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内容简介

本书包括计算机软件、硬件、计算机应用及新技术发展等内容。选文来自英文书籍、期刊和 Internet 站点。正文由 20 个单元组成,每个单元构成一个专题,分 A、B、C 三部分。另附加 20 个单元的阅读材料,供读者选用。

本书可作为大学本科、专科和中专计算机专业及相关专业学生的教材,也可作为计算机使用者的自学读本。

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Preface

Introduction

This book is designed for students of computer and electrical engineering in first or second semester of the junior year. It can be also used for students from different academic fields.

It is composed of two parts: main reading materials and supplementary reading materials. Each part is composed of 20 units. The passages in each unit are focused on a related topic (e.g., programming language).

Changes from the First Edition

This second edition is a complete rewrite of the first edition in order to keep up with the stupendous development of the computer technology.

These changes have also been driven by the feedback we have received teaching the English for Computer Science.

The following new topics are covered in this second edition:

- Network Computer and New Display Technologies
- Tool Language
- Database
- Data security
- Internet Security
- Data Management and Knowledge Management
- SCSI and Universal Serial Bus
- Several Networks

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PART ONE

Unit One

Passage A

History of Computing

A computer is a device capable of solving problems or manipulating information, according to a prescribed sequence of instructions (or program), using some mechanical or electrical process. Since people first began solving problems thousands of years ago, ways have been sought to simplify various problem-solving tasks. Of primary interest over the millennia has been the automation of arithmetic operations. The advent of computer technology provided an inexpensive way to perform simple arithmetic, and, as the technology matured, computer techniques were rapidly extended to solving complex numeric problems, storing, retrieving, and communicating information, and controlling robots, appliances, automobiles, games, manufacturing plants, and a variety of other processes and machines. What is most amazing is that this computer revolution has occurred all within the past 50 years! The following is a brief synopsis of these developments.

Beginnings: Mechanical Computers

The first computer was probably the abacus, which has been used in the Orient for over 3000 years. This device, still in use today, had little competition until the 1600s when John Napier used logarithms as the basis for a device that multiplied numbers. His work led to the invention of the slide rule. Then, in 1642, Blaise Pascal built an adding machine that had geared wheels much like the modern odometer.

In 1820, Charles Babbage built the first device that used the principles of modern computers. His machine, the difference engine, evaluated polynomials by the method of finite differences. He also conceived a mechanical machine that resembled modern-day computers with a store and arithmetic unit. However, the precision required for constructing the mechanical gears was beyond the capabilities of the craftsmen of his time.

Early Electronic Computers

The first real progress toward electronic digital computers came in the late 1930s when Howard Aiken of Harvard University and George Slibitz of Bell Telephone Laboratories developed an automatic calculator using relay networks; the relay is an electromagnetically controlled switch.

Other relay machines were developed during World War II for artillery ballistic calculations. Although these machines were relatively slow and comparatively large, they demonstrated the versatility of the electronic computer. Then, in the early 1940s, John Mauchly and J. Prosper Eckert, Jr., of the University of Pennsylvania designed and built a vacuum tube computer, which they called the electronic numerical integrator and calculator (ENIAC); it was completed in 1945 and installed at Aberdeen Proving Ground, Maryland. ENIAC Used 18,000 electron tubes, which required tremendous amounts of power; its failure rate was high and it was difficult to program because a plugboard was required.

Three very important discoveries were then made, which began the rapid evolution toward today's digital computer. First, John von Neumann proposed that the program reside in the computer's memory where it could be changed at will, solving the programming difficulties of ENIAC; second, in 1947 the transistor was invented by John Bardeen, Walter H. Brattain, and William Shockley, which drastically reduced the size and power requirements by replacing the electron vacuum tube; and, third, J. W. Forrester and his associates at the Massachusetts Institute of Technology developed the magnetic core memory, which made large amounts of storage feasible.

The First Four Generations of Computers

ENIAC and other vacuum tube computers appearing in the late 1940s and through the 1950s have been labeled first-generation digital computers. The advent of transistors in the late 1950s brought about the second generation of machines, which were smaller in size and faster and featured increased capabilities over their ancestors. In the late 1960s and throughout the 1970s, the third generation of machines appeared. These machines are characterized by their use of integrated circuits consisting of subminiature packages of multiple transistor circuits, which provided still another drastic reduction in size. Improvements in packaging and memory technology also contributed to the improved third-generation machines.

