高等职业教育电子信息类“十一五”规划教材
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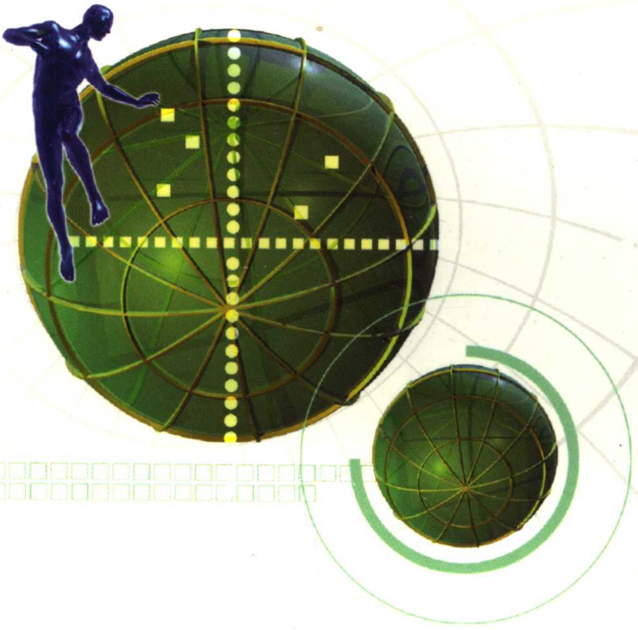

计算机专业英语（第二版）

JISUANJI ZHUANYE YINGYU

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高等职业教育电子信息类“十一五”规划教材

计算机专业英语（第二版）

A Course in Computer English

（The Second Edition）

朱晋蜀　宋国明　编著

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内容简介

本书介绍了计算机科学的主要内容，旨在提高读者阅读计算机英语文献的能力。全书涉及了计算机历史、计算机硬件、操作系统、程序设计、数据结构、计算机网络、管理信息系统、数据库、因特网、计算机病毒、电子商务、高级计算等技术。内容素材以经典原版教材、国外最新的计算机著作、学术期刊和网上资料为基础，涉及计算机科学各个领域的当前现状和最新发展。每章均配有导读、阅读理解练习，使读者能够快速掌握计算机的大量专业词汇，并提高阅读理解能力。全书正文无一个汉字，有利于读者学习纯正的英语。本书汲取了美国、加拿大计算机专业大学教材的特色和风格，是作者长期致力于计算机英语教学改革的结晶，具有鲜明的特色与创新性。

本书可作为大学本科、专科计算机专业教材，也可作为使用计算机的广大科技人员的学习参考书。

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Preface

The purpose of this course, as its title indicates, is to teach students of computer science major, whose second language is English, the language of computer scientific English. An attempt has been made to arrange simple pieces in order of the systematization of computer science. A few slight simplifications have been made here and there in the vocabulary and context, but this has not been done to any great extent.

English is a very important tool for Chinese university and college students, especially for computer science students. I am still impressed when I studied Data Structure in Chengdu Radio Engineering Institute (Electronic Science & Technology University of China) in 1980. Having been reading and studying English textbook since then have given me so much help and many benefits for my Master Degree, and studied computer networking in Canada, and my job.

The book is intended primarily for one semester computer scientific English course. A variety of materials have collected and edited from computer science textbooks which were published in the United States or on the Internet. The range of the book is from computer history to currently advanced computing technologies. I believe it's systematic and informative.

The most important thing for a student is that he or she can read and understand English papers and books in the computer science field after their graduating from university or college. Three purposes have been intended by this edited book:

(1) Study pure English.

(2) Learn quite a lot of computer terminology.

(3) Review and refresh computer science concepts.

Learning a language is not a matter of acquiring a set of rules and building up a large vocabulary. The teacher's efforts should not be directed at informing his students about a language, but at enabling them to use it. A student's mastery of a language is ultimately measured by how well he can use it, not by how much he knows about it. A student who has learnt a lot of grammar but who cannot use a language is in the position of a pianist who has learnt a lot about harmony but cannot play the piano. The student's command of a language will therefore be judged not by how much he knows, but by how well he can perform.

