高等学校计算机应用规划教材

计 算 机 英 语

学生用书(第三版)

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内 容 简 介

直接阅读外文技术资料和文献是每个计算机技术人员和研究人员必须具备的一种能力。本书旨在使学生及专业人员能够熟悉并掌握计算机方面的基本专业英文词汇，熟悉科技英语的基本规律，并提高在计算机专业英文文献方面的阅读能力。

本书共20章，汇集了计算机技术各方面的内容，包括计算机硬件、软件、网络与通信、计算机应用等。本书的特点是内容和专业词汇的涵盖面广，选择的文章具有代表性和新颖性，尤其是阅读材料包括了最近10年中产生的一些新技术的介绍，从而使教师在选择教学内容方面有较大的灵活性。

本书适合于计算机科学与技术专业、软件工程专业、信息管理与信息系统专业、电子商务专业以及其他相关专业的本科生、研究生作为计算机专业英语课程的教材，对于从事计算机方面各种工作的专业技术人员提高计算机专业外文文献的阅读能力也有一定的帮助。

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第三版前言

本教材第二版发行后，依然深受广大计算机专业英语老师和学生的欢迎。在吸取各方面意见的基础上，本书第三版在第二版的基础上，将学生用书中每一章的 Grammatical Notes to the Text 和阅读材料放入了教师用书中，压缩了学生用书的篇幅。

本书的内容分为 5 篇。第 1 篇——计算机硬件基础，包括第 1 章——计算机系统概述，第 2 章——计算机系统的组成，第 3 章——计算机体系结构。第 2 篇——计算机软件基础，包括第 4 章——算法与数据结构，第 5 章——程序设计与语言，第 6 章——操作系统。第 3 篇——计算机软件，包括第 7 章——应用软件，第 8 章——数据库系统概论，第 9 章——软件工程，第 10 章——面向对象技术。第 4 篇——计算机网络与通信，包括第 11 章——计算机网络概述，第 12 章——局域网、城域网和广域网，第 13 章——Internet，第 14 章——信息安全。第 5 篇——计算机应用技术，包括第 15 章——信息系统，第 16 章——人工智能与专家系统，第 17 章——企业资源规划，第 18 章——供应链管理，第 19 章——客户关系管理，第 20 章——电子商务。

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为便于教学，本教材提供了配套的教师用书和 PPT 教学课件，教师用书可随主教材一起订购，也可免费获赠，具体信息请见书后的“《教师用书》需求信息反馈卡”。PPT 教学课件可通过 http://www.tupwk.com.cn/downpage 下载。本书课文中右上角带有注解序号的句子的语法解释，请参见教师用书。

本书由姜同强主编，苗天顺任副主编。姜同强、苗天顺负责全书的统稿。参加编写的人员包括(按章节顺序排列)：王雯编写第 1 章～第 6 章，姜同强编写第 7 章～第 10 章及各章专业术语的解释，孔凡航、周亦鹏编写第 11 章～第 15 章，赵守香编写第 16 章～第 20 章。另外，姜同强负责各章中 Technical Notes to the Text 和 Technical Terms and Proper Names 的编写；苗天顺负责编写各章语法注释和部分课后练习，盖爽编写了部分阅读材料，曹倩负责在第二版的基础上整理和调整第三版的内容。

在本书的编写和出版过程中，清华大学出版社的同志为使本书尽快出版付出了辛勤劳动，在此表示感谢。另外，还要感谢我们编写团队中的每一位成员，这些成员具有不同的专业背景，没有他们高效率的通力合作，就不可能在短时间内完成这样一本工作量巨大的教材编写。

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编　者

2012 年 11 月于北京

第二版前言

本教材第一版发行后，深受广大计算机专业英语老师和学生的欢迎，好评如潮。甚至参加全国计算机技术与软件专业技术资格(水平)考试的考生都将本教材视为应试必读教材之一。短短4年时间已经多次印刷，印刷量突破几万册。有的老师在来信中说："我们在教学过程中多次使用清华大学出版社出版的《计算机英语》，效果很好。该书内容非常丰富，为教师的教学提供了极大的灵活性；该书提供配套的教师用书，为教师的备课提供了极大的方便。大多数此类教材中都包含课文的中文翻译，这样做既不利于提高学生学习计算机英语的效果，也不利于教师的备课，而且使课文的信息量大大降低，而本书在编排上将课文与翻译分离开来，彻底解决了上述问题，学生的学习效果和教学效果得到了极大的提高。"

另外，学生们反映，该教材中专业术语的解释部分很受欢迎，在某种程度上起到了专业词典的作用，用起来很方便，而且专业术语的解释很详细，既提高了计算机英语的阅读能力，又学到了很多新的知识，可谓一石二鸟。

在吸取各方面意见的基础上，本书第二版针对第一版的内容做了以下几个方面的调整。

(1) 将每一章的课文进一步精练，并适当调整内容，压缩了篇幅。调整比较大的内容包括：

- 删除。将第一版教材中的第8章(Files and File Processing)、第15章(Multimedia Technology)、第19章(Digital Image Processing)和第24章(CAD/CAM and CIMS)删除。
- 合并。将第一版教材中的第12章(Introduction to Computer Network)和第13章(OSI and TCP/IP Reference Model)合并为一章，第14章(Local Area Networks & Metropolitan Area Networks)和第15章(Wide Area Networks)合并为一章。
- 分解。将第一版教材中的第22章(Enterprise Resource Planning)分解为3章，分别是 Enterprise Resource Planning，Supply Chain Management 和 Customer Relationship Management。

(2) 每一章课文前增加了"Pre-reading Questions"内容以方便学生预习。课文后增加了以下几部分内容：Grammatical Notes to the Text，Words Bank to the Text(包括3部分内容，其中新增了 Useful New Words 和 Useful Phrases and Expressions 两部分内容)。

(3) 进一步丰富和规范了课后练习。

(4) 精练了课后的阅读材料，并进行了适当的调整和压缩。

(5) 为讲授此课的教师制作了配套的电子课件。

本教材与同类教材相比，有如下几个方面的区别。

- 编写教材的教师队伍是由以下三个方面的人员构成的：计算机相关专业的教师、从事多年计算机专业英语教学的一线教师、从事多年普通英语教学的一线教师。
- 从教材的结构和内容编排来看，有其独到之处：既有专业词汇的正规解释，又包括了一些常见的语法现象的解释。从事本课程教学的教师无论是从事计算机专业的还是英语专业的，本书都为他们提供了极大的方便。
- 国内的大多数教材在内容选取上都有所侧重：有的计算机英语教材偏重于硬件，有的偏重于软件，还有的教材是信息电子类的计算机英语，侧重于通信电子方面。另外，有的教材侧重于理论，例如数据结构、离散数学；而有的则侧重于应用，例如软件工程、数据库开发。本教材的编写改变了这种状况，在理论和应用上，在硬件、软件、网络、应用等方面均有所体现。

本教材的特色包括如下几个方面。

- 内容丰富，灵活性强。本书的内容非常丰富，涵盖了计算机科学技术专业及其相关专业的一些主要课程内容，包括计算机硬件、软件、网络与通信、计算机应用等，为不同专业教师的教学提供了可选性和极大的灵活性。
- 实用性和专业性相结合。本书的选材在保持原汁原味的同时使学习者更能接触到计算机英语的真实语境和主流思想，虽然有一定的难度，但非常实用和专业。另外，选材与我国大学本科专业教学计划中的专业课程有很好的对应关系。
- 重视教师的教学效果和学生的学习效果。大多数此类教材中都包含课文的中文翻译，这样做既不利于提高学生的学习效果，也不利于教师的备课，而且使课文的信息量大大降低。而本书在编排上将课文与翻译分离开来，彻底解决了上述问题，学生的学习效果和教师的教学效果得到了极大的提高。
- 附赠教师用书：凡选用本书作为教材的教师，均可免费获赠《计算机英语 • 教师用书(第二版)》。具体方法请参见书后的“《教师用书》需求信息反馈卡”。

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由于作者水平有限，加之时间仓促，本书中出现的错误在所难免，欢迎广大读者批评指正。

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2008 年 9 月于北京

第一版前言

随着时代的发展，计算机与网络技术已渗透到人们工作和生活的各个方面。计算机英语也随之独立成为一门专业英语，并在计算机应用中作为人机之间交流的媒介。

一个计算机方面的人才除了要掌握计算机理论和技能以外，更重要的是具备快速获取新的计算机方面知识的能力。而计算机英语(尤其是阅读能力)则是体现这种能力的一个重要方面。本书正是在这样的指导思想下编写的。