The late 1960s also brought the emergence of the minicomputer. In addition to large complex machines, often called mainframes, many manufacturers offered these smaller, limited-capability, general-purpose computers. Minicomputers, which derived their name from their size and cost, have been used in many diverse applications and have played a major role in popularizing the use of computers. The minicomputer widely increased computer usage in the scientific and engineering communities. Machines found their way into industrial and university research laboratories. Computerized process control in industry became commonplace.

The fourth generation of computers was ushered in during the late 1970s and early 1980s with the appearance of machines based on large scale integrated (LSI) and very large scale integrated (VLSI) circuit hardware components. VLSI made it feasible to build small but powerful computers known as personal computers or workstations. The central component of these machines is the microprocessor, which is an entire central processing unit of a computer implemented in a single VLSI component. Intel Corporation and Motorola have led the way in microprocessor technology development.

Perhaps the appearance of personal computers such as the IBM Personal Computer, based on Intel microprocessors, and the Apple Macintosh, based on Motorola microprocessors, has had the most dramatic impact on expanding the range of computer applications than has any other occurrence. Before the personal computer became widespread, one could safely say that most computers were used by computer experts. Now computers are commonly used by experts and nonexperts alike. Computer networks have become commonplace during the fourth generation as well. Networks have increased access to computer and have spawned new applications, such as electronic mail.

The Fifth Generation and Beyond

When will the fifth generation of computers begin? Or has it already begun? Using the classical measure, the switch to a new hardware technology base, the answer is no. But should hardware technology be the only indicator of computer generations? Probably not. It is clear that advances in software have had profound effects on the way computers are used. New user interfaces, such as voice activation, or new computational paradigms, such as parallel processing and neural networks, may also characterize the next-generation machine. Whatever the case may be, it is likely that parallel processing, artificial intelligence, optical processing, visual programming, and gigabit networks will play key roles in computer systems of the future. We will likely be in the fifth generation of computers for some time before it becomes apparent.

Passage B

The PC Explosion

A veritable explosion of personal computers occurred, starting with Steve Jobs and Steve Wozniak exhibiting the first Apple II at the First West Coast Computer Fair in San Francisco. The Apple II boasted built-in BASIC, colour graphics, and a 4100 character memory for only $ 1298. Programs and data could be stored on an everyday audio-cassette recorder. Before the end of the fair, Wozniak and Jobs had secured 300 orders for the Apple II and from there Apple just took off.

Also introduced in 1977 was the TRS-80. This was a home computer manufactured by Tandy Radio Shack. In its second incarnation, the TRS-80 Model II, came complete with a 64, 000 character memory and a disk drive to store programs and data on. At this time, only Apple and TRS had machines with disk drives. With the introduction of the disk drive, personal computer applications took off , as a floppy disk was a most convenient publishing medium for distribution of software.

IBM, which up to this time had been producing mainframes and minicomputers for medium to large-sized businesses, decided that it had to get into the act and started working on the Acorn, which would later be called the IBM PC. The PC was the first computer designed for the home market which would feature modular design so that pieces could easily be added to the architecture. Most of the components, surprisingly, came from outside of IBM, since building it with IBM parts would have cost too much for the home computer market. When it was introduced, the PC came with a 16,000 character memory, keyboard from an IBM electric typewriter, and a connection for tape cassette player for $ 1265.

By 1984, Apple and IBM had come out with new models. Apple released the first generation Macintosh, which was the first computer to come with a graphical user interface (GUI) and a mouse. The GUI made the machine much more attractive to home computer users because it was easy to use. Sales of the Macintosh soared like nothing ever seen before. IBM was hot on Apple's tail and released the 286-AT, which with applications like Lotus 1-2-3, a spreadsheet, and Microsoft Word, quickly became the favourite of business concerns.

That brings us up to about ten years ago. Now people have their own personal graphics workstations and powerful home computers. The average computer a person might have in their home is more powerful by several orders of magnitude than a machine like ENIAC. The computer revolution has been the fastest growing technology in man's history.

As an example of the wonders of this modern-day technology, let's take a look at this presentation. The whole presentation from start to finish was prepared on a variety of computers using a variety of different software applications. An application is any program that a computer runs that enables you to get things done. This includes things like word processors for creating text, graphics packages for drawing pictures, and communication packages for moving data around the globe.