As we've known, there are all four basic language skills: understanding, speaking, reading and writing. But the emphasis of this course is wholly on the comprehension and understanding. The students are trained to use their eyes instead of their ears.

For comprehension reading, upon encountering an unfamiliar vocabulary item in a passage there are several strategies readers can use to determine the message of the author. First, they can continue reading, realizing that often a single word will not prevent understanding of the general meaning of a selection. If further reading does not solve the problem, readers can use one or more three basic skills to arrive at an understanding of the unfamiliar word. They can use context clues to see if surrounding words and grammatical structures provide information about the unknown word. They can use word analysis to see if understanding the parts of the word leads to an understanding of the word. Or, they can use a dictionary to find an appropriate definition.

Guessing the meaning of an unfamiliar word from context clues involves using the following kinds of information:

(1) knowledge of the topic about which you are reading;

(2) knowledge of the meanings of the other words in the sentence (or paragraph) in which the word occurs;

(3) knowledge of the grammatical structure of the sentences in which the word occurs.

If you are a computer student, do you think you need to look up a word "evil" in a dictionary?

Most hardware manufacturers view operating systems as a necessary ***evil*** *without which their hardware would not sell at all.*

Do you understand the meaning of the following sentence without knowing exactly meaning of the "undergone"?

Operating systems, like computer hardware, have ***undergone*** *a series of revolutionary changes called generations.*

Another way to discover the meanings of unfamiliar vocabulary items is to use word analysis, that is, to use knowledge of the meanings of the parts of a word. Many English words have been formed by combining parts of older English, Greek, and Latin words. For instance, the word *bicycle* is formed the parts *bi-*, meaning two, and *cycle*, meaning round or wheel. Often knowledge of the meanings of these word parts can help the reader to guess the meaning of an unfamiliar word.

Sometimes the meaning of a single word is essential to an understanding of the total meaning of selection. If context clues and word analysis do not provide enough information, it will be necessary to use a dictionary. I believe students should use an English/English dictionary because it will give you more precise information. It's an important way to learn a pure English. Using E/E dictionary is not hard as most of students imagine. For example, the explanation of word *prone* is: (adj.) having the probability of (usu. something undesirable): *One is more prone to make mistakes when one is tired.* The explanation and the example sentence make us easier understood.

Sometimes comprehension of an entire passage requires the understanding of a single sentence. It's called key sentence where the main idea come from in the paragraph or even in a passage.

Students will need to use all of their language skills in order to understand the reading selections in A Course in Computer English. The book contains many types of selections on a wide variety of topics on computer science. These selections provide practice in using different reading strategies to extract the message of the writer. They also give students practice in four basic reading skills: skimming, scanning, reading for through comprehension, and critical reading.

Skimming is quick reading for the general idea of a passage. This kind of rapid reading is appropriate when trying to decide if careful reading would be desirable or when there is not time to read something carefully.

Like skimming, scanning is also quick reading. However, in this case the search is more focused. To scan is to read quickly in order to locate specific information. When you read to find a particular date, name, or number you are scanning.

Reading for thorough comprehension is careful reading in order to understand the total meaning of the passage. At this level of comprehension the reader is able to summarize the author's idea but has not yet made a critical evaluation of those ideas.

Critical reading demands that readers make judgments about what they read. This kind of reading requires posing and answering questions such as, Does my own experience support that of the author? Do I share the author's point of view? Am I convinced by the author's arguments and evidence?

Systematic reading of computer science technology will give computer students refresh their computer knowledge and practice in the basic language and reading skills necessary to become proficient readers.

Any effort of this scope is bound to have its flaws. I assume complete responsibility for any remaining defects. I would be most grateful for your comments, criticisms, and correction. Your suggestions will motivate me to publish the new edition of this book. Any correspondence should be sent to Zhu Jinshu (author). I will acknowledge all correspondence immediately.

