21世纪全国高职高专计算机教育“十一五”规划教材
丛书主编 全国高等学校计算机教育研究会课程与教材建设委员会主任 李大友

计算机英语

主　编　申时凯　梁洪波
副主编　李　雷　杨彩卿
　　　　康漫红　李丽平　潘铁强

中国计划出版社

21世纪全国高职高专计算机教育“十一五”规划教材

计算机英语

本书编委会　编著

中 国 计 划 出 版 社

图书在版编目（CIP）数据

计算机英语 / 《计算机英语》编委会编著. —北京：中国计划出版社，2007.8
21世纪全国高职高专计算机教育“十一五”规划教材
ISBN 978-7-80177-942-7

I. 计… II. 计… III. 电子计算机－英语－高等学校：技术学校－教材 IV. H31

中国版本图书馆CIP数据核字（2007）第076743号

内 容 简 介

本书以计算机基础知识为前提，对计算机英语进行了比较全面的描述。内容包括计算机软硬件、网络以及安全方面的知识。

每章除了正文以外，还列出了本章的专业词汇对照表及重点词汇的讲解，正文后面的习题可用来对自己的学习情况进行检测。每章后面的阅读材料是对正文内容的补充，有助于加深对正文的理解，扩展知识面。

本书既可作为高职高专院校计算机专业学生的英语教材，也可作为计算机爱好者和自学者的学习参考资料。

21世纪全国高职高专计算机教育“十一五”规划教材
计算机英语
本书编委会　编著
☆
中国计划出版社出版
（地址：北京市西城区木樨地北里甲11号国宏大厦C座4层）
（邮政编码：100038 电话：63906433　63906381）
新华书店北京发行所发行
北京市艺辉印刷有限公司印刷

787×1092毫米　1/16　16.75印张　407千字
2007年8月第一版　2007年8月第一次印刷
印数1—5000册
☆
ISBN 978-7-80177-942-7
定价：25.00元

丛书编委会

主　任：李大友

副主任：王行言　郑　莉　傅连仲

委　员：（按音序排列）

蔡　莉	成安霞	东朝晖	范双南	韩小祥
黄国雄	黄志刚	将星军	李国安	李　红
李金祥	李亚平	李寅虎	李玉虹	刘　钢
刘灿勋	刘长生	刘立军	刘文涛	刘晓魁
刘占文	罗文华	孟繁增	商信华	邵　杰
舒大松	万雅静	王德奎	王宏基	文其知
吴　博	吴国经	吴　玉	武嘉平	谢书玉
阳若宁	杨邦荣	杨学全	袁学松	曾凡文
钟新文	周承华	周少华	朱元忠	朱志伯

本书编委会

主　编：申时凯　梁洪波

副主编：李　雷　杨彩卿　康漫红　李丽平　潘铁强

参　编：葛茜倩　顾理琴　许冬霞　李红梅　刘　芳　易　竞

宁　燕　胡　平　王春艳　李　菲　邢向荣　辛伯宇

刘建香　林莉　时武略　刘颖　成奋华

丛 书 序

编写背景和目的

高等职业教育是现代国民教育体系的重要组成部分，在实施科教兴国战略和人才强国战略中具有特殊的重要地位。现在，我国就业和经济发展正面临着两个大的变化，即：社会劳动力就业需要加强技能培训，产业结构优化升级需要培养更多的高级技术人才。温家宝总理在2005年11月7日的全国职业教育工作会议上指出，高等职业教育的发展仍然是薄弱环节，不适应经济社会发展的需要；大力发展高等职业教育，既是当务之急，又是长远大计。《国家教育事业发展“十一五”规划纲要》中提出，要以培养高素质劳动者和技能型人才为重点，提高学生创新精神和实践能力，大力发展职业教育；扩大高等职业教育招生规模，到2010年，使高等职业教育招生规模占高等教育招生规模的一半以上。在以上背景下，我国已进入了新一轮高等职业教育改革的高潮，目前高职院校的学校规模、专业设置、办学条件和招生数量，都超过了历史上任何一个时期。

