高等学校计算机专业教材精选·计算机基础

计算机专业英语

方 娟 编著

清华大学出版社

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内 容 简 介

本书是用英语编写的计算机技术教材。全书系统地介绍了计算机硬件、软件等基础知识，包括现阶段比较新的技术和应用；选编了大量与计算机专业基础、专业技术及专业前沿知识相关的英文资料。为了帮助读者掌握所学内容，书中给出了参考译文和一些关键术语的注释，每章都有练习题和阅读材料。

本书可作为计算机及相关专业本科生的专业英语教材，也可供计算机专业研究生自学使用，同时，还可供既想了解计算机知识，又想学习专业英语的普通读者阅读。

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前　言

计算机技术在日新月异地发展，个人、单位和家庭几乎都离不开计算机，计算机也在不断地改变着人们的生活。因此，为了更好地利用计算机、掌握计算机的应用，必须能够阅读和翻译与计算机有关的英文资料和技术文献以及国外的一些最新的计算机研究成果，以便能更快、更好地了解计算机方面的最新知识。

本书参考了大量国内外计算机英文资料和计算机专业英语书籍，结合作者近些年来讲授计算机专业英语课程的经验，按读者的实际需求编写了此书。全书系统地介绍了计算机硬件、软件等基础知识，包括现阶段比较新的技术和应用；选编了大量与计算机专业基础、专业技术及专业前沿知识相关的英文资料。为了帮助读者掌握所学内容，书中给出了参考译文和一些关键术语的注释，每章都有练习题和阅读材料。

本书可作为计算机及相关专业本科生的专业英语教材，也可供计算机专业研究生自学使用，同时，还可供既想了解计算机知识，又想学习专业英语的普通读者阅读。书中每章后附有相关习题，可以帮助读者更好地掌握相关章节的内容，并在每章后增加了最新的英文阅读资料，使读者可以学习更多的计算机专业知识。

全书共分 16 章，分别从计算机的硬件、软件以及应用等不同方面进行介绍，并且针对计算机专业本科生的课程讲解。

本书主要由方娟编写并进行修改和核对，第 2、4 章由魏坚华进行终稿校对。

由于作者水平有限，书中难免会有不当之处，敬请广大读者批评指正。

编　者

2014 年 1 月于北京

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CHAPTER 1 FUNDAMENTALS OF COMPUTERS (计算机基础)

1.1 WHAT IS A COMPUTER(什么是计算机)

A computer is a tool for manipulating and storing information. Generally speaking, a computer is an electronic device that can accept input, process it according to a set of instructions, store the instructions and the results of processing, and produce results as its output.

There are many different kinds of computers, ranging in size from hand-held[1] calculators to large and complex computing systems filling several rooms or entire buildings. In the past, only a relatively small percentage of people had hands-on contact with computers. Today, computers leave virtually no aspect of life or work untouched. With a computer, you have the potential to organize your work and life in ways that are not only better for you as a person, but are dramatically more effective and efficient.

The numbers, letters, and images input to a computer are called data. The instructions that carry out the processing are called computer programs or software. The output, intended for use and interpretation by people, is called information.

Inside the computer, there is a complicated network of electronic circuits that control switches or levels. They both have two possible states: for the switches are on or off and the levels are high or low. That is the reason why binary is widely used to represent information in computer.

The reason why computers can work at rather high speed is very simple: it is an electronic machine[2]. For example, as soon as you turn on the switch, the light gets light at the same time. How fast the speed of the current is! Computers do all they can do instantaneously.

There are times when a computer seems to operate like a mechanical "brain", but its achievements are limited by minds of human beings. It is a useful tool for people.

NOTES

[1] hand-held 可译为"手持的"。

[2] it 此处指前面的 a computer。

KEYWORDS

manipulate	处理	information	信息	instruction	指令
calculator	计算器	image	图像	switch	开关

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第 1 章　计算机基础

1.1　什么是计算机

计算机是一种处理和存储信息的工具。那么，计算机是什么呢？一般而言，计算机是一种电子设备，它能接收输入信息，根据一系列指令处理输入信息、存储指令和处理的结果，生成结果作为输出。

计算机根据其体积的大小，可以分成许多种类，有很小的手持计算器，也有大至需要占用数间房屋，甚至整个建筑物的大型的复杂计算机系统。在过去，只有相当少的人能够接触到计算机；而现在，计算机已经触及到了生活和工作的每一个角落。如果拥有一台计算机，你就有可能以一种不仅是更好的，而且是具有惊人效率的方式去生活和工作。