1. 编写目的

- 使学生熟悉并掌握计算机方面的基本专业英文词汇。
- 提高学生的计算机专业英文文献的阅读能力。

2. 本书特点

- 系统性：本书涵盖了计算机技术各方面的内容，包括计算机硬件、软件、网络与通信、计算机应用等。
- 新颖性：本书反映了20世纪90年代到21世纪初的最新技术。
- 代表性：本书选择的文章在内容上具有一定的代表性，基本体现了计算机硬件、计算机软件、网络与通信和计算机应用方面的典型技术。
- 广泛性：本书专业词汇的涵盖面广。
- 附赠配套教材：凡选用本书作为教材的教师，均可免费获赠《计算机英语(教师用书)》。具体方法请见书后的“《教师用书》需求信息反馈卡”。

3. 本书的结构及内容

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每章除了正文外，还列举出本章的专业词汇对照表、重点词汇的详细说明，正文后

还附有练习题，可作为对学生学习情况的检测。每章最后的阅读材料是对正文内容的补充，反映了最新的技术，可作为学生课后阅读的内容，加深对正文内容的理解。

4. 读者对象

本书主要读者对象是计算机专业及相关专业的高职、高专、本科学生和从事计算机相关工作的专业人员。

本书由姜同强主编。参加编写的人员包括(按章节顺序排列)：王雯、罗代洪编写第 1 章、第 2 章、第 3 章、第 4 章、第 5 章和第 6 章，姜同强、杨冰编写第 7 章、第 8 章、第 9 章、第 10 章和第 11 章，孔凡航、吕燕编写第 12 章、第 13 章、第 14 章、第 15 章、第 16 章、第 17 章和第 18 章，赵守香编写第 19 章、第 20 章、第 21 章、第 22 章、第 23 章和第 24 章。王振玲对全书内容进行了审校。

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编　者

2004 年 6 月

目　　录

Chapter 1
Computer System Overview

Pre-reading Questions

1. What is a digital computer?

2. Are there any differences between the binary number system and the common decimal number system?

3. How many types of computers do you know? Name at least four of them.

Digital computer is also called electronic computer or computer. Computers surround us. It's hard to find a field in which computers are not being used.[1] In this chapter, we will introduce digital computer, data types, the evolution of computers, and types of computers.

1.1 Digital Computer

The digital computer is a digital system that performs various computational tasks. The word "digital" implies that the information in the computer is represented by variables that take a limited number of discrete values.[2] These values are processed internally by components that can maintain a limited number of discrete states. The decimal digits 0,1,2,⋯ 9, for example, provide 10 discrete values. The first electronic digital computers, developed in the late 1940s, were used primarily for numerical computations. In this case, the discrete elements are the digits. From this application the term digital computer has emerged.[3] In practice, digital computer functions more reliably if only two states are used. Because of the physical restriction of components, and because human logic tends to be binary, digital components that are constrained to take discrete values are further constrained to take only two values and are said to be binary.

Digital computers use the binary number system, which has two digits: 0 and 1.[4] A binary digit is called bit. Information is represented in digital computer in groups of bits. By using various coding techniques, groups of bits can be made to represent not only binary numbers but also other discrete symbols, such as decimal digits or letters of the alphabet.[5] For example, ASCII (American Standard Code for Information Interchange) originally used 7 bits to form a character. By judicious use of binary arrangements and by using various coding techniques, the groups of bits are used to develop complete sets of instructions for performing various types of computations. In contrast to the common decimal numbers that employ the base 10 system, binary numbers use a base 2 system with two digits：0 and 1.The decimal equivalent of a binary number can be found by expanding it into a power series with a base of 2.

A computer system consists of hardware system and software system. The hardware system is the physical equipment that you can see and touch, such as the disks and the screen. The software system is the intangible “control” that governs the computer; it is the total of all the programs that can be run on the computer. A program is a list of instructions. Programs tell the hardware what to do. The hardware of the computer is usually divided into three major parts: input and output devices (I/O devices), a central processing unit (CPU), and memory. They are described in more detail in Chapter 2. Software can be classified according to its purpose. Application software is designed to accomplish real-world tasks in fields such as accounting, entertainment, and engineering. If you’ve ever played a video game or typed a paper on a word processor, you’ve already had some experience with application software programs. System software, on the other hand, controls the computer system itself. System software includes not only the complex programs used by technicians to create application software in the first place but also the organizational programs needed to start up the computer and govern its use of other programs.[6] They are described in more detail in Chapter 2 and Chapter 6.

1.2 Data Types

Binary information in digital computers is stored in memory or processor registers. Registers contain either data or control information. Control information is a bit or a group of bits used to specify the sequence of command signals needed for manipulation of the data in other registers.[7] Data are numbers and other binary-code information that are operated on to achieve required computational results. Now we present the most common types of data found in digital computers and show how the various data types are represented in binary-code form in computer registers.

The data types found in the registers of digital computers may be classified as being one of the following categories:

- Numeric data can often be represented as integers. In unsigned integers, an n-bit value can range from 0 to 2n－1. An n-bit signed integer can have any value between－2n－1and 2n－1－l, inclusive. Both formats can be used in arithmetic algorithms. Some numeric data cannot be represented as integers. These values, which typically include fractional portions, are represented in floating point format in computers. A computer may have special registers and instructions exclusively for floating point data.
- The Boolean values TRUE and FALSE are used often enough to warrant having their own data type, Boolean, and assembly language instructions.[8] Typically, a data

value is set to zero to represent FALSE and any nonzero value for TRUE. Boolean assembly language instructions can perform logical operations on these values. Unlike logical instructions, which generate one result per bit of the operands, Boolean instructions generate only one result. To illustrate the difference, consider the case in which A=0000 0010 and B=0000 0001. The logical AND of these binary values produces the result 0000 0000. However, if they are Boolean values, A and B are both TRUE, since they are both nonzero. Their Boolean AND must produce a result of TRUE, represented by a nonzero value.

- Computers must also deal with character data. The characters are stored as binary values encoded using ASCII, EBCDIC, UNICODE, or some other character encoding standards. Rather than arithmetically or logically manipulating characters, a computer may concatenate strings of characters, replace some characters with others, or otherwise manipulate character strings.[9] Some assembly language instruction sets include instructions to directly manipulate character data. Others use routines constructed from other instructions to achieve the same result.

1.3　The Evolution of Computer

The first large-scale electronic computer was the Electronic Numerical Integrator and Computer (ENIAC), which became operational in 1946. From that start, computer has developed through four so-called generations, or stages, each one characterized by smaller size, and less expense than its predecessor.[10]

1. First Generation (1944—1958)

In the earliest general-purpose computer, most input and output media were punched cards and magnetic tape. Main memory was almost exclusively made up of hundreds of vacuum tubes—— although one computer used a magnetic drum for main memory. These computers were somewhat unreliable because the vacuum tubes failed frequently. They were also slower than any microcomputer used today, produced a tremendous amount of heat, and were very large. They could run only one program at a time.

2. Second Generation (1959—1963)

By the early 1960s, transistors and some other solid-state devices that were much smaller than vacuum tubes were being used for much of the computer. Magnetic cores, which looked like very small metal washers strung together by wires that carried electricity, became the most widely used type of main memory. Removable magnetic disk packs, stacks of disks connected by a common spindle, were introduced as storage devices. Second-generation machines tended to be smaller, more reliable, and significantly faster than first-generation computers.

3. Third Generation (1964—1970)

In the third period, the integrated circuit (IC)—— a complete electronic circuit that packages transistors and other electronic components on a small silicon chip—— replaced traditional transistorized circuitry. Integrated circuits are cost-effective because individual components don't need to be wired directly to the computer's system board.

The use of magnetic disks for secondary data storage became widespread, and computers began to support such capabilities as multiprogramming (processing several programs simultaneously) and timesharing (people using the same computer simultaneously). Minicomputers were being widely used by the early l970s and were taking some of the business away from the established mainframe market. Processing that formerly required the processing power of a mainframe could now be done on a minicomputer.

4. Fourth Generation (1971—Now)

Large-scale integrated(LSI) and very-large-scale integrated(VLSI) circuits were developed that contained hundreds to millions of transistors on a tiny chip.[11] In 1971, Ted Hoff of Intel developed the microprocessor, which packaged an entire CPU, complete with memory, logic, and control circuits, on a single chip. The microprocessor and VLSI circuit technology caused radical changes in computers—— in their size, appearance, cost, availability and capability, and they started the process of miniaturization—— the development of smaller and smaller computers.

Also during this time, computer's main memory capacity increased, and its cost decreased, which directly affected the types and usefulness of software that could be used.[12] Software applications like word processing, electronic spreadsheets, database management programs, painting and drawing programs, desktop publishing, and so forth became commercially available, giving more people reasons to use a computer.[13]

1.4 Types of Computers

Computers are usually classified into four broad categories: microcomputers, minicomputers, mainframe computers and supercomputers. It's hard to give a precise definition to each type because computer speeds and storage capacities change rapidly. Nevertheless, the following definitions will suffice.