随着信息社会的到来，灵活应用计算机知识、解决各自领域的实际问题成了当代人必须掌握的技能，为此，高职院校面向不同专业的学生开设了相关的计算机课程。然而，作为高职院校改革核心之一的教材建设大大滞后于高等职业教育发展和社会需求的步伐，尤其是多数计算机应用教材，或显得陈旧，或显得过于偏重理论而忽视应用。以致于一些通过3年学习的高职院校学生毕业后，所掌握的技能不能胜任用人单位的需求。

鉴于此，中国计划出版社与全国高等学校计算机教育研究会课程与教材建设委员会联合在全国1105所高职高专中做了广泛的市场调查，并成立了《21世纪全国高职高专计算机教育“十一五”规划教材》编委会，由全国高等学校计算机教育研究会课程与教材建设委员会主任委员、北京工业大学李大友教授担任编委会主任。编委会进行了大量调查研究，通过借鉴国内外最新的、适用于高职高专教学的计算机技术经验成果，推出了切合当前高职教育改革需要、面向就业的系列职业技术型计算机教材。

系列教材

本计算机系列教材主要涵盖了当前较为热门的以下就业领域：

- 计算机基础及其应用
- 计算机网络技术
- 计算机图形图像处理和多媒体
- 计算机程序设计
- 计算机数据库

- 电子商务
- 计算机硬件技术
- 计算机辅助设计

教材特点

本套教材的目标是全面提高学生的计算机技术实践能力和职业技术素质，为此，中国计划出版社与全国高等学校计算机教育研究会课程与教材建设委员会合作，邀请了来自全国各类高等职业学校的骨干教师（其中很多为主管教学的院长或系主任）作为编委会成员外，还特聘了多位具有丰富实践经验的一线计算机各应用领域工程师参加教材的技术指导和编审工作，以期达到教学理论和实际应用紧密结合的效果。

同时，为配合各学校的精品课程建设工程，本套教材以国家级精品课程指标为指引方向，借鉴其他兄弟出版社的先进经验和成功案例，提出了建设“立体化教学资源平台”的概念，其内容包括教材、教学辅导资料、教学资源包、网络平台等内容，并将在后续培训、论文发表等多方面满足教师与精品课程建设的需求。

本系列教材的特点如下：

（1）面向就业。本系列教材的编写完全从满足社会对技术人才需求和适应高等职业教育改革的角度出发，教材所涉及的内容是目前高职院校学生最迫切需要掌握的基本就业技能。

（2）强调实践。高职高专自身教育的特点是强调实践能力，计算机技术本身也是实践性很强的学科，本系列教材紧扣提高学生实践能力这一目标，在讲解基本知识的同时配套了大量相关的上机指导、实训案例和习题。

（3）资源丰富。本系列教材注重教材的拓展配套，辅助教学资源丰富。除了由本书作为主干教材外，还配有电子课件、实训光盘、习题集和资源网站等辅助教学资源。

读者定位

本计算机应用系列教材完全针对职业教育，主要面向全国的高职高专院校。本系列教材还可作为同等学历的职业教育和继续教育的教学用书或自学参考书。

本系列教材的出版是高职教育在新形势下发展的产物。我们相信，通过精心的组织和编写，这套教材将不仅能得到广大高职院校师生的认可，还会成为一套具有时代鲜明特色、易教易学的高质量计算机系列教材。我们与时俱进，紧密配合高职院校的办学机制和运行体制改革，在后期的组织推广及未来的修订出版中不断汲取最新的教学改革经验和教师学生及用人单位的反馈意见，为国家高等职业教育奉献我们的力量。

丛书编委会

前　言

随着时代的发展，计算机和网络技术已经渗透到人们工作和生活的方方面面。能够读懂计算机英文资料和文献已经成为从事计算机方面工作的人员必须具备的一种能力。本书的编写目的就是为了使学生能够熟悉并掌握计算机方面的基本专业英文词汇，从而提高其在计算机专业英文文献方面的阅读能力，同时也是为了使学生能够具备快速获取新的计算机知识的能力。

