

计算机英语

Computer (第2版)

(Second Edition)

刘艺 王春生 编

English



机械工业出版社
China Machine Press

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Computer English

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江苏工业学院图书馆
藏书章



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本书是一本面向 21 世纪的计算机专业英语教材, 它涉及了计算机基础知识、硬件结构、程序设计、软件工程、应用开发、网络通信、信息安全、电子商务以及其他深刻影响着我们的生活的高新技术。全书以计算机和 IT 领域的最新英语时文和经典原版教材为基础, 通过大量精心挑选的阅读材料, 配以相应的注释和练习, 使读者能够快速掌握计算机英语的一般特点和大量专业词汇, 并提高阅读和检索计算机原版文献资料的能力。本书选材广泛, 图文并茂, 版式设计创意新颖, 极大地方便了读者的学习和查阅。书后还附有词汇表和缩略语表。

本书可供大专院校计算机及 IT 相关专业的学生使用, 也可供参加计算机水平考试的考生、IT 行业的工程技术人员以及谋求出国发展的计算机人才学习参考。

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序 言

汉语中有一句成语，“如虎添翼”，意思是说一个能干的人，如果有了好的助手或工具，他的威力、能力就会倍增。我们的时代是知识经济的时代，是经济向全球化发展的时代。一个人，尤其青年人要有所作为，在从事的工作上有所成就，赶上时代的潮流，有两种知识和技能是非常重要的，一是英语，二是计算机。一个人掌握好这两种知识和技能就等于平添了两个好助手，真可谓插上翅膀，任凭他展翅飞翔。本书就是集双翼于一体的好书、一本好教材。

本书有以下几个特点：

第一，它将英语和计算机两种知识融为一体。英语已经成为一种国际性的语言，这是一个不用争辩的事实。英语在国际上作为通用的计算机及 IT 的行业性用语，有着其他语言所不能替代的地位。无论是学习最新的计算机技术，还是使用最新的计算机软硬件产品，都离不开对计算机英语的熟练掌握。据我了解，现在国内外许多院校，为了适应这种需求，已经或正在积极准备开设计算机英语课，不仅把它作为计算机专业的必修课，还将其作为一门实用的选修课推广到其他专业。本书从内容到编排都非常适合作为这样一门课程的教材，使读者不仅可以学到计算机的基础知识，还可学到与计算机相关的英语，毕其功于一役。

第二，选材精当，“新”字当头。本书的选材十分广泛丰富，既有计算机基础知识、硬件体系结构、软件工程和网络通信等方面的专业文章，又精心挑选了电子商务、因特网、计算机安全、IT 业精英论点等方面的文献资料。

第三，版式新颖，处处方便读者。学习计算机英语必然会遇到英语和计算机知识方面许多新的词汇和其他阅读上的难点。本书采用了旁注生词，脚注难点的同步对照注释方法，大大方便了读者，读者可以在当前页上获得学习指导，释义解惑。

本书的两位编者都是年轻人，但是在编写计算机和英语教材与工具书方面都已经积累了丰富的经验，成绩斐然。两位编者要求我为本书写一个序，虽然我对计算机英语知之甚少，但是为写序，浏览全书，得益不浅，欣然命笔，是为序。

全国高校外语教学指导委员会委员

博士生导师

姚乃强 教授

前 言

英语作为计算机及 IT 业的行业性语言,有着其他语言所不能替代的功能。无论是学习最新的计算机技术,还是使用最新的计算机软硬件产品,都离不开对计算机英语的熟练掌握。正是为了适应这种要求,不少有实力、有远见的院校纷纷开设了计算机英语课。有些院校不仅把它作为计算机专业的必修课,还将其作为一门实用的选修课推广到其他专业。

本书是按照最新《大学英语教学大纲》对专业英语的要求,为开设计算机英语课程而编写的面向 21 世纪的教材。在满足计算机专业英语教学的同时,我们并没有过分沉溺于晦涩抽象的理论和专业术语之中,而是注重实际应用与调动学习兴趣。本书选材广泛,内容丰富,涉及了计算机基础知识、硬件结构、程序设计、软件工程、应用开发、网络通信、信息安全、电子商务以及其他深刻影响着我们生活的信息技术。