The colour slides that you have been looking at were prepared on an IBM 486 machine running Windows. Windows is a type of operating systems. Operating systems are the interface between the user and the computer, enabling the user to type high-level commands such as "format a:" into the computer, rather that issuing complex assembler or C commands. Windows is one of the numerous graphical user interfaces around that allows the user to manipulate their environment using a mouse and icons. Other examples of graphical user interfaces (GUIs) include X-Windows, which runs on UNIX machines such as Hercules, or System 7, which is the operating system of the Macintosh.

Once Windows was running, I used a multimedia tool called Freelance Graphics to create the slides. Freelance, from Lotus, allows the user to manipulate text and graphics with the explicit purpose of producing presentations and slides. It contains drawing tools and numerous text placement tools. It also allows the user to import text and graphics from a variety of sources. A number of the graphics used are from clip art collections off of a CD-ROM.

The text for the lecture was also created on a computer. Originally, I used Microsoft Word, which is a word processor available for the Macintosh and for Windows machines. Once I had typed up the lecture, I decided to make it available, slides and all, electronically by placing the slides and the text onto my local Web server at the University.

Passage C

Web and Web Server

The Web (or more properly, the World Wide Web) was developed at CERN in Switzerland as a new form of communicating text and graphics across the Internet making use of the hypertext markup language (HTML) as a way to describe the attributes of the text and the placement of graphics, sounds, or even movie clips. Since it was first introduced, the number of users has blossomed and the number of sites containing information and searchable archives has been growing at an unprecedented rate. The web can be used for:

Looking up information on publication.

Finding out about research and staff at various universities.

Downloading pictures, games, and other files.

It is now even possible to order your favourite pizza in Santa Cruz via the Web!

The actual workings of a Web server are beyond the scope of this course but knowledge of two things is important: 1) In order to use the Web, someone needs to be running a Web server on a machine for which such a server exists, and 2) the local user needs to run an application program to connect to the server; this application is known as a client program. Server programs are available for UNIX machines such as Hercules, Chiron, and Meena. Server programs are available for the Macintosh. Client programs are available from NCSA for UNIX, Windows, and the Macintosh, which provide a graphical interface for the Web and allow the user to view pictures.

As mentioned earlier, servers contain files full of information about courses, research interests and games, for example. All of this information is formatted in a language called HTML (hypertext markup language). HTML allows the user to insert formatting directives into the text, much like some of the first word processors for home computers. Anyone who is currently taking English 100 or has taken English 100 knows that there is a specific style and format for submitting essays. The same is true of HTML documents.

More information about HTML is now readily available everywhere, including in your local bookstore.

Web Switches

In enterprise networks, the name of the game is getting packets from point A to point B fast. By speeding IP packet forwarding, conventional Layer 3 and Layer 4 switches have greatly improved network performance. But businesses such as Web and content hosting, and electronic commerce services, depend on fast, reliable, error-free Web performance.

Enter a technique called Web switching. Web switching is designed to address the requirements of Web traffic. Web switches intercept all traffic destined for a particular site. As a result, these switches have the ability to track content requests and predict heavy traffic loads before servers become overwhelmed.

Armed with URL load-balancing capabilities, Network Address Translation, and embedded Domain Name System intelligence, the switches use complex policies to manage and speed Web traffic flow.

Web switches are able to quicken the pace of Web traffic because they use URLs, in addition to IP addresses, to make switching decisions. URLs provide a method of identifying content wherever it is on the Internet. A URL identifies only the content requested; It does not dictate where the content might be found. So instead of viewing the IP address associated with the URL as the network address, this address points to the virtual IP address (VIP) of the Web switch, which functions as a cache or content traffic manager. The result: a consistently positive performance for Web site users.

Current load-balancing servers or devices, including Layer 4 switches, route incoming packets based on the destination IP address or the combination of destination IP address, protocol ID and transport port number. This can be problematic in a Web environment. To a Layer 4 load-balancing device, Web applications appear to be using TCP port 80 — the typical TCP port for HTTP traffic — making Web application traffic indistinguishable from HTTP traffic.