本书共分为 4 章。第 1 章讲述了计算机硬件方面的知识，主要包括计算机硬件概述、中央处理器、存储系统、输入/输出系统和总线控制原理。第 2 章讲述了计算机软件方面的知识，分为操作系统软件和应用软件两部分。操作系统部分重点讲述了目前应用最广泛的 Windows 2000、Windows XP 和 Linux 三种操作系统；应用软件重点讲述了 Microsoft Office 软件中应用最多的 Word、Excel 和 PowerPoint，以及一部分多媒体知识。第 3 章讲述了计算机网络方面的知识，主要包括 LAN、WAN、Internet 等相关知识。第 4 章讲述了计算机安全方面的知识，主要包括计算机安全、病毒、防火墙、计算机防御等知识。

每章除了正文以外，还列出了本章的专业词汇对照表及重点词汇的讲解，正文后面的习题可用来对自己的学习情况进行检测。每章后面的阅读材料是对正文内容的补充，有助于加深对正文的理解，扩展知识面。

本书既可作为高职高专院校计算机专业学生的英语教材，也可作为计算机爱好者和自学者的学习参考资料。

本书由申时凯、梁洪波主编，李雷、杨彩卿、康漫红、李丽平、潘铁强担任副主编，葛茜倩、顾理琴、许冬霞、李红梅、刘芳、易竞、宁燕、胡平、王春艳、李菲、邢向荣、辛伯宇、刘建香、林莉、时武略、刘颖、成奋华参与编写。

由于时间仓促与编者水平有限，不足与欠妥之处在所难免，恳请广大读者不吝指正。

编者

2007年6月

目　录

第 1 章

COMPUTER HARDWARE

1.1 GENERAL INTRODUCTION OF COMPUTER HARDWARE

We build computer to solve problems. Early computer solved mathematical and engineering problems, and later computers emphasized information processing for business applications. Today, computers also control machines as diverse as automobile engines, robots, and microwave ovens. A computer system solves a problem from any of these domains by accepting input, processing it, and producing output. Fig.1-1 illustrates the function of a computer system.

Fig.1-1 The three activities of a computer system

Computer systems consist of hardware and software. Hardware is the physical part of the system. Once designed, hardware is difficult and expensive to change. Software is the set of programs that instruct the hardware and is easier to modify than hardware. Computers are valuable because they are general-purpose machines that can solve many different kinds of problems, as opposed to special-purpose machines that can each solve only one kind of problem. Different problems can be solved with the same hardware by supplying the system with a different set of instructions, that is , with different software.

Every computer has four basic hardware components:

- Input devices.
- Output devices.
- Main memory.
- Central processing unit (CPU).

Fig.1-2 shows these components in a block diagram. The lines between the blocks represent the flow of information flows from one component to another on the bus, which is simply a group of wires connecting the components. Processing occurs in the CPU and main memory. The organization, in Fig.1-2, with the components connected to each other by the common bus.

However, other configurations are possible as well.

Computer hardware is often classified by its relative physical size:

- Small microcomputer.
- Medium minicomputer.
- Large mainframe.

Just the CPU of a mainframe often occupies an entire cabinet. Its input/output (I/O) devices and memory might fill an entire room. Microcomputers can be small enough to fit on a desk or in a briefcase. As technology advances, the amount of processing previously possible only on large machines becomes possible on smaller machines. Microcomputers now can do much of the work that only minicomputers or mainframes could do in the past.