1. Microcomputers

Microcomputers, also called personal computers (PC), are small computers that can fit next to a desk or on a desktop, or can be carried around. Microcomputers are either used as stand-alone computer or connected to a network, such as a local area network. A local area network (LAN) connects, usually by special cable, a group of desktop personal computers and peripheral devices in an office or a building.

2. Minicomputers

Minicomputers are designed to support many time-sharing terminals at once. Minicomputers operate faster and are more expensive than microcomputers. Often, a minicomputer satisfies the general-purpose computing needs of a department or small business. Other minicomputers are dedicated to specific applications. For example, a minicomputer may be used to control an assembly line in a factory, recode data in a research laboratory, or help programmers develop programs for other computers.

3. Mainframe computers

Mainframe computers are larger, faster, and more expensive than minicomputers. Mainframe computers also have many processors. They are found in banks, insurance companies, airlines, large corporations, and government organizations. Mainframes often serve hundreds of time-sharing users at once. Mainframes are ideal for problems requiring extensive mathematical calculations or for sharing large volumes of information among many people.

4. Supercomputers

First developed in the 1970s, supercomputers are the fastest and highest-capacity computers. Their cost ranges from several hundreds of thousands to millions of dollars. They may occupy special air-conditioned rooms and are often used for research. Among their uses are worldwide weather forecasting and analysis of weather phenomena, oil exploration, aircraft design, evaluation of aging nuclear weapons systems, and mathematical research.[14] Unlike microcomputers, which generally have only one central processing unit, supercomputers have hundreds to thousands of processors and can perform trillions of calculations per second.

Technical Notes to the Text

1. digital computer，数字计算机。能执行数学计算和逻辑运算，其值通常用二进制数字来表示的一种计算机。

2. binary，二进制。以 2 为基数的一种计数系统。常见的用法有：binary system，二进制数字系统；binary code，二进制码。

3. bit，(二进制)位，比特。代表在二进制计数系统中，数字 0 和 1 中的任何一个。同 binary digit。存储设备中的最小信息容量单位。binary digit 的缩写。例如，bits per second，缩写为 bps，指每秒钟传输的位数。

4. ASCII，美国国家信息交换标准码，是 American National Standard Code for

Information Interchange 的缩写。一种在不同厂家生产的设备之间为信息交换而定义编码的标准。这种编码使用由 7 位编码字符组成的编码字符集，用于数据处理系统、数据通信系统和有关设备之间的信息交换。ASCII 字符集由 128 个代码组成，其中 96 个是大小写字母、数字和符号，32 个为控制符。

5. coding，编码(方法，技术)；程序。coding techniques，编码技术；binary coding，二进制编码。

6. input and output devices (I/O devices)，输入输出设备。输入设备是可将用户所输入的程序、数据、操作命令等信息变换成计算机能接受的二进制形式的信息，并输入到内存中，以便计算机进行处理的设备。例如键盘、鼠标。输出设备是可将计算机的处理结果转换成人或其他设备可识别和接受的形式，并将其表现出来的设备。例如显示器、打印机等。

7. central processing unit (CPU)，中央处理器。它是由控制单元(CU)、算术／逻辑运算单元(ALU)和存储单元(包括寄存器和高速缓存)三个部分组成的。三部分通过互连机构的连接，互相配合，共同完成对指令信息和数据信息的分析、判断、运算，从而控制计算机各部件协调工作。

8. register，寄存器。一种存储装置，具有规定的存储容量，例如一个位、一个字节或一个计算机字，通常有特定的用途。

9. unsigned integer，无符号整数。常见的表达方式有：signed integer，带符号整数；signless integer，无符号整数，正整数。

10. data types，数据类型。可由程序设计语言直接说明的数据的结构特性、特点和特征。例如，FORTRAN 语言中的整数和实数。

11. floating point，浮点(数)，可缩写成 FLP 或 FP。一种表示数的形式，数目可表示为一个数乘以基数的幂次，例如，十进制数 397 可写成 3.97×10^2 或 0.397×10^3。

12. Boolean，布尔值，布尔。有真(用 True 表示)和假(用 False 表示)两个值。

13. assembly language，汇编语言。一种接近于二进制机器指令的程序语言。

14. operand，操作数，运算数，运算对象；运算域。

15. EBCDIC，扩充二—十进制交换码。是 Extended Binary Coded Decimal Interchange Code 的缩写。一种由 8 位编码字符组成的编码字符集。

16. UNICODE，统一的字符编码标准，采用双字节对字符进行编码。

17. routine，例行程序，例程。设计用来执行一项特定且有限的任务的一套程序指令。

18. ENIAC，电子数字积分计算机，是 Electronic Numerical Integrator and Calculator[Computer]的缩写，是世界上第一台通用计算机的名称，1946 年由美国制造。

19. punched card，穿孔卡。在字(词)处理技术中，其上用穿孔行来代表文本及程序指令的一种卡片。

20. magnetic tape，磁带。一种具有可磁化表面层的带状物，以磁记录方式存储数据。

21. vacuum tube，真空管，可缩写为 VT。一种内部空气全部或部分抽空的电子管，从而使电子在不受或少受空气分子的干扰下运动。

22. magnetic drum，磁鼓。具有磁性表面涂层的直圆柱体，数据以磁记录方式存储在它的磁性表面上。

23. main memory，主存储器，主存。计算机中最主要的存储设备。常见的类似表达方式如下：

- auxiliary memory，辅助存储器；辅助性记忆装置
- buffer memory，缓冲存储器；超高速缓冲存储器
- dynamic random access memory，(计算机的)动态随机存取存储器
- dynamic memory，动态存储器
- external memory，外存储器，外部记忆装置
- hypothetical memory，虚拟存储器

24. magnetic core，磁芯。一片通常为环状的、用作存储器的磁性材料。

25. integrated circuit，集成电路，可缩写为 IC。一种微型的材料片或材料块，上面集成了复杂的电子元件和它们的连接线路。

26. silicon chip，硅片。为大量集成电路提供半导体基片的一种硅(圆)片。

27. multiprogramming，多道程序设计(技术，方法)；多道程序，可缩写成 MP。

28. minicomputer，小型计算机。一种比微型计算机内存容量大且运行速度高的小型计算机，通常可装入一个机柜。

29. mainframe，主机，大型计算机。

- 大型计算机，大型的、强大的计算机，经常用作一些相互连接的终端服务器。
- 主机，计算机除了外部和分离的装置以外的中心运作部件。

30. microprocessor，微处理器。一个芯片上的包含有一个计算机的全部中央处理组件的集成电路。

31. personal computer，个人计算机，可缩写为 PC。供个人用的微型计算机，例如在办公室、家里或学校。

32. supercomputer，巨型计算机。一种主计算机，在一个特定时间内是最大、最快或功率最高的计算机之一。

Words Bank to the Text

A. Useful new words

surround [sə'raund]	*vt.* 包围，环境
computational [ˌkɔmpju(ː)'teiʃənəl]	*adj.* 计算上的
discrete [dis'kriːt]	*adj.* 不连续的，离散的
constrain [kən'strein]	*v.* 抑制，约束；束缚
decimal ['desiməl]	*adj.* 十进的，十进位的
judicious [dʒu(ː)'diʃəs]	*adj.* 明智的，明断的
equivalent [i'kwivələnt]	*adj.* 相等的，相当的

intangible [in'tændʒəbl]	*adj.* 难以明了的，无形的
specify ['spesifai]	*v.* 指定，载明
manipulation [məˌnipju'leiʃən]	*n.* 处理，操作
algorithm ['ælgəriðəm]	*n.* 算法
fractional ['frækʃənl]	*n.* 片断，分数
warrant ['wɔrənt]	*v.* 保证，担保
concatenate [kɔn'kætineit]	*v.* 连接，链接
spindle ['spindl]	*n.* 轴，杆，心轴
simultaneously [siməl'teiniəsly]	*adv.* 同时地
dedicated ['dedikeitid]	*adj.* 专用的
variable ['vɛəriəbl]	*n.* 变量，变数

B. Useful phrases and expressions

in this case/in that case	既然是这样/那样，假使这样/那样的话
emerge (from)	出现，出来，产生
in practice	在实践中，实际上
tend to	倾向于，很可能，常常会，往往会
not only…but also	不但……而且
such as	诸如，像……一样
in contrast to / with	与……形成对比，与……截然不同
consist of	由……构成/组成
be made up of	由……组成/构成
in detail	详细地，详尽地
according to	依据，根据，按照
in the first place	首先，第一(点)
start up	开动，启动，发动
in …form	以……的形式
range from … to …	相当于
vary from…to…	(在一定范围内)从……到……变动，从……到……变化
deal with	处理
rather than	(而)不是
replace…with/by…	以……代替
at a time	一次，每次
and so forth/and so on	等等，诸如此类
either…or	或者……或者，要么……要么
at once=at the same time	同时