Port numbers are a staple of TCP/IP communications. Because several application programs may be running on one machine and using a single network interface, TCP needs to keep track of what data goes to which program. This is done by assigning a port number to every TCP connection. Each TCP session has a destination port number in the TCP header. When a TCP segment is received, the TCP router knows which port to pass it to by looking at the port number in the TCP header. Some standard port numbers are: Telnet, port 23; Simple Mail Transfer Protocol Mail, Port 25; and Post Office Protocol 3 Mail, port 110.

Typically with Layer 4 switching, a Common Gateway Interface request looks no different than a Web-enabled SAP application or streaming audio request, even though all of these requests have very different quality of service (QoS) requirements.

In contrast, Web switches use URLs to route incoming TCP or User Datagram Protocol (UDP) flows to targeted servers. By looking into the HTTP payload down to the URL and cookie, a Web switch knows what content is being requested. With this knowledge, user-defined and/or pre-set policies determine which flow-security rules are enforced, which content is allowed or denied, and which QoS requirements are needed for specific content or users.

Web switches also dynamically replicate hot content to a Web cache and bring the cache into the load-balancing rotation, ensuring that users get the information they need no matter how much traffic is traversing the site.

Related Words

Aberdeen	n. 阿伯丁,阿伯丁郡
activation	n. 活化,激活,[化]活化作用
adding machine	n. 加法机,算术计算机
architecture	n. 建筑,建筑学 体系机构
boast	n. 自夸,值得夸耀的事物　v. 自夸,以有...而自豪
client	n. [计]顾客,客户,委托人
come out with	v. 发表,宣布,把...投入市场
commonplace	n. 平凡的事,普遍(常见)现象　adj. 平凡的
comparatively	adv. 比较地,相当地
craftsmen	n. 技工
demonstrate	vt. 示范,证明,论证　vi. 示威
desktop	n. [计] 桌面, 桌上型电脑

drastic	adj. 激烈的,(药性等)猛烈的
drastically	adv. 激烈地,彻底地
EDSAC	电子数据存储自动计算机
enforce	vt. 实施,强迫
ENIAC	n. 电子数字积分计算机,ENIAC 计算机
fair	n. 美好的事物,美人,展览会
finite	adj. 有限的,[数]有穷的,限定的
gear	n. 齿轮,传动装置　v. 调整,(使)适合,换档
GUI	n. [计] 图形用户界面
Harvard	美国哈佛大学
HTML	Hypertext Markup Language,超文本链接标示语言
HTTP	abbr. Hypertext Transfer Protocol, WWW 服务程序所用的协议
indistinguishable	adj. 不能辨别的,不能区别的
intricate	adj. 复杂的,错综的,难以理解的
logarithm	n. [数] 对数
Macintosh	n. Apple 公司于 1984 年推出的一种系列微机麦金托什机
magnetic	adj. 磁的,有磁性的,有吸引力的
magnitude	n. 大小,数量,巨大,广大,量级
millennium	n. 太平盛世,一千年,黄金时代
multimedia	n. 多媒体,多媒体的采用
navigational	adj. 航行的,航海的
NCSA	(美国) 全国英语教师理事会
neural	adj. 神经系统的,神经中枢的,背的
odometer	n. 里程表,里程计
origin	n. 起源,由来,起因,出身,血统,[数]原点
overwhelm	vt. 淹没,覆没,受打击,制服,压倒
paradigm	n. 模系,范例
Pennsylvania	n. 宾夕法尼亚州(美国州名)
plugboard	n. 线路连接板,插头板,插件
polynomial	n. 多项式,由 2 字以上组成的学名
prehistoric	adj. 史前的,陈旧的
presentation	n. 介绍,陈述,赠送,表达
problematic	adj. 问题的,有疑问的
profound	adj. 深刻的,意义深远的,渊博的,造诣深的
purchaser	n. 买方,购买者
release	v. 让与,免除,发表　n. 版本,发布
rudimentary	adj. 根本的,未发展的
server	n. 服务器
session	n. 对话,对话期
slide rule	计算尺

soar	v. 高飞,高丛,滑翔,剧增,昂扬
staple	n. 钉书钉,主要产品(或商品),原材料,主要部分
synopsis	n. 大纲,提要(对照表),说明书
take off	v. 拿掉,取消,脱衣,起飞
transistor	n. [电子]晶体管
tube	n. 管,管子,[英] 地铁,<美> 电子管,显像管
UDP	abbr. User Datagram Protocol 用户数据报协议
UNIX	一种多用户的计算机操作系统
URL	abbr. Uniform Resource Locator,在 Internet 的 WWW 服务程序上用于指定信息位置的表示方法
usher	n. 引座员,招待员,传达员,前驱 vt.引导,展示
vacuum	n. 真空,空间,真空吸尘器
von	prep. (=from of)(常加在姓前)
Web	World Wide Web
X-Windows	(一种基于网络,客户/服务器模型的)图形窗口系统