输入到计算机的数字、字母和图像都被称为数据，执行处理过程的指令叫做程序或软件，人们打算使用或解释的输出被称为信息。

计算机内部具有复杂的电路网络，它可以控制开关或电平，这两者都有两种状态：开关的开或关，电平的高或低，这就是在计算机中广泛使用二进制来表示信息的原因。

计算机能高速工作的原因很简单，因为它是一台电子装置。以开电灯为例，当你合上开关，几乎同时电灯就亮了。电流速度太快了！计算机在瞬间就可以完成它们所能做的事情。

虽然，计算机有时像机械脑一样工作，但它的能力总是受制于人类的心智，计算机只是一个人类的有用工具。

1.2　THE HISTORY OF COMPUTERS(计算机的历史)

Computers have been in use for a relatively short period of time. The first commercial computer became available in the early 1950s. Since then, computers have gone through a rapid evolution. But before the time, computers and computing devices developed slowly.

It is hard to say exactly when the modern computer was invented. Starting in the 1930s and through the 1940s, a number of machines were developed which similar to a computer. But most of these machines did not have all the characteristics that we associate with computers today. These characteristics are that the machine is electronic, that it has a stored program, and that it is general purpose.

One of the first computer-like device was developed in Germany by Konard Zuse in 1941. Called the Z3, it was a general-purpose, stored-program machine with many electronic parts, but it had a mechanical memory. Howard Aiken developed another electromechanical computing machine with financial assistance from IBM, at Harvard University in 1943. It was called the Automatic Sequence Control Calculator Mark I, or simply the Harvard Mark I. Neither of these machines was a true computer, however,

because they were not entirely electronic.

The first general-purpose electronic computer operated successfully was the Electronic Numerical Integrator and Computer (ENIAC). John Mauchly and J. Presper Eckert of the Moore School of Engineering, University of Pennsylvania, proposed its construction in 1942. Work started on its development in June 1943 and the computer was completed by late 1945. It occupied 1500 ft^2 ($140m^2$) of floor space, weighted over 30 tons, consisted of approximately 18 000 vacuum tubes, 70 000 resistors, 10 000 capacitors and 6000 switches and consumed 150kW of power. It was used to generate ballistic tables and weather forecasts. In principle it was programmable but in fact this could only be done with considerable difficulty by rewiring parts of the machine.

With the development of the ENIAC, the computer became a useful scientific and business tool. The ENIAC could operate without human intervention, depending only upon stored instructions. This development marked the beginning of the modern computer era. Since then, many refinements in computer's speed, size, and cost have been made. Much advancement in computer technology is divided into five time periods called generation.

1. The First Generation of Computers (1946—1958)

The first generation of computers lasted from 1946 to 1958. They were large, costly to buy, expensive to power, and often unreliable. The most prominent feature of the ENIAC——vacuum tubes characterized it. In 1950, several other notable computers were built, each contributing significant advancements, such as binary arithmetic, random access, and the concept of stored programs. These computer concepts are common in today's computers.

It was during this period that symbolic languages were developed. Symbolic languages use symbols made up of letters and numbers to stand for 0s and 1s of machine language.

2. The Second Generation of Computers (1959—1964)

In the second generation of computers, transistors replaced vacuum tubes. Although invented in 1948[1], the first all-transistor computer did not become available until 1959. Transistors are smaller and less expensive than vacuum tubes, and they operate faster and produce less heat. Hence, with the development of second-generation computers, the size and cost of computers decreased, the speed increased, and their air-conditioning needs was reduced.

And, the second generation of computers was given auxiliary storage, sometimes called external of secondary storage. Data were stored outside computer on either magnetic tape or magnetic disks. The use of auxiliary storage ended the limitation on how much data the computer could store and reduced the use of punched cards. Using magnetic tapes for input and output operations increased the speed of computer.

In addition, improvements were made in the symbolic programming languages. Many

new programming languages were designed, including COBOL in 1960. More and more businesses and organizations were beginning to use computers for their data processing needs. New languages were more like English than the earlier ones, making programming the computer much easier.

The expense item should be emphasized. The cost of a computer during the first, second, and part of the third generations represented a significant portion of a company's budget. Computers were expensive. Cost per instruction executes can be used to compare the cost of computers over the last three decades. Significant innovations, spurred by intense competition, have resulted in enormous increases in computer performance and substantial reductions in price. This trend, established with the introduction of second-generation computers, continues today.

3. The Third Generation of Computers (1965—1970)

The third generation of computers lasted from 1965 to 1970. During the time, technology continued to improve and computers became even smaller, while their memory capacities became larger[2].

The technical development that marks the third generation of computers is the use of integrated circuits or ICs in computers[3]. An integrated circuit is a piece of a silicon (a chip) containing numerous transistors. One IC replaces many transistors in a computer, resulting in a continuation of the trends begun in the second generation. These trends include reduced size, reduced cost, increased speed, and reduced need for air conditioning.