C. Technical terms and proper names

digital computer	数字计算机
decimal digits	十进制数字
binary	二进制
bit	位；比特
ASCII	美国国家信息交换标准代码
computer system	计算机系统
hardware system	硬件系统
software system	软件系统
I/O devices	输入/输出设备
central processing unit (CPU)	中央处理器(CPU)
memory	存储器
application software	应用软件
video game	计算机游戏
system software	系统软件
register	寄存器
floating point data	浮点数据
Boolean	布尔值，布尔
character data	字符数据
EBCDIC	扩充的二—十进制交换码
punched cards	穿孔卡片
magnetic tape	磁带
main memory	主存
vacuum tubes	电子管，真空管
magnetic drum	磁鼓
transistors	晶体管
solid-state devices	固态器件
magnetic cores	磁芯
integrated circuit (IC)	集成电路
silicon chip	硅芯片
multiprogramming	多道程序设计
timesharing	分时，分时技术
minicomputers	小型计算机
mainframe	大型计算机
large-scale integrated (LSI)	大规模集成
very-large-scale integrated(VLSI)	超大规模集成
word processing	文字处理
electronic spreadsheets	电子表格

database management programs	数据库管理程序
desktop publishing	桌面印刷
personal computers (PC)	个人计算机
microcomputers	微型计算机，微机
storage capacities	存储容量
stand-alone computer	独立计算机
local area network(LAN)	局域网
peripheral devices	外部设备，外设
assembly line	流水线，生产线
supercomputer	巨型计算机

Exercises

Comprehension of the Text

Ⅰ. Fill in the following blanks.

1. __________is designed to accomplish real-world tasks in fields.

2. An 8-bit signed integer can have any value between_________and_________.

3. _________ controls the computer and enables it to run the hardware and applications software.

4. A computer system consists of _________ and _________.

5. List four types of computers:_________, _________, _________ and _________.

Ⅱ. Read the following statements carefully, and decide whether they are true (T) or false (F) according to the text.

1. The software system is the physical equipment that you can see and touch.

2. Typically, a data value is set to zero to represent FALSE and 1 value for TRUE.

3. In the earliest general-purpose computer, most input and output media were magnetic disks.

4. Supercomputers are largest, fastest, and most expensive computer available.

5. A computer system consists of hardware system and software system.

Ⅲ. Match each of the following terms to the appropriate definition.

(1) integrated circuit (IC)　　(2) CPU　　(3) bit　　(4) ASCII

_______ The processing unit is at the heart of a computer.

_______ A unit of information conveyed by a single binary digit.

_______ A complete electronic circuit that packages transistors and other electronic components on a small silicon chip.

_______ A system for encoding characters as binary digits.

Ⅳ. Translate the following into Chinese.

(1) coding techniques (2) application software (3) floating point data
(4) timesharing (5) storage capacities

Vocabulary

Ⅴ. Fill in the blanks with the words given below. Change the form where necessary.

specify	equivalent	warrant
emerge	magnetic	simultaneously
dedicated	decimal	discrete

1. He ______ from the accident unharmed.
2. This material is ______ to be pure silk.
3. He changed his pounds for the ______ amount of dollars.
4. The regulations ______ that you may use a dictionary in the examination.
5. ________ mathematics has become popular in recent decades because of its applications to computer science.
6. The _________ 0.61 stands for 61 hundredths.
7. The electrically charged gas particles are affected by _________ forces.
8. Bessie has _________ her life to caring for others.

Collocation

Ⅵ. Look at the following sentences taken from the text. Just think about what else you can "increase" and fill in the sentences with the right word.

Example: A special very-high-speed memory called a cache is sometimes used to **increase** the **speed** of processing by making current programs and data available to the CPU at a rapid rate.

1. The aim of this course is to increase the awa______ of self-worth of our black children.

2. The plan is to increase the effi______ of the railway services and provide more choices for passengers.

3. When we are learning a new language we have to take into account the increasing inter_____ of different cultures in society.

4. Their purposes in studying in the United States include increasing their com______ of English, to finish high school, and to understand the American way of life as much as possible.

5. This new teaching tool shows how to combine traditional classroom techniques with the use of video and this will increase the con_______ of teachers who may be unfamiliar with the medium.

6. He increased his sp______ to overtake the lorry.

Summary of the Text

Ⅶ. Choose the best one of the four answers given to fill in each blank.

This chapter introduces digital computer, data types, the evolution of computers, and types of computers. __1__ is known to all, it's hard to find a field in __2__ computers are not being used. Digital computer, also called electronic computer or computer, is a digital system that __3__ various computational tasks. Digital computers use the __4__ number system, which has two digits: 0 and 1. By using various coding __5__ , groups of bits can be made to represent not only binary numbers __6__ other discrete symbols, such as decimal digits or letters of the alphabet. A computer system consists of hardware system and software system. Programs tell the hardware what to do. __7__ software is designed to accomplish real-world tasks in fields such as accounting, entertainment, and engineering. Computers are usually __8__ into four broad categories: microcomputers, minicomputers, mainframe computers, and supercomputers. It's hard to give a __9__ definition to each type because computer speeds and storage __10__ change rapidly.

1. A. As	B. It	C. As it	D. That
2. A. what	B. which	C. where	D. when
3. A. performs	B. carries	C. makes	D. integrates
4. A. decimal	B. binary	C. Arabian	D. American
5. A. technique	B. technology	C. techniques	D. technologies
6. A. instead of	B. rather than	C. but also	D. as well
7. A. Application	B. System	C. Word	D. Excel
8. A.put	B. made	C. conducted	D. classified
9. A. precious	B. progress	C. proceeding	D. precise
10. A. capacities	B.capable	C. capabilities	D. capacity

Translation

Ⅷ. Translate the following into Chinese.

1. By using various coding techniques, groups of bits can be made to represent not only binary numbers but also other discrete symbols.

2. System software includes not only the complex programs used by technicians to create application software in the first place but also the organizational programs needed to start up the computer and govern its use of other programs.

3. Data are numbers and other binary-code information that are operated on to achieve required computational results.

4. Rather than arithmetically or logically manipulating characters, a computer may concatenate strings of characters, replace some characters with others, or otherwise manipulate character strings.

5. Software applications like word processing, electronic spreadsheets, database management programs, painting and drawing programs, desktop publishing, and so forth became commercially available, giving more people reasons to use a computer.

Chapter 2
Computer System Organization

Pre-reading Questions

1. What is a computer system?
2. How many levels of memory hierarchy do you know? Name at least three of them.
3. Identify the types of data transfer modes.

In this chapter, we will examine the organization of basic computer systems, which consist of computer organization introduction, system buses, CPU organization, memory subsystem organization and I/O subsystem organization.

2.1 Computer Organization Introduction

A computer system consists of hardware system and software system. The hardware of the computer is usually divided into three major parts or three primary subsystems: the CPU, the memory subsystem, and the I/O subsystem. Figure 2-1 shows the generic organization of these components.

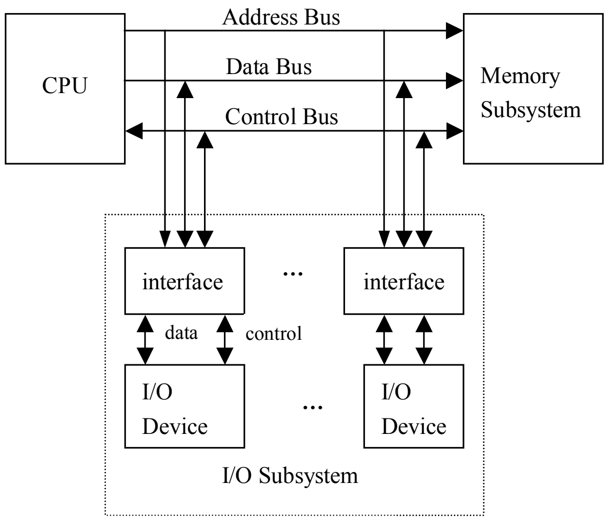

Figure 2-1 Computer Organization

The CPU performs many operations and controls computer. The memory subsystem is used to store program being executed by the CPU, along with the program's data.[1] The I/O subsystem allows the CPU to interact with input and output devices such as the keyboard and monitor of a personal computer.

The components of the computer are connected to the buses. So we first describe the system buses.

2.2 System Buses

Physically, a bus is a set of wires. They are used to connect the components in the computer system. To send information from one component to another, the source component outputs data onto the bus. The destination component then inputs this data from the bus. As the complexity of a computer system increases, it becomes more efficient at using buses rather than direct connections between every pair of devices.[2]

2.2.1 Address Bus

The system buses shown in Figure 2-1 have three buses. The uppermost bus in this figure is the address bus. When the CPU reads data or instructions from or writes data to memory, it must specify the address of the memory location it wishes to access. It outputs this address to the address bus, memory inputs this address from the address bus and uses it to access the proper memory location. When accessing an I/O device, the CPU places the address of the device on the address bus. Unlike the other buses, the address bus always receives data from the CPU, and the CPU never reads the address bus.