本书第 1 版作为 IT 专业英语教材出版以来深受读者喜爱,已被全国众多高校采用。短短三年时间里,印数已超过 3 万册。

由于全球 IT 业发展迅速、变化频繁,新技术和新术语大量涌现。为适应这种情况,深化教学改革,我们对本书第 1 版进行了全面修订,推出《计算机英语》(第 2 版)。这次修订主要完成以下工作:

- **调整部分课文** 第 2 版替换了 9 篇内容过时或不太合适的课文。新增的课文更加紧跟技术潮流,把握主流趋势。既有涉及微软的 .NET 和 Sun 的 J2EE 两大技术阵营的最新技术时文,也有《设计模式》这样的经典名著,还有对下一代操作系统 Longhorn 的展望。借此也引入了大量新的技术术语和缩略语,为读者尽快独立阅读英文资料,融入英文技术社区提供帮助。
- **对保留的课文进行修改** 在本次修订中,我们对一些保留课文中的疏漏进行了改正,调整了部分注解,使之更加贴切。
- **优化全书的体系结构** 本书第 1 版共有 15 个单元,现调整为 14 个单元,以免内容过多,在有限的学时中难以完成教学任务。我们删除了原书第 1 版的“Distributed Systems (分布式系统)”单元,新增了“Software Engineering (软件工程)”单元,并将原来的“Network (网络)”和“Network Infrastructure (网络基础结构)”两个单元合并成“Computer Networks (计算机网络)”单元。同时修改了全书的体系结构,使之更符合计算机科学的体系结构,基本上遵循了计算机基础、硬件、软件、网络与通信、应用等五个层次。
- **调整版式** 我们在保留原书最具特色的旁注生词、脚注难点的同步对照注释版式外,

还通过双色印刷,使生词更加醒目,加强读者对计算机词汇的理解和记忆。另外,书后还附有生词表和缩略语表,而且所有生词与缩略语均注明在书中首次出现的课次与具体文章。它们既可作为全书的索引,方便读者进行相关内容的查阅复习,也可作为一本实用的英汉计算机小词典,在日常学习和生活中备用。同时,我们还为大部分文章精心选配了插图和示意图,以增加文章内容的直观性与趣味性,使读者能更好地理解原文并提高学习兴趣。

- **提供完善的在线服务** 为了加大对授课老师的支持力度,我们为老师准备了参考译文、练习答案、考试试卷等教辅材料,并筹备制作多媒体教学软件。授课老师可以登录机械工业出版社华章分社网站 <http://www.hzbook.com> 注册并下载配套的教辅材料。

本书的读者还可以在线访问作者网站 <http://www.liu-yi.net> 或本书的论坛 <http://www.liu-yi.net/BBS/list.asp?boardid=3> 以获取更多的参考资料。

本书在出版过程中得到机械工业出版社华章分社的鼎力支持,同时谈亮、刘春花、洪蕾、王珊珊、蒋丹丹等也为本书的编写和顺利出版付出了心血,在此一并表示感谢!

尽管本书在编写过程中,在资料的查核、术语的汉译以及文字的规范等方面都做了大量工作,但由于计算机领域的发展日新月异,许多新术语尚无确定的规范译法,加上编者水平有限,书中难免有不尽如人意之处,恳请广大读者不吝赐教。

编者

2004年11月于南京

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使用说明

1. 本教材根据其内容分为四部分,共 14 课。每一课包括三篇文章。课文 A 为精读材料,课文 B 和课文 C 为泛读材料。三篇课文均围绕同一主题。课文 A 一般为该主题的概述,课文 B 和课文 C 多就该主题的某一具体方面或具体例子展开讨论。

2. 课文 A 的长度一般为 1400~1800 词,要求学生能正确理解和熟练掌握其内容。课文 B 和课文 C 的长度一般为 1200~1600 词,要求能掌握中心大意,抓住主要事实。

3. 课文 A 配有四项练习,即“课文理解填空”、“词组中英文互译”、“完形填空”和“段落翻译”;课文 B 和课文 C 配有两项练习,即“课文理解填空”和“词组中英文互译”。各项练习均与课文内容和计算机专业紧密结合,旨在巩固和拓展学生所学内容。