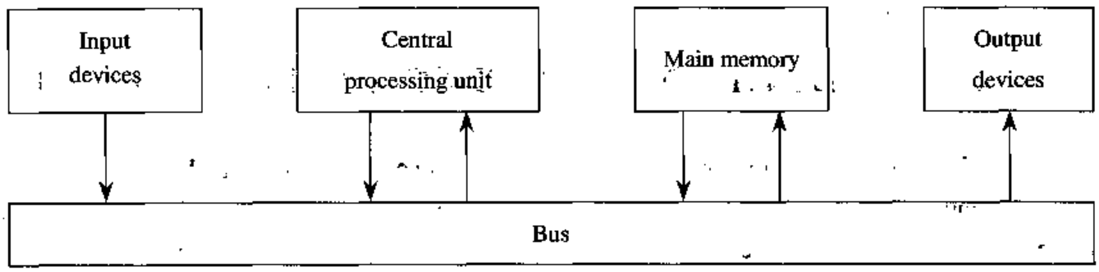

Fig.1-2 Block diagram of the components of a computer system

The classification just described is based on physical size as opposed to storage size. A computer system user is generally more concerned with storage size, because that is a more direct indication of the amount of useful work that the hardware can perform. Speed of computation is another characteristic that is important to the user. Generally speaking, users want a fast CPU and large amounts of storage , but a physically small machine for the I/O devices and main memory.

When computer scientists study problems, therefore, they are concerned with space and time—the space necessary inside a computer system to store a problem and the time required to solve it. They commonly use the metric prefixes of Table 1-1 to express large or small quantities of space or time.

Table 1-1 Prefixes for power of 10

Multiple	Prefix	Abbrev	Multiple	Prefix	Abbrev
10^9	giga-	G	10^{-3}	milli-	m
10^6	mega-	M	10^{-6}	micro-	μ
10^3	kilo-	K	10^{-9}	nano-	n

Example: Suppose it takes 4.5 microseconds, also written 4.5 μs, to transfer some information across the bus from one component to another. (a) How many seconds are required for the transfer? (b) How many transfers can take place during one minute?

(a) A time of 4.5 μs is 4.5×10^{-6} from Table 1-1 0.0000045s. (b) Because there are 60 seconds in one minute, the number of times the transfer can occur is (60s)/(0.0000045s/transfer) or

13 300 000 transfers. Note that since the original value was given with two significant figures, the result should not be given to more than two or three significant figures.

Table 1-1 shows that in the metric system the prefix kilo- is 1000 and mega- is 1 000 000. But in computer science, a kilo- is 2^{10} or 1024. The different between 1000 and 1024 is less than 3%, so you can think of a computer science kilo- as being about 1 000 even though it is a little more. The same applies to mega- and giga-, as in Table 1-2. This time, the approximation is a little worse, but for mega- it is still with in 5%.

Table 1-2 Computer science values of the large prefixes

Prefix	Computer science values
giga-	2^{30}=1 073 741 824
mega-	2^{20}= 1 048 576
kilo-	2^{10}=1 024

KEYWORDS

computer	计算机	input device	输入设备
information processing	信息处理	output device	输出设备
hardware	硬件	main memory	主存储器
software	软件	central processing unit (CPU)	中央处理器
program	程序	bus	总线
general-purpose machine	通用（计算）机	microcomputer	微型计算机
special-purpose machine	专用（计算）机	minicomputer	小型计算机
instruction	指令	mainframe	主机，特大型机
set of instruction	指令集，指令系统		

NOTES

（1）hardware（计算机硬件）。主要包括 CPU、内存、主板、显卡、声卡、键盘，这些构成了计算机的物理部件。

（2）software（计算机软件）。主要包括操作系统、应用程序等在计算机中运行的程序包。

（3）main memory（主存储器）。简称主存。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。

（4）bus（总线）。它是计算机系统各部件之间的一种电连接，信号及电源就是通过它们传输的。信息可以从多个源部件中的任何一个经总线传输到多个目标部件中的任何一个。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，用来传输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：一种用来传输调整系统运行信号的总线。

（5）microcomputer（微型计算机）。通常其存储空间较小，内存较小，运行速度较慢，家庭用或者办公用计算机大多数为微型计算机。

（6）minicomputer（小型计算机）。一种比微型计算机内存大、存储空间大、运行速度快的计算机，通常用于网络服务器或者科学及工程用途。

（7）mainframe（大型计算机）。功能强大的计算机，通常用来进行特别复杂、计算量特别大的数学计算，例如天气模拟等。

（8）set of instruction（指令系统）。指一台计算机中所有指令的集合。

EXERCISES

1. Multiple choices.

（1）When we store a program into a computer, _____is necessary.