It is a pleasure to acknowledge the encouragement and assistance of many people who have helped in this project. First of all, to Zhu Dan, editor of University of Electronic Science and Technology of China Press, go my special thanks. Her advice facilitated publishing this book. Thanks for my wife Liu Hong, who provided the incredible support and understanding without which this book could never have come to fruition.

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A Letter to Students

Dear Students:

This is the second version of A Course in Computer English. It is designed to help you learn about computer English.

Compared with the first edition, the second has made some changes on the following:

Five new chapters are added in this book, which are Chapter 2 Computer Hardware, Chapter 4 Computer Language and Programming, Chapter 10 Computer Virus and Security, Chapter 11 Computer Commerce, and Chapter 12 Advanced Computing Technology. The orders of other chapters are adjusted in this new edition such as Data Structure, Communications and Networking, Operating Systems, Developing Information Systems, Database Management Systems, and Internet. In order to keep up with the development of new computer technology, great deals of new concepts are introduced in these chapters as well. It makes the contents more systematic and informative.

Some new items have been added in the exercises. Various types of exercises will help you to comprehend the texts more thoroughly.

Hopefully you will be motivated to pursue a study of computer science beyond this book. If there is any topic concerning this book that you would like to express an opinion about, I would like to hear from you at the following address:

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I hope that this book enriches your study of computer science.

Best wishes,

Zhu Jinshu
mzhu@mail.cec.edu.cn

目　录

Chapter 1 Computer Overview

Computers have been in use for a relatively short period of time. The first *commercial* computers became available in early 1950s. Since then, computers have gone through a rapid evolution. Before that time, computing devices or computers developed slowly, although people have developed an *amazing* variety of data processing tools and techniques over the centuries.

1.1 History of Computing Machines

People have been trying to find easier ways of doing calculations for thousands of years. Around 3000 B.C., the Sumerians used a box of stones as a device for representing numbers. The *abacus*, invented by the Chinese over 2500 years ago, was one of the first efforts. They are still in wide use in some parts of Asia. The first mechanical calculator was invented by Blaise Pascal, a French mathematician, in 1642. The first general-purpose calculating machine was Leibniz Wheel introduced in early 1700s.

The first major step toward the development of a computer took place in 1822. A British mathematician, Charles Babbage, designed a machine that he called the difference engine, for calculating certain types of mathematical tables. According to his design, the difference engine would use *gears* and *levers* to do calculation. Babbage received several *grants* from the British government to build the machine, but he was never able to complete it. A machine based on Babbage's ideas was completed in 1855 and used in the United States and Great Britain.

In 1834, while working on the difference engine, Babbage *conceived* the idea of a more powerful calculating machine, which he called the analytical engine. As with the difference engine, this machine would use gears and levers for calculations. In addition, it would have the capability of storing up to one thousand numbers and could be programmed for different calculations. Many of the ideas for programming the analytical engine were developed by Augusta Ada Byron. In a way, she was the first programmer.

Babbage never completed the analytical engine, partially because the technology needed to build the machine's parts was not *available*. The engine, however, had many of the *characteristics* of a modern computer: a primary storage, an arithmetic unit, and programming capabilities. It lacked the electronic characteristics of current computers. However, had Babbage lived one hundred years later, he may have invented the first electronic computer.

To enter programs into his analytical engine, Babbage planned to use cards with *patterns* of holes in them. He borrowed the idea from a loom invented by Joseph Jacquard in France in 1801. The *loom* wove patterns into *fabric* by following instructions given by holes in cards. In Babbage's analytical engine, the cards would contain instructions to tell the machine what calculations to perform.

