected computers called networks. Such connections allow the sharing of resources, including hardware, software and data. The communication component of a computer system vastly extends the computer's range and utility. A modem is a communication device that enables computers to communicate via telephone lines or cable. Modems are available as both internal and external devices. Figure 1.8 shows a processing cycle of a computer.

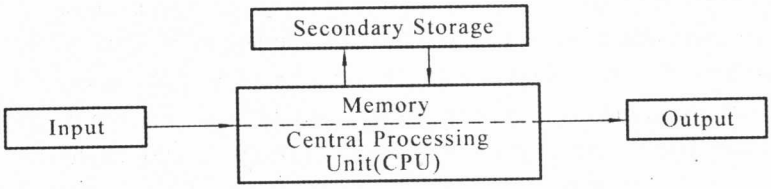


Figure 1.8 Processing Cycle of a Computer

Von Neumann Architecture of Computer Systems

要点提示

冯·诺依曼体系结构中，计算机由存储器、算术逻辑单元、控制单元、输入和输出系统五个部分组成。

All computers share the same basic architecture, whether it be a multi-million dollar mainframe or a Palm Pilot. All have memory, an I/O system, an arithmetic/logic unit, and a control unit. This type of architecture is named Von Neumann architecture after the mathematician who conceived the design (See Figure 1.9).

Memory is the subsystem that serves as temporary storage for all program instructions and data that are being executed by the computer. It is typically called RAM. Memory is divided up into cells, each cell having a unique address so that the data can be retrieved.

Arithmetic/logic unit is the subsystem that performs all arithmetic operations and comparisons for equality. In the Von Neumann design, this and the Control Unit are separate components, but in