A. space　　B. time　　C. input device　　D. output device

（2）Early computer solved______problems.

A. control　　B. business applications

C. engineering　　D. mathematical

（3）We can use prefix micro to express______.

A. time metric　　B. space metric

C. both time and space metric　　D. 10^{-6}

（4）We can say a bus is simply______.

A. a group of wires　　B. a wire

C. a 8-bit bus　　D. a 16-bit bus

（5）A computer system user generally more cares for______.

A. physical size of the computer

B. storage size

C. speed of computation

D. efficiency of the computer

（6）According to the physical size of computers we can classify the computers into______.

A. microcomputer　　B. minicomputer

C. mainframe　　D. supercomputer

（7）Prefix “mega-” used for computer science is_______.

A. larger than 10^6 B. smaller than 10^6

C. equal to 2^{20} D. 1 048 576

(8) The basic hardware components of any computer include_______.

A. CPU B. main memory

C. input devices D. output devices

2. Fill in the blank with appropriate words or phrases found behind this exercise..

(1) A computer system solves a problem by_______.

(2) The amount of effective work of a computer can be indicated by_______directly.

(3) Computer systems consist of_______.

(4) Computer that can solve only one kind of problem is a_______.

(5) Computer that can solve many different kinds of problems is a_______.

(6) _______ instruct the hardware.

(7) _______ is difficult and expensive to change.

(8) We usually show the computer components in a_______.

A. general-purpose machine

B. hardware

C. accepting input, processing problems, and producing output

D. block diagram

E. software

F. storage size

G. special-purpose machine

H. hardware and software

READING MATERIALS

1. Instruction pipeline

Pipeline processing can occur not only in the data stream but also in the instruction stream as well. An instruction pipeline reads consecutive instructions from memory while previous instructtions are being executed in other segments. This causes the instruction fetch and execute phases to overlap and perform simultaneous operations. One possible digression associated with such a scheme is that an instruction may cause a branch out of sequence. In that case the pipeline must be emptied and all the instructions that have been read from memory after the branch instruction must be discarded.

Consider a computer with an instruction fetch unit and an instruction execution unit designed to provide a two-segment pipeline. The instruction fetch segment can be implemented by means of a first-in, first-out (FIFO) buffer. This is a type of unit that forms a queue rather than a stack. Whenever the execution unit is not using memory, the control increments the program counter and uses its address value to read consecutive instruction from memory. The instructions are inserted into the FIFO buffer so that they can be executed on a first-in, first-out basis. Thus an instruction stream can be placed in a queue, waiting for decoding and processing by the execution segment. The instruction l stream queuing mechanism provides an efficient way for reducing the average access time to memory for reading instructions. Whenever there is space in the FIFO buffer, the control unit initiates the next instruction fetch phase. The buffer acts as a queue from which control then extracts the instructions for the execution unit.

Computers with complex instructions require other phase in addition to the fetch and execute to process an instruction completely. In the most general case, the computer needs to process each instruction with the following sequence of steps.

- Fetch the instruction from memory.
- Decode the instruction.
- Calculate the effective address.
- Fetch the operands from memory.
- Execute the instruction.
- Store the result in the proper place.

There are certain difficulties that will prevent the instruction pipeline from operating at its maximum rate. Different segments may take different times to operate on the incoming information. Some segments are kipped for certain operations. For example, a register mode instruction does not need an effective address calculation. Two or more segments may require memory access at the same time, causing one segment to wait until another is finished with the memory. Memory access conflicts are sometimes resolved by using two memory buses for access instructions and data in separate modules. In this way, an instruction word and a data word can be read simultaneously from two different modules.

The design of an instruction pipeline will be most efficient if the instruction cycle is divided into segment of equal duration. The time that each step takes to fulfill its function depends on the instruction and the way it is executed.

2. Supercomputers

A commercial computer with vector instructions and pipeline floating-point arithmetic operations is referred to as a supercomputer. Supercomputers are very powerful, high-performance machines used mostly for scientific computations. To speed up the operation, the components are packed tightly together to minimize the distance that the electronic signals have to travel. Supercomputers also use special techniques for removing the heat from circuits to prevent them from burning up because of their close proximity.