Jacquard's cards were also the inspiration for Herman Hollerith, an engineer working for the Census Bureau in the late 1800s. The Census Bureau takes the U.S. census every ten years. The 1880 census required $7(\frac{1}{2})$years to compile. With population growth, the Census Bureau projected that the 1890 census could take more than ten years to *tabulate*, so something had to be done. Hollerith conceived the idea of recording census data on cards similar to Jacquard's. Patterns of holes in the cards could represent different population characteristics. The cards were called punched cards. Hollerith invented two machines for punching holes in the card, one machine for sorting cards based on patterns of holes, and another machine for counting or tabulating data from cards. Using Hollerith's punched card machines, the 1890 census took only $2(\frac{1}{2})$ years to compile.

Hollerith saw a commercial value to his ideas, so in 1896 he formed the Tabulating Machine Company to manufacture and sell his machines. His machines were used in the 1900 census as well as by some businesses for data processing. In 1911, the Tabulating Machine Company *merged* with several others companies to form the Computing-Tabulating-Recording (CTR) Company. In 1924, CTR changed its name to International Business Machines Corporation (IBM), which today is the largest computer manufacture in the world.

The punched cards were used for many years after their development. Punched card machines became more and more *sophisticated*, until many businesses had rooms full of machines used for punched card data processing. For years, computers used punched cards as their main form of input. The modern punched card is still available today, but is *rarely* used. The birth of the true electronic computer did not occur until the mid-1990s.

1.2 Invention of Computer

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 that were like 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 devices was developed in Germany by Konrad Zuse in 1941. Called the Z3, it was general-purpose, stored-program machine with many electronic parts, but it had a mechanical memory. Another electromechanical computing machine was developed by Howard Aiken, 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.

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—Colossus. Colossus, which incorporated 1500 vacuum tubes, was operational by December 1943. It was Colossus that *cracked* Nazi radio messages *enciphered* in complex Enigma codes in hours, and turned the tide in favor of the Allies.

Independently of this, a *prototype* electronic machine had been built as early as 1939 in U.S., by John Atanasoff and Clifford Berry at Iowa State College. Perhaps the most *influential* of the early computer like devices was the Electronic Numerical Integrator and Computer, or ENIAC. It was developed by J. Presper Eckert and John Mauchly at the University of Pennsylvania. The project began in 1943 and was completed in 1946. The machine was huge; it weighed 30 tons and contained over 18 000 vacuum tubes.

The ENIAC was a major *advancement* for its time. It was the first general-purpose, electronic computing machine and was capable of performing thousands of operations per second. It was controlled, however, by switches and plugs that had to be *manually* set. Thus, although it was a general-purpose electronic device, it did not have a stored program. Therefore, it did not have all the characteristics of a computer.

While working on the ENIAC, a brilliant mathematician, John von Neuman joined Eckert and Mauchly's team. Together, they developed the idea of a stored program computer. Later machines were built with program storage, based on the idea of John von Neuman. Until 1949, the world's first electronic, stored-program, general-purpose computer, EDSAC (Electronic Delay Storage Automatic Calculator), which was developed in Cambridge, became operational. It is probably the world's first electronic, stored-program, general-purpose computer.

Eckert and Mauchly formed a company in 1947 to develop a commercial computer. Their objective was to design and build the Universal Automatic Computer or UNIVAC, which was completed in 1951. Known as the UNIVAC I, this machine was the first commercially available computer. The first UNIVAC I was delivered to the Census Bureau and used for the 1950 *census*. The second UNIVAC I was used to predict that Dwight Eisenhower would win the 1952 presidential election, less than an hour after the *polls* closed. The UNIVAC I began the modern of computer use.

1.3 Computer Generations of Computer

Since the UNIVAC I, computers have evolved rapidly. The evolution has been the result of changes in technology that have occurred regularly, including development hardware and software. These changes have resulted in four main generations of computers. Each generation of computers is *characterized* by a major technological development that *fundamentally* changed the way computers operate. It results in increasingly smaller, cheaper, more powerful, and more efficient and *reliable* devices.