The third computer generation was also the time when minicomputers became widespread. The most popular model was the PDP-8, manufactured by DEC. Other companies, including Hewlett-Packard Company, introduced minicomputers during the third generation. These machines had many of the same capabilities as large computers, but they were much smaller, had less storage space, and cost less. Another development was the use of remote terminals, input/output devices that are electronically linked to main computer but located at some distance from it. A popular innovation was the introduction of families of computers that could support as many as forty different external devices, such as printer and remote terminals. Each computer in the family contained a different main storage capacity. A company could easily move up a machine with more storage while continuing to use the same external devices.

The principal software development during the third computer generation was the increased sophistication of operating systems. Although simple operating systems were developed for first-and second-generation computers, many of the features of modern operating system first appeared during the third generation. These include multiprogramming, virtual memory, and time-sharing. The first operating systems were mainly batch systems, but during the third generation, interactive systems, especially on minicomputers, became common. The BASIC programming language was designed in 1964 and became popular during the third computer generation because of its interactive nature.

Third-generation computers work so quickly that they provide the capability to run more than one program concurrently (multiprogramming). For example, at any given time the computer might be printing payroll checks, accepting orders, and testing programs.

4. The Fourth Generation of Computers (1971—1990)

The fourth generation of computers is more difficult to define than the other three generations. Most people think that this period is given as 1971 to 1990 or to present.

A silicon chip contained more and more transistors, which characterizes this generation. Large-scale Integration (LSI) circuit, featuring thousands of electronic components on a single silicon chip became common during the 1970s. One of the most significant contributions to the emergence of the fourth generation of computers is the microprocessor. The microprocessor, which can be contained on a single silicon chip[4], is a product of the micro-miniaturization of electronic circuitry. The first fully operational microprocessor, sometimes called a "computer on a chip", was invented in 1971. Today, there are more microprocessors on Earth than there are people. This device costs less than a soft drink and can be found in everything from elevators to satellites.

The combination of the microprocessor and other densely packed chips used for storage and input/output operations forms a microcomputer. Modern microcomputers have more power than the large computers of earlier generations. LSI has already progressed into VLSI (Very Large Scale Integration), which means even more capabilities in even smaller packages.

Software development during the fourth computer generation started off with little change from the third generation. Operating systems were gradually improved, and new languages were designed. Database software became widely used during this time. The most important trend, however, resulted from the microcomputer revolution, is that packaged software became widely available for microcomputers. Thus, most software is purchased, not developed from scratch.

5. The Fifth Generation of Computers

What will be the fifth generation of computers? The answer to this question is difficult to say. New technology could be invented that changes the way computers work. There already is an effort to increase computer speed by using substances other than silicon in chips. Certainly there will be increased numbers of transistors on a chip in the future. Computers that use light for data storage and processing are also being developed.

Some people think fifth-generation computers will be intelligent computers capable of reasoning similar to that of a person. Such a computer would have to be very powerful and would require sophisticated software. Researchers in the United States, Japan, and elsewhere are already designing fifth-generation computers along these lines. It may be many years before we know whether they are successful. We may have to wait a long time for the fifth computer generation.

NOTES

[1] although 后省略了 transistors。

[2] while 在此处起到转折的作用。

[3] that 引导的定语从句修饰 technical development。

[4] which 引导的是非限制性定语从句，修饰主语 the microprocessor。

KEYWORDS

general-purpose	通用	memory	内存
transistor	晶体管	vacuum tube	真空管
auxiliary storage	辅助存储器	budget	预算
silicon	硅	operating system	操作系统
processor	处理器	virtual memory	虚拟内存
batch system	批处理系统	keyboard	键盘
large-scale integration circuit	大规模集成电路	microprocessor	微处理器

1.2 计算机的历史

人类使用计算机只有很短的一段时间。第一台商用计算机始于 20 世纪 50 年代初，从那时起，计算机开始了飞速发展。但在这之前，计算机和计算工具却发展得很慢。

很难确切地定义现代计算机是什么时间发明的，从 20 世纪 30 年代到 40 年代，人们就开发了很多类似于计算机的机器，但大多数机器根本没有现代计算机的特征。现代计算机的特征应该为电子设备，能够存储程序而且是通用的。

Konard Zuse 于 1941 年在德国开发了一台类似于计算机的设备，被称为 Z3。它是通用型的、使用许多电子部件存储程序的机器，但它的记忆部件是机械的，另外一台电子机械计算机由 Howard Aiken 在夏威夷大学于 1943 年设计完成，并得到了 IBM 的资助。它被称为“自动序列控制计算器 I”或简称“夏威夷 I”。这些机器都不是真正意义上的计算机，因为它们都不完全是电子的。