4. 国家教育部于 1999 年新颁布的《大学英语教学大纲》(修订本)规定:“学生在完成基础阶段的学习任务,达到四级或六级后,都必须修读专业英语。”这就意味着学生在学习专业英语之前必须达到大学英语四级水平,但不一定达到六级。因此,本教材的生词选注以四级为起点,参照标准为 2000 年 7 月出版的《大学英语教学大纲》(修订本)配套词汇表。所注生词有两类:一类是通用词,即大纲词汇表未列入 1~4 级的词汇;另一类为计算机及相关专业词汇,是大纲词汇表未列入 1~4 级,或未注明有关词义的词汇。生词均通过双色印刷在课文中标出,并在课文对应段落旁边进行注释,以便于阅读和记忆。相同生词原则上只在首次出现之处进行注释,但书后附有词汇表以备检索。

5. 计算机英语的特点之一是大量使用缩略语。本教材对缩略语采取两种处理方式:一是在首次出现处进行脚注;二是对大家十分熟知或其意思在文中不言自明的缩略语未加脚注。脚注中出现的所有缩略语均收入书后的缩略语表,以备查阅和方便记忆。另外,在计算机英语中,缩略语所代表的词组或术语在大小写上有比较随意和不一致的现象。本教材原则上尊重原文所采用的形式。

6. 完成本教材的学习后应达到的要求,可参照《大学英语教学大纲》(修订本)有关专业英语的规定。

7. 计算机专业英语课的开设及本教材的使用可采用以下建议。本科生可安排在第五学期至第七学期,研究生可安排在第一学年。对于教学时数比较充裕的院校,可讲授全书;对教学时数比较少的院校,可重点介绍前三部分,将第四部分作为课外阅读。教师也可按照实际情况安排教学内容。

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第一部分

计算机基础

第1单元

我的电脑

- 课文 A: 计算机概览
 - 课文 B: 穿戴式计算机
 - 课文 C: PDA 拳击赛: Palm 对 Pocket PC
-

第2单元

计算机硬件结构

- 课文 A: 计算机硬件
 - 课文 B: 通用串行总线
 - 课文 C: DVD
-

第3单元

操作系统

- 课文 A: 操作系统
 - 课文 B: Longhorn: Windows 的下一个版本
 - 课文 C: 什么是 Linux
-

第4单元

计算机语言与编程

- 课文 A: 编程语言
 - 课文 B: Java 语言
 - 课文 C: 数组
-

Unit 1 My Computer

(我的电脑)

Section A

Computer Overview



I. Introduction

numeric(al)

/nju:'merik(əl)/

a. 数字的; 数值的

manipulate

/mə'nɪpjuleɪt/

v. 操作; 处理

transaction

/træn'zækʃən/

n. 交易; 业务; 事务 (处理)

A computer is an electronic device that can receive a set of instructions, or program, and then carry out this program by performing calculations on **numerical data** or by **manipulating** other forms of information.

The modern world of high technology could not have come about¹ except for the development of the computer. Different types and sizes of computers find uses throughout society in the storage and handling of data, from secret governmental files to banking **transactions** to private household accounts. Computers have opened up a new era in manufacturing

¹ *come about*: 发生, 产生。

automation

/ˌɔ:tə'meɪʃən /

n. 自动化

enhance /in'hɑ:ns /

v. 增强

conjecture

/kən'dʒektʃə /

n. 推测, 猜想

database

/'deɪtəbeɪs /

n. 数据库

privacy /'praɪvəsi /

n. 隐私; 秘密

precursor

/ˌpri:kə:sə /

n. 先驱

digit /'dɪdʒɪt /

n. 数字

loom /lu:m /

n. 织机

perforated

/'pɜ:fəreɪtɪd /

a. 穿孔的

conceive /kən'si:v /

v. (构) 想出

punched card

穿孔卡片

electrical contact

电触点

compile /kəm'paɪl /

v. 汇编; 编译

census /'sensəs /

n. 人口普查

analytical

/ˌænə'lɪtɪkəl /

a. 分析的

Analytical Engine

分析机, 解析机

through the techniques of **automation**, and they have **enhanced** modern communication systems. They are essential tools in almost every field of research and applied technology, from constructing models of the universe to producing tomorrow's weather reports, and their use has in itself opened up new areas of **conjecture**. **Database** services and computer networks make available a great variety of information sources.¹ The same advanced techniques also make possible invasions of personal and business **privacy**. Computer crime has become one of the many risks that are part of the price of modern technology.