Unit Two

Passage A

Organization of a Stored Program Digital Computer

Now that we have been introduced to the basic elements used to construct digital logic circuits, let us take a look at the organization of a digital computer. A digital computer is a system whose functional elements consist of arithmetic/logic units (ALUs), control units, memory or storage units, and input/output (I/O) equipment. The interaction of these elements is shown in Fig1. Every computer system has a native set of instructions, called machine instructions that specify operations to be performed on data by the ALU and other interactions between the ALU, memory, and I/O devices. The memory elements contain the data plus a stored list of machine instructions called a program.

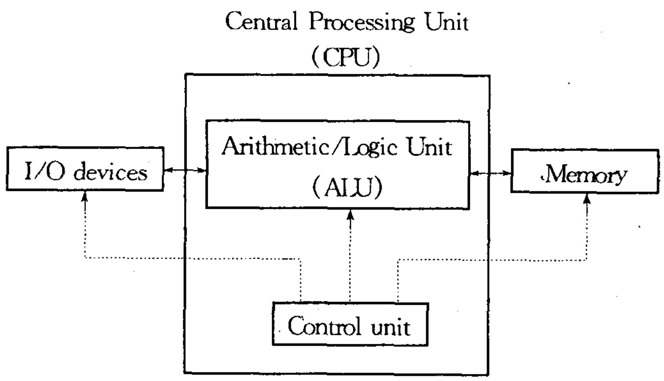

Figure 1 High-lever organization of a digital computer

The control unit coordinates all operations of the ALU, memory, and I/O devices by continuously cycling through a set of operations that cause instructions to be fetched from memory and executed. The instruction cycle of a simple digital computer, illustrated in Fig2, includes the following basic steps:

1. Fetch the next instruction of the current program from memory into the control unit.
2. Decode the instruction; that is, determine which machine instruction is to be executed.
3. Fetch any operands needed for the instruction from memory or from input devices.
4. Perform the operation indicated by the instruction.
5. Store in memory any results generated by the operation, or send the results to an output device.

Instructions are taken from memory in sequential order unless a special kind of instruction is encountered called, synonymously, a branch, jump, skip, or transfer. The branch instructions allow looping and decision-making programs to be written.

Figure2 Instruction cycle of a stored program computer

Computer Instructions

As the control unit of a digital computer fetches an instruction from memory for execution, several types of operations may result.

1. Arithmetic instructions cause the binary data to be added, subtracted, multiplied, or divided as specified by the computer programmer in the program.

2. Test and compare operations are available and determine the relation (greater than, less than, equal to, or other) of two pieces of binary data.

3. Branch or skip instructions may be employed that alter the sequential nature of program execution, based on the results of a test or compare. This type of function adds considerable flexibility to programs.

4. Input and output commands are included for reading messages into the computer, writing messages from the computer, and controlling peripheral devices.

5. Logical and shifting operations provide the computer with the ability to translate and interpret all the different codes it uses. These instructions allow bit manipulation to be accomplished under program control.

All instructions for any digital computer may be grouped into one of these five categories.

Information Representation in Computers

We have briefly discussed the instructions and data stored in the digital computer's memory unit, but no mention was made of the form of these items. Information in a computer system can generally be divided into three categories: numeric data, nonnumeric data, and instruction codes.

Numeric Data Representation

Numbers are stored in the computer's memory in the binary (base 2) number system. Binary numbers are written using the two binary digits (bits), 1 and 0. By contrast, we use 10 decimal digits in writing decimal numbers.