第一台成功运行的通用电子计算机是电子数值积分计算机(ENIAC)。它的结构是宾夕法尼亚大学莫尔工程学院的约翰·莫奇莱(John Mauchly)与埃克特(J. Presper Eckert)于 1942 年提出的。该机器于 1943 年 6 月开始研制，1945 年底完成。它占地 1500 平方英尺($140m^2$)，重量超过 30 吨。它由大约 18 000 只真空管，70 000 只电阻，10 000 只电容及 6000 只开关组成，耗电 150kW。它被用于编制弹道表和天气预报。从原理上说，它是可编程的，但是，要做到这一点相当困难，因为要对机器的部件重新连线。

由于 ENIAC 的研制成功，计算机成为有用的科学和商业工具。ENIAC 能够不需要人的干预而只依靠存储的指令进行操作。这标志着现代化计算机时代的开始。从那以后，计算机在速度、大小、价格等方面有了许多改进，被分为 4 个阶段，也就是 4“代”。

1. 第一代计算机(1946—1958 年)

第一代计算机从 1946 年持续至 1958 年。它们体积大，价格昂贵，功耗大通常还不可靠。ENIAC 最显著的特征——真空管——第一代计算机的显著标志，到 1950 年又制造出

了另外几台著名的计算机，而且每一台都取得了很大的进展，形成了诸如二进制运算、随机存取和存储程序的概念，这些概念仍普遍应用于当今的计算机中。

正是在这个时期，符号语言得到了开发。符号语言是用字母和数字组成的符号代表机器语言的 0 和 1。

2. 第二代计算机（1959—1964 年）

在第二代计算机中，晶体管代替了真空管。尽管晶体管是 1948 年发明的，但第一台全晶体管计算机直到 1959 年才出现。晶体管比真空管体积小、价格便宜，工作更快、产生的热量更少。因此，第二代计算机的体积缩小、成本降低了，但它们的速度却加快了，并且对空调环境的要求也降低了。

而且，第二代计算机有了辅助存储器，有时也称为外存或二级存储器。数据被存储在计算机外部的磁带或磁盘上。辅助存储器的使用结束了计算机主存容量对程序和数据的使用规模的限制，减少了穿孔纸带的使用，采用磁带来进行输入和输出，提高了计算机的速度。

此外，在符号程序设计语言上得到了改进，开发了许多新的程序设计语言，包括 1960 年出现的 COBOL 语言。越来越多的公司和组织开始使用计算机进行数据处理。新的语言比以前更加接近英语，从而使设计计算机程序变得更加容易了。

在这里应该强调一下费用问题。在第一代、第二代和第三代的部分时间内，计算机的价格占公司预算的很大一部分。计算机以前是很昂贵的，在过去 30 年中曾以执行每条指令的费用来衡量计算机的价格。由激烈的竞争所带来的一系列重大革新成果导致了计算机性能的猛增和价格的降低，这一趋势是由第二代计算机的出现而形成的，并且时至今日仍沿着这种趋势在发展。

3. 第三代计算机（1965—1970 年）

第三代计算机从 1965 年持续至 1970 年。在此期间，技术继续得到了提高，同时计算机的体积变得更小，而其存储能力却更大了。

集成电路即 IC 的使用标志着第三代计算机的技术发展。集成电路就是一个包含数以万计晶体管的硅片（芯片），在计算机中，一块 IC 替代了许多晶体管，导致了一种在第二代计算机中开始的趋势的延续。这些趋势包括减小尺寸、降低成本、加快速度和减少空调的需要。

第三代计算机也是小型计算机开始普及的时代，最流行的型号是由 DEC 公司生产的 PDP-8。包括惠普公司在内的其他公司在第三代介入了小型计算机领域。这些机器有许多与大型计算机相同的能力，虽然存储空间较小，但体积更小，且价格更便宜。另一个发展是使用远程终端，即是一个远离主机但通过电子线路与主机联系在一起的输入输出设备。一个很受欢迎的改进是产生了能够支持多达 40 多个不同外部设备（例如，打印机和远程终端）的计算机系列。系列中的每一种计算机都有不同的主存容量。计算机公司能够在使用原有的外部设备的情况下，通过增加存储容量很容易地将计算机升级。

在第三代计算机中，主要的软件开发是完善了操作系统。尽管人们为第一代、第二代计算机开发了简单的操作系统，但是直到第三代计算机，具有现代操作系统特征的系统才开始出现。这些特征包括多道程序设计、虚拟内存和分时操作。第一个操作系统主要是批处理系统，但是在第三代计算机中，尤其是在小型计算机上的交互式系统变得很普遍。在 1964 年出现了 BASIC 程序设计语言，因为其交互式的特征而在第三代计算机中广泛使用。

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