The instruction set of supercomputers contains the standard data transfer, data manipulation, and program control instructions of conventional computers. This is augmented by instructions that process vectors and combinations of scalars and vectors. A supercomputer is a computer system best known for its high computational speed, fast and large memory systems, and the extensive use of parallel processing. It is equipped with multiple functional units and each unit has its own pipeline configuration. Although the supercomputer is capable of general-purpose applications found in all other computers, it is specifically optimized for the type of numerical calculations involving vectors and matrices of floating-point numbers.

Supercomputers are not suitable for normal processing of a typical computer installation. They are limited in their use to a number of scientific applications, such as numerical weather forecasting, seismic wave analysis, and space research. They have limited use and limited market because of their high price.

The first supercomputer developed in 1976 is the Cray-1supercomputer. It uses vector processing with 12 distinct function units in parallel. Each functional unit is segmented to process the incoming data through a pipeline. All the functional units can operate concurrently with operands stored in the large number of registers (over 150) in the CPU. A floating-point operation can be performed on two sets of 64-bit operands during one clock cycle of 12.5 ns. This gives a rate of 80 megaflops during the time that the data are processed through the pipeline. It has a memory capacity of 4 million 64-bit words. The memory is divided into 16 banks, with each bank having a 50ns access time. This means that when all 16 banks are accessed simultaneously, the memory transfer rate is 320 million words per second. Cray research extended its supercomputer to a multiprocessor configuration called Cray X-MP and Cray Y-MP. The new cray2 supercomputer is 12 times more powerful than the cray1 in vector processing mode.

3. The Development of Computer Technology

Whatever you are, a scientist or an apprentice, a farmer or a successful scholar; and whether you are diligent or lazy, old or young; in the modern work, study and life, you always need your honest friends—computers.

The first electronic computers were built in the 1940s. By the early 1970s, they were in common use in large businesses, government, and the military. The largest computers (like the ENIAC=the Electronic Numerical Integrator and Computer) were called mainframes. And typically cost more than a million dollars. Designed for use by a major company or a government installation, they were housed in a large room, and required special electrical cabling and air conditioning.

In the late 1960s and early 1970s, engineers made great strides in reducing the size of electronic components. They developed the semiconductor chip, which was about the size of a fingernail and could contain hundreds of transistors. The semiconductor chips enabled engineers to miniaturize the circuits contained in all electronic devices. Most importantly, it produced a new generation of mainframes and minicomputers with increased capability, greater speed, and smaller size.

In the early 1970s, semiconductor technology progressed to the point where the circuits for the "brain" of a computer (the central processing unit or CPU) could be manufactured on a single semiconductor chip. These miniaturized computers were called microprocessors, and were manufactured by corporations such as Intel and Motorola.

By the mid-1970, several such microcomputers were available to consumers. The first microcomputers were sold in the form of kits, designed for electronic hobbyists. In order for microcomputers to become problem-solving tools, a number of hurdles needed to be overcome. The first was to simplify the program for the machines. One step in this direction was taken by a young Harvard drop-out named Bill Gates, who wrote a version of the programming language BASIC for one of the earliest microcomputers. BASIC had been introduced at Dartmouth College in the mid-1960s by John Kemeny and Kenneth Kurtz. Thus it was a popular programming language on mainframe computers. Gates founded a computer company called Microsoft, which has become one of the major producers of software for microcomputers.

In 1977, Stephen Jobs and Stephen Wozniak, two microcomputer enthusiasts, working in a garage, designed their own microcomputer. This was to be named the Apple. And their fledgling business was to become the Apple Computer Corporation. Business grew at an unprecedented rate. In no time, Apple was selling hundreds and then thousands of machines per month.

One reason behind Apple's success was the availability of a number of useful application programs. The most important of these was spreadsheet VISICALS, which allowed accountants and financial planners to automate many of the calculations that they were accustomed to doing on adding machines, or with pencil and paper. Hours of calculations were thus completed in a matter of seconds. Such raw power did much to convince people that microcomputers were real problem-solving tools, not toys.