II. History

The first adding machine, a **precursor** of the digital computer, was devised in 1642 by the French scientist, mathematician, and philosopher Blaise Pascal.² This device employed a series of ten-toothed wheels, each tooth representing a **digit** from 0 to 9. The wheels were connected so that numbers could be added to each other by advancing the wheels by a correct number of teeth. In the 1670s the German philosopher and mathematician Gottfried Wilhelm Leibniz³ improved on this machine by devising one that could also multiply.

The French inventor Joseph-Marie Jacquard⁴, in designing an automatic **loom**, used **thin**, **perforated** wooden boards to control the weaving of complicated designs. During the 1880s the American statistician Herman Hollerith⁵ **conceived** the idea of using perforated cards, similar to Jacquard's boards, for processing data. Employing a system that passed **punched cards** over **electrical contacts**, he was able to **compile** statistical information for the 1890 United States **census**.

1. The Analytical Engine

Also in the 19th century, the British mathematician and inventor Charles Babbage⁶ worked out the principles of the modern digital computer.

¹ *Database services and computer networks make available a great variety of information sources.*: 数据库服务和计算机网络使各种各样的信息源可供使用。这句话由于宾语 (a great variety of information sources) 较长, 因此将宾语的补语 (available) 放到了宾语的前面。文中下一句话也属同样情况。

² *Blaise Pascal*: 布莱斯·帕斯卡 (1623~1662), 法国数学家、物理学家、哲学家, 概率论创立者之一。

³ *Gottfried Wilhelm Leibniz*: 戈特弗里德·威廉·莱布尼兹 (1646~1716), 德国自然科学家、哲学家, 微积分、数理逻辑的先驱, 提出了二进制。

⁴ *Joseph-Marie Jacquard*: 约瑟夫-玛丽·雅卡尔 (1752~1834), 法国著名的织机工匠, 纹板提花机的主要改革家。

⁵ *Herman Hollerith*: 赫尔曼·何勒里斯 (1860~1929), 美国发明家和统计学家。

⁶ *Charles Babbage*: 查尔斯·巴比奇 (1792~1871), 英国数学家和发明家。

Difference Engine

差分机

input stream

输入(信息)流

analog(ue)

/'ænalɒg /

a. 模拟的

shaft /ʃɑ:ft /

n. 轴

approximation

/ə.pɹɒksɪ'meɪʃən /

n. 近似(值)

computing

/kəm'pjʊ:tɪŋ /

n. 计算(技术)

torpedo /tɔ:'pi:dəu /

n. 鱼雷

submarine

/sʌbmə'ri:n /

n. 潜艇

bombsight

/bɒmsaɪt /

n. 轰炸瞄准器

incorporate

/ɪn'kɔ:pəreɪt /

v. 包含, 吸收; 把…

合并, 使并入

vacuum tube

真空管

crack /kræk /

v. 破译

encipher /ɪn'saɪfə /

v. 把…译成密码

prototype

/'prəʊtətaɪp /

n. 原型; 样品

He conceived a number of machines, such as the **Difference Engine**, that were designed to handle complicated mathematical problems. Many historians consider Babbage and his associate, the mathematician Augusta Ada Byron¹, the true pioneers of the modern digital computer. One of Babbage's designs, the Analytical Engine, had many features of a modern computer. It had an **input stream** in the form of a deck of punched cards, a "store" for saving data, a "mill" for arithmetic operations, and a printer that made a permanent record.² Babbage failed to put this idea into practice, though it may well have been technically possible at that date.

2. Early Computers

Analogue computers began to be built in the late 19th century. Early models calculated by means of rotating shafts and gears. Numerical **approximations** of equations too difficult to solve in any other way were evaluated with such machines. Lord Kelvin³ built a mechanical tide predictor that was a specialized analogue computer. During World Wars I and II, mechanical and, later, electrical analogue **computing** systems were used as **torpedo** course predictors in submarines and as **bombsight** controllers in aircraft. Another system was designed to predict spring floods in the Mississippi River⁴ basin.