1.3.1 First-Generation Computer: 1951—1958

First-generation computers were characterized by the use of vacuum tubes as their *principal* electronic component. Vacuum tubes are *bulky* and produce a lot of heat, so first-generation computers were large and required extensive air conditioning to keep them cool. These computers were somewhat unreliable because the vacuum tubes failed frequently, which was caused by the emitting heat. In addition, because vacuum tubes do not operate very fast, these computers were relatively slow. The first generation computers could run a program at a time, but they were very expensive. The UNIVAC was priced at $500 000 in 1950.

The first computers were programmed in machine language, but during the first computer generation, the idea of programming language translation and high-level languages occurred. Grace Hopper, who was a Navy lieutenant in 1945, learned to program the Harvard Mark I. In 1952, she developed the first programming language translator, followed by others in later years. Other software developments during this period included the design of the FORTRAN programming language in 1957. This language became the first widely used high-level language. Also, the first simple operating systems became available with first-generation computers.

1.3.2 Second-Generation Computer: 1959—1963

In the second generation of computers, transistors replaced vacuum tubes. Although invented in 1948, the first all-transistor computer did not become available until 1959. Transistors are smaller and cheaper than vacuum tubes, operating faster and producing less heat. Hence, with second-generation computers, the size and cost of computers decreased, their speed increased, and their air-conditioning needs were reduced. Although the transistors still generated a great deal of heat that could *induce* the damage of computer, it was a vast improvement over the vacuum tubes.

In this time, magnetic cores 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.

Computers were used in industry and business. One of the most popular second-generation computers was the IBM 1401, which was a medium-sized computer used by many businesses. All computers at this time were mainframe computers costing over a million dollars. The first minicomputer became available in 1960 and cost about $120 000. This was the PDP-1, manufactured by Digital Equipment Corporation (DEC).

Software also continued to develop during this time. 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.

1.3.3 Third-Generation Computer: 1964—1970

The technical development that marks the third generation of computers is the use of integrated circuits or ICs in computers. An integrated circuit is a piece of 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, improved reliability, and reduced need for air conditioning.

The first integrated circuit was invented in 1958, but the first computers to make extensive use of them were not available until 1964. In that year, the IBM introduced a line of mainframe computers called the System/360. The computers in this line became the most widely used third-generation machines. There were many models in the System/360 line, ranging from small, relatively slow, and inexpensive ones, to large, very fast, and costly models. All models, however, were compatible so that programs written for one model could be used on another. This *feature* of *compatibility* across many computers in a line was adopted by other manufacturers of third-generation computers.

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 Data General Corporation and Hewlett-Packard Company, introduced minicomputers during the third generation.

The use of magnetic disk for secondary data storage became wide spread in this generation. Computers began to support such capability as multiprogramming (processing several programs *simultaneously*), *virtual* memory, and timesharing (people using the same computer simultaneously). Software also got great development, for instance, the increased sophistication of operating systems. Many of the features of modern operating systems first appeared during the third generation. 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.

1.3.4 Fourth-Generation Computer: 1971—Present

The microprocessor brought the fourth generation of computers. This generation is characterized by more and more transistors being contained on a silicon chip. First there was large scale integration (LSI) with hundreds and thousands of transistors per chip, then came very large scale integration (VLSI) with tens of thousands and hundreds of thousands of transistors. The trend continues today.

Perhaps the most important trend that began in the fourth generation is the *proliferation* of microcomputers. In 1971 Ted Hoff of Intel developed the microprocessor, which packaged an entire CPU, completed 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. They started the process of *miniaturization*: the development of smaller and smaller computers. The first computer to use microprocessors became available in the mid-1970s. The first microcomputer designed for personal use was the Altair, which was sold in 1975. The first Apple computer was put into market with the IBM PC in 1981. Today, microcomputers far *outnumber* all other types of computers combined.

Supercomputers first became *prominent* in the fourth generation. Although many companies, including IBM and CDC, developed high-speed computers for scientific work, it was not until

Cray Research Inc. introduced the Cray1 in 1975 that supercomputers became *significant*. Today, supercomputers are an important computer *classification*.