At about the same time as the introduction of the Apple II, a number of the microcomputers appeared on the market. One of the most popular was Tandy Corporation's TRS-80. Apple and Tandy were the two largest manufacturers, each with about a 25 percent share of the market.

Early microcomputer users banded together into groups to exchange ideas and to share solutions to problems. A strong spirit of adventure encouraged users to feel they were participating in a major intellectual turning point in computer use. Part of the excitement was created by the unusual mixture of people who participated. In addition to computer scientists and engineers, physicians, business people, and students become microcomputer enthusiasts, at work as well as home. All were interested in the same goal: using microcomputers to solve problems.

So many application packages began to appear around 1980. The first generation programs for word processing, data management, spreadsheets, and communication allowed novice users to experience the power of microcomputing.

However, most corporations underestimated the significance of bringing computing power down to the level of the individual users. This view abruptly changed in 1981 when International Business Machines (IBM), the largest computer company in the world, introduced its own microcomputer, dubbed the IBM PC (PC being the abbreviation for personal computer). The fact that IBM, a company of such corporate prestige, would enter this market convinced businesses that the microcomputer was more than a passing fad. Within a short time, the microprocessor was recognized as a productivity tool to be used by workers at all levels to process, store, retrieve, and analyze information. Almost every business could find a legitimate place for the microcomputer.

Now, there is a light-weight, notebook computer, or portable computer, designed to be moved easily.

4. Number System

A number system of base, or radix, r is a system that uses distinct symbols for r digits. Numbers are represented by a string of digit symbols. To determine the quantity that the number represents, it is necessary to multiply each digit by an integer power of r and then form the sum of all weighted digits. For example, the decimal number system in everyday use employs the radix 10 system. The 10 symbols are 0, 1, 2, 3, 4, 5, 6, 7 ,8, and 9. The string of digits 123.5 is interpreted to represent the quantity

$$1\times10^2+2\times10^1+3\times10^0+5\times10^{-1}$$

That is, 1 hundred, plus 2 tens, plus 3 units, plus 5 tenths. Every decimal number can be similarly interpreted to find the quantity it represents.

The binary number system uses the radix 2. The two digit symbols are 0 and 1. The string of digits 101101 is interpreted to represent the quantity

$$1\times2^5+0\times2^4+1\times2^3+1\times2^2+0\times2^1+1\times2^0=45$$

To distinguish between different radix numbers, the digits will be enclosed in parentheses and the radix of the number inserted as a subscript. For example, to show the equality between decimal and binary forty-five we will write $(101101)_2=(45)_{10}$. Besides the decimal and binary number systems, the octal and hexadecimal are important in digital computer work. The eight symbols of the octal system are 0, 1, 2, 3, 4, 5, 6, and 7. The 16 symbols of the hexadecimal system are 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, A, B, C, D, E, and F. The last six symbols are, unfortunately, identical to the letters of the alphabet and can cause confusion at times. However, this is the convention that has been adopted. When used to represent hexadecimal digits, the symbols A, B, C, D, E, F correspond to the decimalnumbers 10, 11, 12, 13, 14, 15 respectively.

A number in radix r can be converted to the familiar decimal system by forming the sum of the weighted digits. For example, octal 123.5 is converted to decimal as follows:

$$(123.5)_8=1\times8^2+2\times8^1+3\times8^0+5\times8^{-1}=(83.625)_{10}$$

The equivalent decimal number of hexadecimal 2D is obtained from the following calculation:

$$(2D)_{16}=2\times16^1+13\times16^0=(45)_{10}$$

Separating the number into its integer and fraction parts and converting each part separately carry out conversion from decimal to its equivalent representation in the radix r system. The conversion of a decimal integer into a base r representation is done by successive divisions by r and accumulation of the remainders. The conversion of a decimal fraction to radix r representation is accomplished by successive multiplications by r and accumulation of the integer digits so obtained.

The conversion of decimal 38.125 into binary is done by first separating it into its integer