2.2.2 Data Bus

Data is transferred via the data bus. When the CPU fetches data from memory, it first outputs the memory address on its address bus. Then memory outputs the data onto the data bus, the CPU can then read the data from the data bus. When writing data to memory, the CPU first outputs the address onto the address bus, and then outputs the data onto the data bus. Memory then reads and stores the data at the proper location. The processes for reading data from and writing data to the I/O devices are similar.

2.2.3 Control Bus

The control bus is different from the other two buses. The address bus consists of n lines, which combine to transmit one n-bit address value. Similarly, the lines of the data bus work together to transmit a single, multibit value. In contrast, the control bus is a collection of individual control signals. These signals indicate whether data is to be read into or written out of the CPU, whether the CPU is accessing memory or an I/O device, and whether the I/O device or memory is ready to transfer data.[3] Most of these signals are output from the CPU to the memory and I/O subsystems, and a few are output by these subsystems to the CPU.

2.3 CPU Organization

The part of the computer that performs the bulk of data processing operations is called the central processing unit and is referred to as the CPU. In microcomputer, it is often called the microprocessor. The CPU is made up of three major parts, as shown in Figure 2-2.

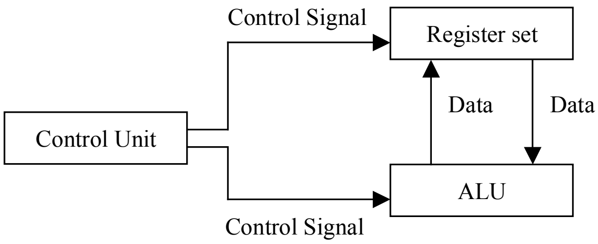

Figure 2-2　CPU Internal Organization

2.3.1 Register Set

The register set stores intermediate data used during the execution of the instructions. The register set, as its name implies, includes a set of registers and a bus or other communication mechanism. The register set also contains other registers that are not directly accessible by the programmer. The relatively simple CPU includes registers to latch the address being accessed in memory and a temporary storage register, as well as other registers that are not a part of its instruction set architecture.[4]

2.3.2 Arithmetic Logic Unit

The arithmetic logic unit, or ALU, performs most arithmetic and logical operations, such as adding or ANDing values. It receives its operands from the register set of the CPU and stores its results back in the register set. Since the ALU must complete its operations within a single clock cycle, it is constructed by using only combinatorial logic.

2.3.3 Control Unit

The control unit, or CU, supervises the transfer of information among the registers and instructs the ALU as to which operation to perform. This unit generates the internal control signals that cause registers to load data, increment or clear their contents, and output their contents, as well as cause the ALU to perform the correct function. The control unit receives some data values from the register set, which it uses to generate the control signals. This data includes the instruction code and the values of some flag registers. The control unit also generates the signals for the system control bus, such as the READ, WRITE, and IO/M# signals. A microprocessor typically performs a sequence of operations to fetch, decode, and execute an instruction. By asserting these internal and external control signals in the proper sequence, the control unit causes the CPU and the rest of the computer to perform the operation needed to correctly process instructions.

The CPU performs a variety of functions dictated by the type of instructions that are incorporated in the computer. Computer architecture is sometimes defined as the computer structure and behavior as seen by the programmer that uses machine language instructions. This includes the instruction format, addressing modes, the instruction set, and the general organization of the CPU register.

2.4 Memory Subsystem Organization

Memory is also known as internal memory or main memory. It refers to the circuits in the computer that hold whatever programs and data are available for immediate use by the CPU. In this section we will review the different types of physical memory and discuss the memory hierarchy.

2.4.1 Types of Memory

There are two major types of memory: Random Access Memory (RAM) and Read Only Memory (ROM).

1. RAM

RAM, also called read/write memory, can be used to store data that changes. Unlike ROM, RAM is erasable, temporary, and volatile ——meaning that it blanks out each time you turn the computer off. RAM is essential to a computer because it provides rapidly accessible circuitry where the CPU can run your programs and process your data. You may have dozens of computer games or other application software programs stored on a disk, but the computer cannot use them there; when you select a program to run, the computer must first copy it from the disk to RAM where the CPU can access it. It's particularly important to remember that all the data you type into the computer goes directly to RAM. If you want to keep your data permanently, you must save it by copying it to a secondary storage device such as a disk. The amount of RAM in a computer can be very important. If your computer has too little memory, complicated programs will run slowly or won't run at all. To stretch the amount of RAM, an operating system can use a strategy called virtual memory that reserves part of the hard disk for use as an extension to RAM.[5] In a computer with virtual memory, less-used parts of programs are shifted from RAM to a hard disk and are moved back only when needed. Although virtual memory may allow your computer to run large programs, it will reduce the amount of secondary storage and may cause programs to run slowly because it takes time to swap data to and from the hard disk.

There are two types of RAM chips, which are differentiated by how they maintain their data.

(1) DRAM

Dynamic RAM or DRAM chips are like leaky capacitors. Initially data is stored in the DRAM chip, charging its memory cells to their maximum values. The charge slowly leaks out and would eventually go too low to represent valid data. Before this happens, however, refresh circuitry reads the contents of the DRAM and rewrites the data to its original locations, thus restoring the memory cells to their maximum charges. DRAM is used to construct the RAM in personal computers.

(2) SRAM

Static RAM, or SRAM, is more like a register than a leaky capacitor. Once data is written to SRAM, its contents stay valid, and it does not have to be refreshed. Static RAM is faster than DRAM, but it is also much more expensive. The cache memory in personal computers is constructed from SRAM.

2. ROM

ROM chips are designed for applications in which data is only read. These chips are programmed with data by an external programming unit before they are added to the computer system. Once this is done, the data usually does not change. A ROM chip is well suited for this purpose because it is nonvolatile, meaning that the instructions recorded in it do not disappear when the power is off. When you turn the computer on, the permanent software in ROM boots the computer. To boot the computer, ROM first tells the CPU to determine what input, output, and storage devices happen to be attached to your computer. Then it instructs the CPU to check a disk to see if it contains operating system software that will let you start giving commands. The ROM in a typical personal computer also has a variety of self-test routines to make it easier to diagnose and repair hardware failures.

There are several types of ROM chips, which are differentiated by how and how often they can be programmed.

(1) Masked ROM

A masked ROM, or simply a ROM, is programmed with data as the chip is fabricated. The mask used to create the chip is designed with the required data hard-wired into it. These chips are useful for consumer appliances, where large numbers of units are produced, and, once installed, data will not be changed.[6]

(2) PROM

A PROM is a programmable ROM. Unlike the ROM, the PROM has a series of internal connections similar to fuses. Programming data into the PROM essentially blows the proper fuses so that each word of memory stores the correct value. Because these fuses cannot be restored once they are blown, PROMs can only be programmed once.

(3) EPROM

An EPROM is an erasable PROM. As its name implies, an EPROM can be programmed like a PROM, but its contents can be erased and the chip reprogrammed. These chips have a small clear window on their faces. The chip is erased by being placed under ultraviolet light that causes the capacitors to leak their charge, thus we can reset the chip's contents. When in use, the window is usually covered with opaque tape to prevent any ultraviolet rays in room light or sunlight from inadvertently destroying the contents of the chip. Because they are erasable, but are used in applications where their data does not change, EPROMs are typically used in product development labs and in prototypes.

(4) EEPROM or E^2PROM

An EEPROM, sometimes denoted as E^2PROM, is an electrically erasable PROM. It works like an EPROM, except that its contents are erased and reprogrammed electrically, rather than by using ultraviolet light. Unlike the EPROM, which must be entirely erased and then reprogrammed, it is possible to modify individual locations of the EEPROM while leaving other locations unchanged. Also, it takes only seconds to reprogram an EEPROM, it takes about 20 minutes to erase an EPROM. One common use for EEPROMs is the basic input/output system, or BIOS, of personal computers.

(5) Flash EEPROM

A special type of EEPROM called a flash EEPROM is electrically erasable in blocks of data, rather than individual locations. It is well suited for applications that write blocks of data and can be used as a solid stated hard disk. It is also used for data storage in digital cameras. Flash EEPROM can only be rewritten with data a finite number of times, which currently limits its widespread use in computer systems.

2.4.2 Memory Hierarchy

The memory hierarchy system consists of all storage devices employed in a computer system from the slow but high-capacity auxiliary memory to a relatively faster main memory, to an even small and faster cache memory accessible to the high-speed processing logic.[7] The components in a typical memory hierarchy are shown in Figure 2-3.