3. Electronic Computers

During World War II, a team of scientists and mathematicians, working at Bletchley Park, north of London, created one of the first all-electronic digital computers: Colossus⁵. By December 1943, Colossus, which **incorporated** 1,500 vacuum tubes, was operational. It was used by the team headed by Alan Turing⁶, in the largely successful attempt to **crack** German radio messages **enciphered** in the Enigma code⁷.

Independently of this, in the United States, a **prototype** electronic

¹ *Augusta Ada Byron*: 奥古斯塔·埃达·拜伦(1815~1852), 英国数学家, 诗人拜伦之女。

² *It had an input stream in the form of a deck of punched cards, a "store" for saving data, a "mill" for arithmetic operations, and a printer that made a permanent record.*: 它有一个以一叠穿孔卡片的形式存在的输入流、一个存储数据的“仓库”、一个进行算术运算的“工厂”和一台产生永久记录的打印机。

³ *Lord Kelvin*: 开尔文勋爵(1824~1907), 全名威廉·汤姆森·开尔文(William Thomson Kelvin), 英国物理学家, 发展了热力学理论, 创立了热力学绝对温标(即开尔文温标)。

⁴ *Mississippi River*: 密西西比河, 发源于美国中北部的湖沼区, 南注墨西哥湾, 系美国主要河流。

⁵ *Colossus*: 该词读作 /kə'lɒsəs/, 有“巨像”、“巨人”、“巨物”等意。

⁶ *Alan Turing*: 艾伦·图灵(1912~1954), 英国数学家和逻辑学家。

⁷ *Enigma code*: 恩尼格码, 德军在第二次世界大战期间采用的一种密码。

overshadow

/ˌəʊvəʃædəʊ /
v. 使相形见绌

integrator

/ˈɪntɪɡreɪtə /
n. 积分器

patent /ˈpeɪtənt /

n. 专利 (权)

overturn

/ˌəʊvəˈtɜːn /
v. 推翻; 废除

machine had been built as early as 1939, by John Atanasoff¹ and Clifford Berry² at Iowa State College³. This prototype and later research were completed quietly and later **overshadowed** by the development of the Electronic Numerical Integrator And Computer (ENIAC⁴) in 1945. ENIAC was granted a **patent**, which was **overturned** decades later, in 1973, when the machine was revealed to have incorporated principles first used in the Atanasoff-Berry Computer.

