Unit 1 Hardware Knowledge

1.1 Hardware Basics

1.1.1 Text A

Combinational Circuit

A combinational circuit is a connected arrangement of logic gates with a set of inputs and outputs. At any given time, the binary values of the outputs are a function of the binary combination of the inputs. A block diagram of a combinational circuit is shown in Fig. 1-1. The *n* binary input variables come from an external source, the *m* binary output variables go to an external destination, and in between there is an interconnection of logic gates. A combinational circuit transforms binary information from the given input data to the required output data. [1]

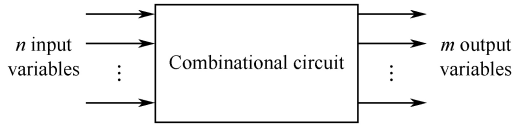

Fig. 1-1 A block diagram of a combinational circuit

A combinational circuit can be described by a truth table showing the binary relationship between the *n* input variables and the *m* output variables. The truth table lists the corresponding output binary values for each of 2^n input combination. A combinational circuit can also be specified with *m* Boolean functions, one for each output variable. [2] Each output function is expressed in terms of the *n* input variables.

Logic Systems

In a DC, or level-logic system, a bit is implemented as one of two voltage levels. If the more positive voltage is the 1 level and the other is the 0 level, the system is said to employ DC positive logic. [3] On the other hand, a DC negative-logic system is one which designates the more negative voltage state of the bit as the 1 level and the more positive as the 0 level. It should be emphasized that the absolute values of the two voltages are of no significance in these definitions. In particular, the 0 state need not represent a zero voltage level (although in some systems it might).

The parameters of a physical device are not identical from sample to sample, and they also vary with temperature. Furthermore, ripple or voltage spikes may exist in the power supply or ground leads, and other sources of unwanted signals, called noise, may present in the circuit. For these reasons, the digital levels are not specified precisely, but each state is defined by a voltage range about a designated level, such as 4V±1V and 0.2V±0.2V.

In a dynamic, or pulse-logic system, a bit is recognized by the presence or absence of a pulse. A 1 signifies the existence of a positive pulse in a dynamic positive-logic system; a negative pulse denotes a 1 in a dynamic negative-logic system. In either system a 0 at a particular input (or output) at a given instant of time designates that no pulse is present at that particular moment.

Logic Circuits

The design of digital computers is based on a logical methodology called Boolean Algebra which uses three basic operations: logical addition, called the OR function; logical multiplication, called the AND function; and logical complementation, called the NOT function. The variables in Boolean algebra are binary, namely, the resulting variable of an operation or a set of operations can have only one of the two values: One or Zero. These two values may also be interpreted as being True or False, Yes or No, and Positive or Negative.

A switch is ideally suited to represent the value of any two-state variable because it can only be “off” or “on”. [4]

There are only three basic logic operations: the conjunction (logical product) commonly called AND; the disjunction (logic sum) commonly called OR; and the negation commonly called NOT.

Key Words

arrangement	排列，整理
combinational	组合的，合并的
complementation	互补，补足
conjunction	结合，联合，联系
designate	指出，指明
diagram	图形，图解
disjunction	分离，析取
interconnection	互连网络
methodology	方法学，方法论
multiplication	倍增，乘法运算
negation	否定，拒绝
negative-logic	负逻辑
represent	表示，代表
ripple	脉动，波动

significance	重要性，意义
spike	尖峰信号

Notes

[1] A combinational circuit transforms binary information from the given input data to the required output data.

说明：本句的介词短语“from…to…”是宾语补足语，进一步说明宾语“binary information”。

译文：组合电路通过传输二进制信息，使得给定的输入数据产生了所需要的输出数据。

[2] A combinational circuit can also be specified with *m* Boolean functions, one for each output variable.

说明：本句的“one for each output variable”是同位语。

译文：组合电路也能规定 *m* 种布尔函数，每种函数对应一个输出变量。

[3] If the more positive voltage is the 1 level and the other is the 0 level, the system is said to employ DC positive logic.