The memory unit that communicates directly with the CPU is called the main memory. Devices that provide backup storage are called auxiliary memory. The most common auxiliary memory devices used in computer systems are magnetic disks and tapes. They are used for storing system programs, large data files, and other backup information. Only programs and data currently needed by the CPU reside in main memory. All other information is stored in auxiliary memory and transferred to main memory when needed.

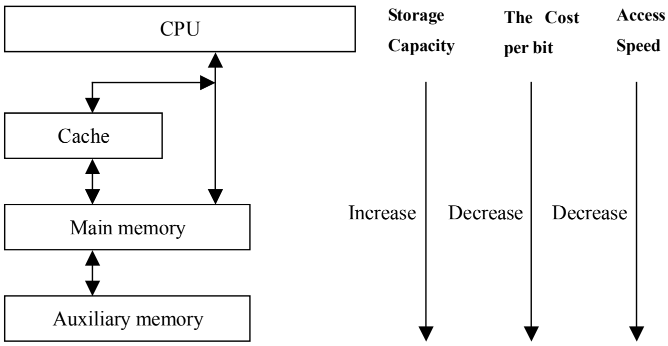

Figure 2-3　A Typical Memory Hierarchy

A special very-high-speed memory called a cache is sometimes used to increase the speed of processing by making current programs and data available to the CPU at a rapid rate.[18] The cache memory is employed in computer systems to compensate for the speed differential between main memory access time and processor logic. CPU logic is usually faster than main memory access time, with the result that processing speed is limited primarily by the speed of main memory.[8] A technique used to compensate for the mismatch in operating speeds is to employ an extremely fast, small cache between the CPU and main memory whose access time is close to processor logic clock cycle time. The cache is used for storing segments of programs currently being executed in the CPU and temporary data frequently needed in the present calculations. By making programs and data available at a rapid rate, it is possible to increase the performance rate of the computer.

Figure 2-3 shows the CPU has direct access to both cache and main memory but not to auxiliary memory. In memory hierarchy system, each component is involved with a different level. The auxiliary memory has a large storage capacity, is relatively inexpensive, but has low access speed compared to main memory. The cache memory is very small, relatively expensive, and has very high access speed. Thus as the memory access speed increases, so does its relative cost. The overall goal of using a memory hierarchy is to obtain the highest-possible average access speed while minimizing the total cost of the entire memory system.

2.5　I/O Subsystem Organization

In this section, we will describe the I/O devices, I/O interface, and modes of transfer.

2.5.1　I/O Devices

1. Keyboards

A computer’s keys are generally divided into four clusters: alphanumeric keys, function keys, cursor keys, and the numeric keypad. Alphanumeric keys include letters, numbers, and punctuation marks. They are arranged much like the keys on a typewriter. Function keys are labeled F1, F2, and so on up to F12 or F15. They can be used for giving common commands such as “Print”or “Quit program.” The precise purpose of any function key varies from one program to another. Cursor keys are used to move the cursor around on the screen. The cursor is the little blinking symbol that indicates where things will happen next on the screen.[9] When you are typing, the cursor always blinks just to the right of the last character you typed. Cursor keys include the arrow keys for moving up, down, left, and right, as well as the PgDn, PgUp, Home, and End keys. The numeric keypad includes the mathematical keys found on a standard calculator.

2. Mouse

Mice are popular because it is easier to point than to type, and because the arrow keys don’t work very well for drawing pictures or moving things on the screen. A mouse consists of a ball mounted under a plastic housing with one or more buttons on top. As you move the mouse around the tabletop, sensors inside register the rolling of the ball and move the cursor around the screen to match. There are three basic ways of giving commands with the mouse. First, you can click the button to identify something—— perhaps to indicate which part of a drawing you want to change. Second, you can drag the mouse; that is, you can hold the button down while you move the mouse. Dragging can be used to move a drawing across the screen. The third way to give a command is to double-click the mouse’s button by pressing it twice within about a half second. Double-clicking is used to select things on the screen.

The simplest pointing tool of all, of course, is the finger. In fact, touch screens are widely used in department—— store advertising displays, information kiosks, lottery game machines, and other places where users are not expected to have much familiarity with computers. On these machines you simply touch the part of the display screen you want to select, just as you might push a vending machine’s button. Depending on the sensing method used by the touch screen, your finger might interrupt a network of infrared rays protected across the screen’s surface.[10] This would tell the computer where you pointed.

3. Monitor

A monitor, or display screen, provides a convenient but temporary way to view information. The earliest computer monitors were simply converted television sets. While ordinary TVs are still used for some video games, most computer programs today demand higher-quality monitors. The quest for better monitors has taken two paths: the improvement of TV-like screens and the development of flat screens.

4. Printers

Different kinds of computer printers use surprisingly different technologies. Some printers squirt ink, some apply heat to sensitive paper, others hammer inked ribbons, and still others create images with lasers. Laser printers work by reflecting a laser beam from a rapidly rotating octagonal mirror onto a light-sensitive roller. Ink-jet printers work by squirting tiny droplets of liquid ink at the paper. Dot-matrix printer features a movable print head containing a row of tiny pins. The pins push an inked ribbon against the paper, producing a matrix (or pattern) of dots. As the print head moves back and forth across the page, the dots can form either letters or graphics.

5. Modem

A modem, short for modulator-demodulator, is used for communicating between computers. The modem converts a computer's electronic impulses to a form that can be transmitted over a telephone line. When the signal reaches the destination computer, another modem reconverts the signal to computer understandable form.

2.5.2 I/O Interface

Input-output interface provides a method for transferring information between internal storage and external I/O devices. Peripherals connected to a computer need special communication links for interfacing them with the central processing unit. The purpose of the communication link is to resolve the differences that exist between the central computer and each peripheral. The major differences are in the following:

- Peripheral are electromechanical and electromagnetic devices and their manner of operation is different from the operation of the CPU and memory, which are electronic devices. Therefore, a conversion of signal values may be required.
- The data transfer rate of peripherals is usually slower than the transfer rate of the CPU, and consequently, a synchronization mechanism may be needed.
- Data codes and formats in peripherals differ from the word format in the CPU and memory.
- The operating modes of peripherals are different from each other and each must be controlled so as not to disturb the operation of other peripherals connected to the CPU.

To resolve these differences, computer systems include special hardware components between the CPU and peripherals to supervise and synchronize all input and output transfers. These components are called interface units because they interface between the processor bus and the peripheral device. I/O interface shows in Figure 2-1. Each peripheral device has associated with an interface unit. Each interface decodes the address and control received from the I/O bus, interprets them for the peripheral, and provides signals for the peripheral controller. It also synchronizes the data flow and supervises the transfer between peripheral and processor.

2.5.3 Modes of Transfer

Binary information received from an external device is usually stored in memory for later processing. Information transferred from the central computer into an external device originates in the memory unit. The CPU merely executes the I/O instructions and may accept the data temporarily, but the ultimate source or destination is the memory unit. Data transfer between the central computer and I/O devices may be handled in a variety of modes. Some modes use the CPU as an intermediate path; the others transfer the data directly to and from the memory unit. Data transfer to and from peripherals may be handled in one of three possible modes: programmed I/O, interrupts, and direct memory access (DMA).

1. Programmed I/O

Programmed I/O operations are the result of I/O instructions written in the computer program. Usually, the transfer is to and from a CPU register and peripheral. Other instructions are needed to transfer the data to and from CPU and memory. Transferring data under program control requires constant monitoring of the peripheral by the CPU. Once a data transfer is initiated, the CPU is required to monitor the interface to see when a transfer can again be made.[11] It is up to the programmed instructions executed in the CPU to keep close tabs on everything that is taking place in the interface unit and the I/O device.[12]

In the programmed I/O method, the CPU stays in a program loop until the I/O unit indicates that it is ready for data transfer. This is a time-consuming process since it keeps the processor busy needlessly. It can be avoided by using an interrupt facility and special commands to inform the interface to issue an interrupt request signal when the data are available from the device.[13] In the meantime the CPU can proceed to execute another program. The interface meanwhile keeps monitoring the device. When the interface determines that the device is ready for data transfer, it generates an interrupt request to the computer. Upon detecting the external interrupt signal, the CPU momentarily stops the task it is processing, branches to a service program to process the I/O transfer, and then returns to the task it was originally performing.

2. Interrupts

An alternative to the CPU constantly monitoring the flag is to let the interface inform the computer when it is ready to transfer data. This mode of transfer uses the interrupt facility. While the CPU is running a program, it does not check the flag. However, when the flag is set, the computer is momentarily interrupted from proceeding with the current program and is informed of the fact that the flag has been set. The CPU deviates from what it is doing to take care of the input or output transfer. After the transfer is completed, the computer returns to the previous program to continue what it was doing before the interrupt.