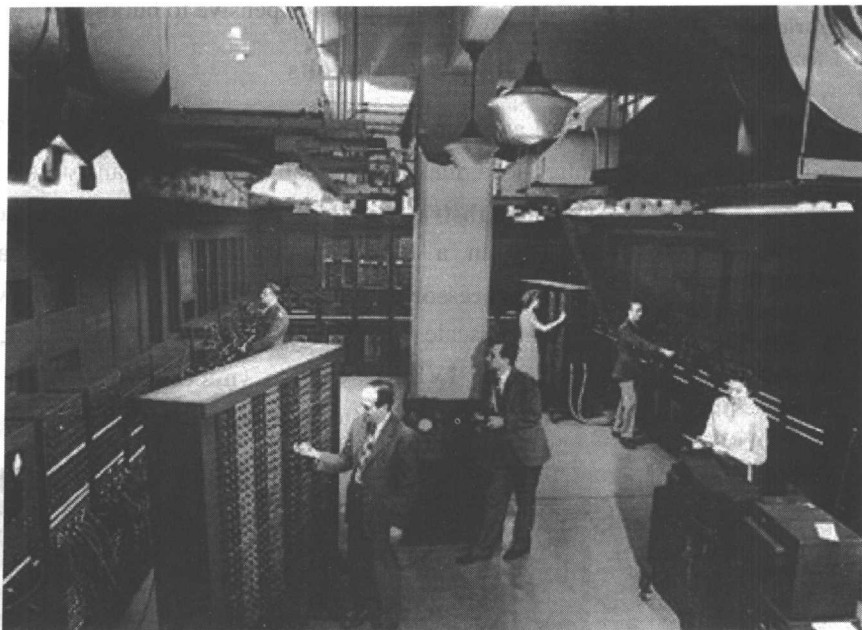


Figure 1A-1: ENIAC was one of the first fully electronic digital computers

Hungarian

/hʌŋˈɡeəriən /

a. 匈牙利的

memory /ˈmeməri /

n. 存储器, 内存

paper-tape reader

纸带阅读器

execution

/ˌeksɪˈkjʊʃən /

n. 执行, 运行

ENIAC (See Figure 1A-1) contained 18,000 vacuum tubes and had a speed of several hundred multiplications per minute, but originally its program was wired into the processor⁵ and had to be manually altered. Later machines were built with program storage, based on the ideas of the **Hungarian-American** mathematician John von Neumann⁶. The instructions, like the data, were stored within a “**memory**”, freeing the computer from the speed limitations of the **paper-tape reader** during **execution** and

¹ **John Atanasoff**: 约翰·阿塔纳索夫 (1903~1995), 美国物理学家。

² **Clifford Berry**: 克利福德·贝里 (1918~1963), 美国物理学家。

³ **Iowa State College**: (美国) 艾奥瓦州立学院。

⁴ **ENIAC**: 电子数字积分计算机, ENIAC 计算机 (Electronic Numerical Integrator And Computer 的首字母缩略)。

⁵ **its program was wired into the processor**: 程序通过导线传送到处理器内。

⁶ **John von Neumann**: 约翰·冯·诺伊曼 (1903~1957), 美籍匈牙利数学家, 对量子物理、数学逻辑和高速计算机的发展均有贡献。

transistor

/træn'sistə/

n. 晶体管

advent /'ædvent/

n. 出现, 到来

versatile /'vɜ:sətail/

a. 多用途的, 通用的

logical element

逻辑元件

fabricate

/'fæbrikeit/

v. 制作

silicon /'silikən/

n. 硅

substrate

/'sʌbstreit/

n. 衬底, 基底

microprocessor

/,maikrəu'prəuseə/

n. 微处理器

microchip

/,maikrəutʃip/

n. 微芯片

etch /etʃ/

v. 蚀刻

permitting problems to be solved without rewiring the computer.

The use of the **transistor** in computers in the late 1950s marked the **advent** of smaller, faster, and more **versatile logical elements** than were possible with vacuum-tube machines. Because transistors use much less power and have a much longer life, this development alone was responsible for the improved machines called second-generation computers. Components became smaller, as did inter-component spacings, and the system became much less expensive to build.

4. Integrated Circuits

Late in the 1960s the integrated circuit, or IC (See Figure 1A-2), was introduced, making it possible for many transistors to be **fabricated** on one **silicon substrate**, with interconnecting wires plated in place¹. The IC resulted in a further reduction in price, size, and failure rate. The **microprocessor** became a reality in the mid-1970s with the introduction of the large-scale integrated (LSI) circuit and, later, the very large-scale integrated (VLSI) circuit (**microchip**), with many thousands of interconnected transistors **etched** into a single silicon substrate.