For example, 129 in decimal means $1\times10^2+2\times10^1+9\times10^0$, or each digit's position represents a weighted power of 10. Note that the 10 digits are 0 through $10-1=9$. Each digit in a binary number, say 1101 is represented by a weighted power of 2, or $1\times2^3+1\times2^2+0\times2^1+1\times2^0$. To convert the binary number to decimal, this weighted sum is determined as $(1101)_2=1\times8+1\times4+0\times2+1\times1=(13)_{10}$ or one-one-zero-one in binary equals 13 in decimal.

Data in the form of binary numbers are stored in registers in the computer and are represented as follows:

1011000111

This is a 10-bit register, which might reside in the arithmetic or memory unit. In memory, the data in a single register are called a word (the word length is 10 bits in this example). Patterns of ones and zeros are the only information that can be stored in a computer's registers or memory. The assignment of a meaning to the bit patterns is called coding, and the codes used in most computers for data are simply variations of the binary weighting scheme just presented.

Nonnumeric (Input/Output) Codes

Although the computer employs binary data, users prefer alphabetic and numeric data representations, for example, records of sales, lists of names, or test grades. The set of alphanumeric symbols allowed for many computers is called the character set and has a special binary-like code called the American Standard Code for Information Interchange (ASCII). In this code the alphanumeric and other special characters (punctuation, algebraic operators, and the like) are coded with 8 bits each. Suppose we wanted to give the digital computer a message "ADD 1". This message has five characters, the fourth one being a space or blank. In the ASCII code our message becomes

Symbol	ASCII Code
A	01000001
D	01000100
D	01000100
	00100000
1	00110001

After our message is sent to the computer, a program in the computer memory accepts it and acts accordingly.

Instruction Codes

The computer's instructions reside in main memory and therefore, by definition, are also represented by patterns of ones and zeros. The instructions are generally broken down into subfields that are coded separately. These subfields are the operation code (op code) and the memory address. The operation code specifies the specific function to be performed.

Passage B

Computer Hardware

Now, let us further examine the interaction of the computer's components shown in Fig1. Programs are stored in the computer's memory as discussed previously. However, the programs are inserted into memory by the control unit in conjunction with the input/output (I/O) equipment, sometimes called peripheral devices. Programs are usually given to the computer from magnetic or optical peripheral storage devices. The computer then fetches the instructions of the program from memory and executes them. Data to be used by a program are likewise transferred into memory from keyboards, scanners, magnetic disks, and other peripheral devices.

Control Unit

The control unit follows the stored list of instructions, directing the activities of the arithmetic unit and I/O devices until the program has run to completion. Each unit performs its task under the synchronizing influence of the control unit.

Arithmetic/Logic Unit

Arithmetic/logic units (ALUs) are combinational or sequential logic circuits that perform various operations on data, as instructed by the control unit. Each ALU is characterized by the type of data that it can manipulate and the set of operations that it can perform on those data. Most ALUs support operations on integers of various sizes and may also include operations to manipulate; fixed-point and floating-point numbers and various nonnumeric data. Typical ALU operations include the following:

. Arithmetic: add, subtract, multiply, divide.

. Logical: AND, OR, exclusive-OR, complement.

. Shift and rotate data.

. Convert data from one type to another.

Control unit and ALU circuits are usually constructed from semiconductor devices packaged in a wide variety of schemes. Models of the second generation have transistors, resistors, diodes, and so on, mounted on printed circuit boards, while models of the third generation use small scale integrated circuits on circuit boards. Fourth-generation machines use large scale and very large scale integrated circuits.

Memory Units

Computer memory units are classified as primary memory if they can be accessed directly by the control unit; otherwise they are classified as secondary memory.

Primary memory units in today's digital computers are usually constructed using high-speed semiconductor elements called RAMs (random access memory) and ROMs (read-only memory). Most systems built prior to 1980, some of which are still in operation today, utilized arrays of magnetic cores as their primary memory elements. A few specialized systems, particularly in space vehicles, utilized plated wire as a replacement for magnetic core in some applications where radiation hardness was required.

Memory units are divided into cells called words, and each cell is known by its physical location, or memory address. The concept of a memory address for a memory cell is equivalent to a mailing address for a mailbox. For example, every post office has rows of mailboxes, each identified by a unique numbered position. Similarly, each memory cell resides in a unique numbered position, the number being the memory address.

Memory units may be characterized by their access and cycle times; memory access time may be defined as the length of time required to extract (read) a word from the memory, and memory cycle time may be defined as the minimum interval of time required between successive memory