The CPU responds to the interrupt signal by storing the return address from the program counter into a memory stack and then controls branches to a service routine that processes the required I/O transfer.[14] The way that the processor chooses the branch address of the service routine varies from one unit to another. In principle, there are two methods for accomplishing this. One is called vectored interrupt and the other, nonvectored interrupt. In a nonvectored interrupt, the branch address is assigned to a fixed location in memory. In a vectored interrupt, the source that interrupts supplies the branch information to the computer. This information is called the interrupt vector. In some computers the interrupt vector is an address that points to a location in memory where the beginning address of the I/O service routine is stored.

3. Direct memory access (DMA)

Another aspect of computer system performance that can be improved is the transfer of data between memory and I/O devices. This is a common operation in computer systems. Loading programs or data files from disk into memory, saving files on disk, and accessing virtual memory pages on any secondary storage medium all fall into this category of operations.

Consider a typical system consisting of a CPU, memory, and one or more input/output devices. Assume one of the I/O devices is a disk drive and that the computer must load a program from this drive into memory. The CPU would read the first byte of the program and then write that byte to memory. Then it would do the same for the second byte and each succeeding byte, until it had loaded the entire program into memory.

This is, at best, inefficient. Loading data into, and then writing data out of, the CPU significantly slows down the transfer. The CPU does not modify the data at all, so it only serves as an additional stop for data on the way to its final destination. The process would be much quicker if we could bypass the CPU and transfer data directly from the I/O device to memory. Direct Memory Access, or DMA does exactly that.

A DMA controller implements direct memory access in a computer system. It connects directly to the I/O device at one end and to the system buses at the other end. It also interacts with the CPU, both via the system buses and two new direct connections.

To transfer data from an I/O device to memory, the DMA controller first sends a bus request to the CPU by setting BR to 1. When it is ready to grant this request, the CPU sets its bus grant signal, BG, to l. The CPU also tri-states its address, data, and control lines, thus truly granting control of the system buses to the DMA controller. The CPU will continue to tri-state its outputs as long as BR is asserted.

Now that the DMA controller has control of the system buses, it can perform the desired data transfers. To load data from an I/O device into memory, it asserts the appropriate I/O control signals and loads data from the I/O device into its internal DMA data register. Next, it writes this data to memory. To do this, it outputs the memory address onto the system's address bus and the data onto the data bus. The DMA controller also asserts the appropriate signals on the system's control bus to cause memory to read the data. DMA controller then writes the second data value to the following memory location, continuing until it has transferred the entire block of data.

To understand how the DMA controller performs this transfer, we must examine its internal architecture. The DMA controller includes several registers. The DMA address register contains the memory address to be used in the data transfer. The DMA count register, sometimes called the word count register, contains the number of bytes of data to be transferred. The DMA control register accepts commands from the CPU. Most DMA controllers also have a status register. This register supplies information to the CPU. DMA controllers also usually include circuitry to abort the transfer if the I/O device is not ready in some predetermined amount of time. This is called timeout.

Technical Notes to the Text

1. bus，总线。计算机系统各部件间的一种电连接，信号及电源就是通过它传送的。信息可从多个源部件中的任何一个经总线传送到多个目标部件中的任意一个。总线由若干平行导线组成，分别传送地址、数据、同步信号、控制信息及电源等。总线的类型有：

- address bus，地址总线。一种单向总线，其上传输用来标识特定的存储单元或特定的输入/输出设备的数字信息。
- data bus，数据总线。在处理器、存储器及外部设备之间进行通信的信息通路。
- control bus，控制总线。一种运载用来调整系统运行的信号的总线。

2. flag register，标志寄存器。一种特殊用途的寄存器，该寄存器的各位按照执行指令期间可能发生的规定条件来设置。

3. cache memory，高速缓冲存储器。一种速度比随机存储器高得多的高速缓冲存储器。它用于加快数据从随机存储器到中央处理器的流动速度。高速缓冲存储器是利用一种算法预先估计中央处理器要从随机存储器中获取什么信息，并把它提前从随机存储器取出存到高速缓冲存储器中。当中央处理器需要信息时，首先在高速缓冲存储器中去查找。如果估计正确，这些信息就可以迅速传到中央处理器，从而相应地提高了计算机的运行速度。高速缓冲存储器有数据和指令高速缓冲存储器两种。

4. virtual memory，虚拟存储器。在具有层次结构存储器的计算机中，为用户提供一个比主存容量大得多的可随机访问的地址空间的技术。虚拟存储技术使辅助存储器和主存储器密切配合，对用户来说，好像计算机具有一个容量比实际主存大得多的主存可供使用。

5. prototype，原型，样机。在系统开发中，适用于系统设计、性能以及生产潜力评估的一种系统模型。

6. BIOS，Basic-Input-Output System 的缩写，基本输入/输出系统。CP/M 和 DOS 操作系统的重要组成部分，负责具体处理计算机的输入和输出数据。

7. interface，接口。计算机和其他实体之间，例如打印机或操作者，相互作用或交

流的点。

8. cursor，光标。显示器上的明亮、通常闪动的、可移动指示物，用于标明某一字母可以进入、修改或删去的位置。

9. touch screen，触摸屏。一种允许用户通过触摸屏上某一区域以与数据处理系统进行交互操作的显示装置。

10. modem，调制解调器，modulator-demodulator 的缩写。一种对信号进行调制与解调的功能部件。调制解调器的功能之一就是使数字数据经过模拟传输设施进行传送。

11. peripheral，外设。外部设备或辅助设备，例如与计算机连接工作的打印机、调制解调器或存储系统。

12. synchronization，同步。调整两个信号相应的有效瞬间，以使它们之间满足所需相位关系的过程。

13. computer architecture，计算机体系结构。是指计算机系统的物理或硬件结构、各组成部分的属性以及这些部分的相互联系。它可以分为系统体系结构和实现体系结构两个方面。前者是从软件开发人员的角度看计算机系统的功能行为和概念结构；后者从计算机系统的价格和性能特征出发，考虑系统的结构和实现。也有人将计算机体系结构专指系统体系结构，而将实现结构称为计算机组织。

14. instruction format，指令格式。计算机指令的表示形式。一条指令通常包含下列信息：操作码、操作数来源、下一条指令的地址。

15. addressing modes，寻址方式。是指生成计算机指令中实际使用的有效地址的方法。广泛使用的寻址方式有直接寻址、寄存器寻址、间接寻址、基址寻址、变址寻址和相对寻址等。

16. instruction set，指令系统，指令集。是指一台计算机中的所有指令的集合。

17. interrupt，中断。计算机在执行程序的过程中，当遇到急需处理的事件时，暂停当前正在运行的程序，转去执行有关服务程序，处理完后自动返回原程序，这个过程称为中断。

18. vectored interrupt，向量中断。存储器的地址码是一串布尔量的序列，是一个布尔向量，所以地址码称为向量地址。当 CPU 响应中断时，由硬件直接产生一个或多个固定地址(即向量地址)，由向量地址指出中断服务程序的入口，这种方法称为向量中断。

19. DMA，直接存储器存取，是 Direct Memory Access 的缩写。是一种完全由硬件执行 I/O 变换的工作方式。在这种方式中，DMA 控制器从 CPU 中完全接管对总线的控制，数据交换不经过 CPU，而直接在内存储器和 I/O 设备之间进行。

Words Bank to the Text

A. Useful new words

generic [dʒiˈnerik]	*adj.* 类的，一般的，普通的
execute [ˈeksikjuːt]	*vt.* 执行，实行

uppermost ['ʌpəməust]	*adj*. 至上的，最高的，最主要的
specify ['spesifai]	*vt*. 指定，详细说明，列入清单
transmit [trænz'mit]	*vt*. 传输，转送
similarly ['similəli]	*adv*. 同样地，类似于
mechanism ['mekənizəm]	*n*. 机械装置，机构，机制
accessible [ək'sesəbl]	*adj*. 易接近的，可到达的
architecture ['ɑːkitektʃə]	*n*. 体系机构
operand ['ɔpəˌrænd]	*n*. 操作数
combinatorial [ˌkɔmbinə'tɔːriəl]	*adj*. 组合的
supervise ['sjuːpəvaiz]	*v*. 监督，管理
generate ['dʒenəˌreit]	*vt*. 产生，发生
sequence ['siːkwəns]	*n*. 次序，顺序
dictate [dik'teit]	*v*. 指令，指示，命令
hierarchy ['haiərɑːki]	*n*. 层次
random ['rændəm]	*adj*. 任意的，随便的，随机的
volatile ['vɔlətail]	*adj*. 飞行的，挥发性的，可变的
secondary ['sekəndəri]	*adj*. 次要的，二级的
differentiate [ˌdifə'renʃieit]	*v*. 区别，区分
dynamic [dai'næmik]	*adj*. 动力的，动力学的，动态的
attach [ə'tætʃ]	*vt*. 缚上，系上
fabricate ['fæbrikeit]	*vt*. 制作，构成
fuse [fjuːz]	*n*. 保险丝，熔丝
erasable [i'reizəbl]	*adj*. 可消除的，可抹去的
ultraviolet ['ʌltrə'vaiəlit]	*adj*. 紫外线的，紫外的
prototype ['prəutətaip]	*n*. 原型
auxiliary [ɔːg'ziljəri]	*adj*. 辅助的
alphanumeric [ælfənjuː'merik]	*adj*. 字母与数字混合编排的
kiosk ['kiːɔsk]	*n*. 书报亭，报摊
infrared ['infrə'red]	*adj*. 红外线的
squirt [skwəːt]	*v*. 喷出
octagonal [ɔk'tægənl]	*adj*. 八边形的，八角形的
synchronization [ˌsiŋkrənai'zeiʃən]	*n*. 同时(性)；[物]同步
initiate [i'niʃieit]	*vt*. 开始，发动
vector ['vektə]	*n*. [数] 向量，矢量
implement ['implimənt]	*vt*. 贯彻，实现
predetermined ['priːdi'təːmin]	*v*. 预定，预先确定