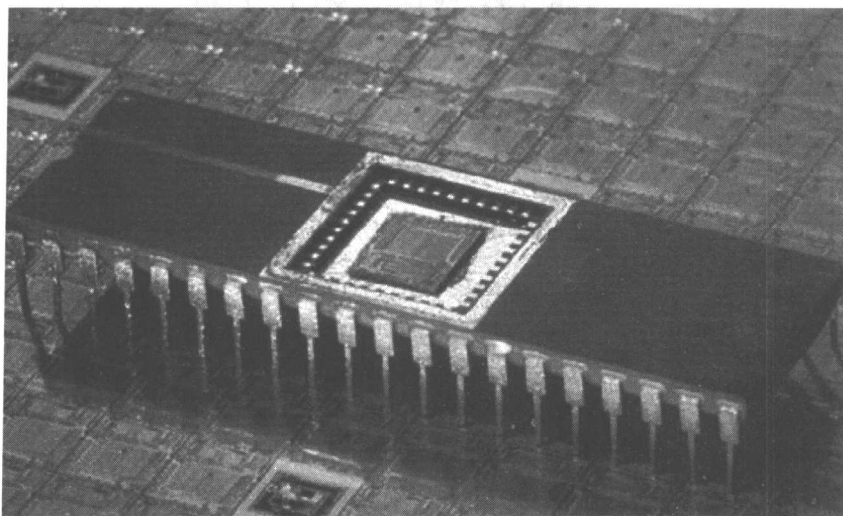


Figure 1A-2: An integrated circuit

binary /'bainəri/

a. 二进制的

bit /bit/

n. 位, 比特

To return, then, to the switching capabilities of a modern computer: computers in the 1970s were generally able to handle eight switches at a time. That is, they could deal with eight **binary** digits, or **bits**, of data, at

¹ *making it possible for many transistors to be fabricated on one silicon substrate, with interconnecting wires plated in place:* 从而有可能将许多晶体管制作在一块硅衬底上, 晶体管之间用镀在那里的导线相连接。

byte / baɪt / n. 字节
datum / 'deɪtəm / n.
 ([复] **data**) 数据
graphics / 'græfɪks /
 n. 图形, 图形显示
decimal / 'desɪməl /
 a. 十进制的
switch / 'swɪtʃ /
 n. 交换 (设备); 开关; 转换
chip / tʃɪp / n. 芯片
instruction set
 指令集
ongoing / 'ɒŋ.gəʊɪŋ /
 a. 正在进行的
conceptually
 / kən'septʃuəli /
 ad. 概念上
microcomputer
 / 'maɪkrəʊkəm'pjʊ:tə /
 n. 微型计算机
desktop / 'deskɒp /
 a. & n. 桌面的; 台式的; 台式 (计算) 机; 桌面
laptop / 'læptɒp /
 n. 膝上型计算机, 便携式计算机
briefcase / 'brɪ:fkɛɪs /
 n. 公文包
palmtop / 'pɑ:mtɒp /
 n. 掌上型计算机
workstation
 / 'wɜ:k.steɪf ən /
 n. 工作站
minicomputer
 / .mɪnɪkəm'pjʊ:tə /
 n. 小型计算机
mainframe
 / 'meɪnfreɪm /
 n. 主机, 大型机
supercomputer
 / 'sʊ:pəkəm'pjʊ:tə /
 n. 超级计算机, 巨型计算机
bus / bʌs / n. 总线

every cycle. A group of eight bits is called a byte, each byte containing 256 possible patterns of ONs and OFFs (or 1s and 0s). Each pattern is the equivalent of an instruction, a part of an instruction, or a particular type of **datum**, such as a number or a character or a **graphics** symbol. The pattern 11010010, for example, might be binary data—in this case, the **decimal** number 210—or it might be an instruction telling the computer to compare data stored in its **switches** to data stored in a certain memory-**chip** location.

The development of processors that can handle 16, 32, and 64 bits of data at a time has increased the speed of computers. The complete collection of recognizable patterns—the total list of operations—of which a computer is capable is called its **instruction set**. Both factors—the number of bits that can be handled at one time, and the size of instruction sets—continue to increase with the **ongoing** development of modern digital computers.

III. Hardware

Modern digital computers are all **conceptually** similar, regardless of size. Nevertheless, they can be divided into several categories on the basis of cost and performance: the personal computer or **microcomputer**, a relatively low-cost machine, usually of **desktop** size (though “**laptops**” are small enough to fit in a **briefcase**, and “**palmtops**” can fit into a pocket); the **workstation**, a microcomputer with enhanced graphics and communications capabilities that make it especially useful for office work; the **minicomputer**, generally too expensive for personal use, with capabilities suited to a business, school, or laboratory; and the **mainframe** computer, a large, expensive machine with the capability of serving the needs of major business enterprises, government departments, scientific research establishments, or the like (the largest and fastest of these are called **supercomputers**).

A digital computer is not a single machine: rather, it is a system composed of five distinct elements: (1) a central processing unit; (2) input devices; (3) memory storage devices; (4) output devices; and (5) a communications network, called a **bus**, which links all the elements of the system and connects the system to the external world.

IV. Programming

A program is a sequence of instructions that tells the hardware of a computer what operations to perform on data. Programs can be built into