Also during this time, computers' main memory capacity increased, and its cost decreased. They directly affected the type and usefulness of software that could be used. 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. Applications like word processing, electronic *spreadsheets*, database management programs, painting and drawing programs, desktop publishing, and so forth became widely used. Packaged software was commercially available from then on.

1.3.5 Fifth-Generation Computer (Future Development)

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. *Optic* computers, which use light for data storage and processing, are also being developed.

The fifth-generation computers will be *intelligent* computers capable of reasoning similar to that of a person. They can solve complicate problems in creative ways, including capability of learning, thinking, reasoning, understanding natural languages, and changing their actions according to the environment. These techniques belong to the topics of artificial intelligence, which is a very active domain in computer science. Such a computer would have to be very powerful and would require sophisticated software. Parallel processing and other new computing techniques are helping the reality of artificial intelligence.

Researchers in the United States, Japan, China 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.

1.4 Types of Computer

Computers have come a long way since the *advent* of first electronic computer in 1946. Modern digital computers are all similar in *conceptual* architectures, although their size, cost and processing capabilities vary *dramatically*. Nevertheless, they can be divided into several *categories* on the basis of cost and *performance*: microcomputer, workstation, minicomputer, mainframe, and supercomputer.

Microcomputers are also called personal computers (PCs). They are relatively inexpensive machine that can fit on a desktop, or can be carried around. *Laptops* and *palmtops*, or called notebook, are smaller personal computers, whose size is small enough to fit in a briefcase or a pocket with flat-panel LCD displays. The price of personal computers ranges from a few hundred of dollars to thousands of dollars anywhere. They are all based on microprocessor technology that an entire CPU on one chip is put in the system. Microcomputers are designed for individual users for word processing, desktop publishing, electronic tabulating, and running database management or other applications. Personal computers can be used as *stand-alone* machines or connected to a network, such as a local area network.

Workstations, introduced in the early 1980s, are microcomputers with *enhanced* graphics and communications capabilities. They are expensive and powerful desktop computers used mainly by engineers, scientists, and special-effects creators for sophisticated purposes. In terms of computing power, workstation lies between microcomputers and minicomputers. In fact, the line is *fuzzy* on both ends when we *distinguish* workstation from microcomputer and minicomputer. The capabilities of low-end workstations overlap those of high-end microcomputers, while high-end workstations can reach the power of minicomputers. Workstations are used for tasks such as designing airplane *fuselages*, and movies' special effects. In order to *reveal* their true power, workstations are often connected into network. This can *facilitate* the transfer of data and information.

Minicomputers are generally too expensive for personal use. Their capabilities are suited to a business, school, or laboratory. In size and performance, minicomputers lie between workstations and mainframes. Like distinction between low-end minicomputers and high-end workstations, it is *blurred* for large minicomputers and small mainframes. In general, a minicomputer is a multiprocessing system capable of supporting from 4 to about 200 users simultaneously.

Mainframe computer is a large, expensive machine with capability of serving the needs of major business enterprises, government departments, and scientific research establishments. A mainframe, which also has many processors, can support hundreds, or even thousands, of users simultaneously. In the *hierarchy* of computer family, the power of mainframe is just below that of supercomputer. But they are still fast, mid- to large-size, large capacity machines. Their size varies depending on how many *concurrent* users they are serving. Mainframes are used by many banks, airlines, insurance companies, and universities.

The supercomputer is the most expensive, fastest, and highest-capacity computer. The cost of supercomputers ranges from several hundreds of thousands to millions of dollars. They may occupy special air-conditioned rooms and are often used for scientific research. They are widely used in weather forecasting and analysis of weather phenomena, oil exploration, aircraft design, evaluation of aging nuclear weapons systems, predictions of spreads of *epidemics*, and mathematical research. Unlike microcomputers, which generally have only one microprocessor, supercomputers have hundreds to thousands of processors and can perform trillions of calculations per second. Supercomputers are employed for specialized applications that require immense amounts of mathematical calculations.