B. Useful phrases and expressions

divide into	分成

along with	连同……一起
interact with	与……相合
receive from	收到
different from	异于……
in contrast	相反，大不相同
be ready to	预备，即将
refer to as	认为与……有关
as well as	也，又
in the proper sequence	以适当的次序
be known as	被认为是
blank out	取消，作废
shift from	转移，移转
leak out	漏出
be suited for	适合
be attached to	连在……上，附属于
a variety of	一系列
be similar to	与……相似
compensate for	赔偿
have much familiarity with	与……熟悉
reflect onto	反射到
keep busy	使忙碌
mode of transfer	转移模式
deviate from	背离，偏离
in principle	原则上，大体上
fall into	分成，属于
now that	既然

C. Technical terms and proper names

memory subsystem	存储子系统
I/O subsystem	输入/输出子系统
bus	总线
system bus	系统总线
chip	芯片
address bus	地址总线
instructions	指令
memory location	存储单元
data bus	数据总线
control bus	控制总线
local bus	局部总线

microprocessor	微处理器
register set	寄存器组
arithmetic logic unit(ALU)	运算器
clock cyc1e	时钟周期
control unit	控制器
computer architecture	计算机体系结构
instruction format	指令格式
addressing modes	寻址方式
instruction set	指令集
internal memory	内存
main memory	主存
Random Access Memory(RAM)	随机存取存储器
Read Only Memory (ROM)	只读存储器
secondary storage	辅助存储器
virtual memory	虚拟存储器
Dynamic RAM(DRAM)	动态 RAM
refresh circuitry	刷新电路
Static RAM(SRAM)	静态 RAM
cache memory	高速缓冲存储器
masked ROM	掩模 ROM
PROM	可编程 ROM
EPROM	可擦写 PROM
ultraviolet light	紫外线
EEPROM or E^2PROM	电擦写 PROM
basic input/output system(BIOS)	基本输入/输出系统
flash EEPROM	快闪存储器
memory hierarchy	存储器体系结构
auxiliary memory	辅助存储器
storage capacity	存储容量
keyboard	键盘
alphanumeric key	字母数字键
function key	功能键
cursor key	光标键
numeric keypad	数字键
mouse	鼠标
touch screens	触摸屏
infrared ray	红外线
monitor	监视器

display screen	显示屏
laser printer	激光打印机
ink-jet printer	喷墨打印机
dot-matrix printer	点阵式打印机
modem	调制解调器
input-output interface (I/O interface)	输入输出接口(I/O 接口)
peripheral	外部(外围)设备，外设
interrupt	中断
program counter	程序计数器
vectored interrupt	向量中断
nonvectored interrupt	非向量中断
interrupt vector	中断向量
Direct Memory Access (DMA)	直接存储器存取
timeout	超时

Exercises

Comprehension of the Text

Ⅰ. Fill in the following blanks.

1. The computer hardware consists of three major parts which are the CPU, the memory subsystem, and ________.

2. There are two major types of memory: Random Access Memory (RAM) and ________.

3. The cache memory in personal computers is constructed from________.

4. ________provides a method for transferring information between internal storage and external I/O devices.

5. Data transfer between the central computer and I/O devices may be handled in a variety of modes. These modes are programmed I/O, ________, and direct memory access (DMA).

Ⅱ. Label each of the following statements as either true or false.

1. The data bus always receives data from the CPU, and the CPU never reads the data bus.

2. Main memory holds whatever programs and data are available for immediate use by the CPU.

3. Dynamic RAM does not have to be refreshed.

4. Dot-matrix printer work by squirting tiny droplets of liquid ink at the paper.

5. The auxiliary memory is very small, relatively expensive, and has very high access

speed.

Ⅲ. Match each of the following terms to the appropriate definition.

(1) ALU (2) RAM (3) E^2PROM (4) DMA

________ an electrically erasable PROM

________ A transfer mode that can be improved is the transfer of data between memory and I/O devices.

________ The unit which performs most arithmetic and logical operations

________ Memory that is erased when the computer is turned off.

Ⅳ.Translate the following words into Chinese.

1. system buses 2. virtual memory 3. computer architecture
4. instruction set 5. direct memory access

Vocabulary

Ⅴ. Fill in the blanks with the words given below. Change the form where necessary.

auxiliary	generate	implement
specify	initiate	accessible
differentiate	volatile	execute

1. The Employment Minister said the reforms would ______ new jobs.
2. The international oil markets have been highly _______ since the early 1970s.
3. They wanted to ______ a discussion on economics.
4. The government promised to ________ a new system to control financial loan institutions.
5. One group claimed to have _______ the American hostage.
6. He is proud that his wife is _______ to reason.
7. The government's first concern was to augment the army and _______ forces.
8. A child may not _______ between his imagination and the real world.

Collocation

Ⅵ. Look at the following sentences taken from the text. Just think about what else you can "generate" and fill in the sentences with the right word.

Example: This unit **generates** the internal control **signals** that cause registers to load data.

1. With its ability to generate numerous se________ quickly, this new type of weed soon became the disaster of the land.

2. They've just built a new nuclear plant to generate more el________ to meet the demands of the local people.

3. Mid-sized cities like Bangalore are now the Silicon Valleys of India——their workers generate de________ for the very products that they produce.

4. The government will put forward a new program which will strengthen local economies, generate jo________ and improve the quality of people's lives.

5. Mike's absence from the class that morning didn't generate any at________.

6. The vast amount of pu______ they generated was immediately reflected in sales.

Summary of the Text

Ⅶ. Choose the best one of the four answers given to fill in each blank.

A computer system_____1_____of hardware system and software system. The hardware of the computer is usually divided into three major parts or three _____2_____subsystems: the CPU, the memory subsystem, and the I/O _____3_____. The CPU is made up of three major parts, Register Set, the _____4_____logic unit, or ALU, and Control Unit. It performs many operations and controls computer. Memory is also known as _____5_____memory or main memory, which is cataloged into two major types of memory: Random Access Memory (RAM) and Read Only Memory (ROM). It refers to the _____6_____in the computer that hold whatever programs and data are available _____7_____ immediate use by the CPU, along with the program's data. Computer systems include special hardware _____8_____between the CPU and peripherals to supervise and synchronize all input and output transfers. These components are called _____9_____units because they interface between the processor bus and the peripheral device. The I/O subsystem allows the CPU to _____10_____with input and output devices.

1. A.consists	B. makes up	C. constitutes	D. comprise
2. A.premier	B. primary	C. preliminary	D. elementary
3. A.system	B. machine	C. subsystem	D. device
4. A.mathematic	B. authorative	C. arithmetic	D. authoritative
5. A.external	B. exterior	C. interior	D. internal
6. A.circuits	B. wires	C. lines	D. hardware
7. A.by	B. for	C. with	D. in
8. A.software	B. setting	C. listing	D. components
9. A.singular	B. dual	C. interface	D. compact
10. A.handle	B. interact	C. respond	D. link

Translation

Ⅷ. Translate the following into Chinese.

1. By asserting these internal and external control signals in the proper sequence, the control unit causes the CPU and the rest of the computer to perform the operation needed to correctly process instructions.

2. In a computer with virtual memory, less-used parts of programs are shifted from RAM to a hard disk and are moved back only when needed.

3. A technique used to compensate for the mismatch in operating speeds is to employ an extremely fast, small cache between the CPU and main memory whose access time is close to processor logic clock cycle time.

4. The data transfer rate of peripherals is usually slower than the transfer rate of the CPU, and consequently, a synchronization mechanism may be needed.

5. In some computers the interrupt vector is an address that points to a location in memory where the beginning address of the I/O service routine is stored.