说明：本句的“If the more positive voltage…”是条件状语。“the system is said to…”用被动语态表示客观叙述。

译文：如果较高的电压为 1 电平，而另一个是 0 电平，则称该系统使用的是直流正逻辑。

[4] A switch is ideally suited to represent the value of any two-state variable because it can only be “off” or “on”.

说明：本句的 because it can only be “off” or “on”是原因状语从句。

译文：因为开关只能是“关”或“开”两个状态，所以它最适合表示两个状态的变量值。

1.1.2 Text B

Bill Gates is an American business magnate, computer programmer and philanthropist. Gates is the former chief executive officer and current chairman of Microsoft, the world’s largest personal-computer software company, which he co-founded with Paul Allen. He is consistently ranked among the world’s wealthiest people and was the wealthiest overall from 1995 to 2007. During his career at Microsoft, Gates held the positions of CEO and chief software architect, and remains the largest individual shareholder, with 8 percent of the common stock. He has also authored or co-authored several books.

Gates is one of the best-known entrepreneurs of the personal computer revolution. In the later stages of his career, Gates has pursued a number of philanthropic endeavors, donating large amounts of money to various charitable organizations and scientific research programs through the Bill & Melinda Gates Foundation, established in 2000.

Gates was born in Seattle, Washington. His father was a prominent lawyer, and his mother served on the board of directors for First Interstate BancSystem. At 13 he enrolled in the Lakeside School, an exclusive preparatory school. Gates graduated from Lakeside School in

1973. He scored 1590 out of 1600 on the SAT and enrolled at Harvard College in the autumn of 1973. While at Harvard, he met Steve Ballmer, who later succeeded Gates as CEO of Microsoft.

In his sophomore year, Gates devised an algorithm for pancake sorting as a solution to one of a series of unsolved problems presented in a combinatorics class by Harry Lewis, one of his professors. Gates's solution held the record as the fastest version for over thirty years; its successor is faster by only one percent. His solution was later formalized in a published paper in collaboration with Harvard computer scientist Christos Papadimitriou.

Pancake sorting is a variation of the sorting problem in which the only allowed operation is to reverse the elements of some prefix of the sequence. Unlike a traditional sorting algorithm, which attempts to sort with the fewest comparisons possible, the goal is to sort the sequence in as few reversals as possible. This operation can be visualized by thinking of a stack of pancakes in which one is allowed to take the top k pancakes and flip them. A variant of the problem is concerned with burnt pancakes, where each pancake has a burnt side and all pancakes must, in addition, end up with the burnt side on top.

Gates did not have a definite study plan while a student at Harvard and spent a lot of time using the school's computers. Gates remained in contact with Paul Allen, and he joined him at Honeywell during the summer of 1974. The following year saw the release of the MITS Altair 8800 based on the Intel 8080 CPU, and Gates and Allen saw this as the opportunity to start their own computer software company. Gates dropped out of Harvard at this time. He had talked this decision over with his parents, who were supportive of him after seeing how much Gates wanted to start a company.

After reading the January 1975 issue of Popular Electronics that demonstrated the Altair 8800, Gates contacted Micro Instrumentation and Telemetry Systems (MITS), the creators of the new microcomputer, to inform them that he and others were working on a BASIC interpreter for the platform. In reality, Gates and Allen did not have an Altair and had not written code for it; they merely wanted to gauge MITS's interest. MITS president Ed Roberts agreed to meet them for a demo, and over the course of a few weeks they developed an Altair emulator that ran on a minicomputer, and then the BASIC interpreter.

The demonstration, held at MITS's offices in Albuquerque was a success and resulted in a deal with MITS to distribute the interpreter as Altair BASIC. Paul Allen was hired into MITS, and Gates took a leave of absence from Harvard to work with Allen at MITS in Albuquerque in November 1975. They named their partnership "Micro-Soft" and had their first office located in Albuquerque. Within a year, the hyphen was dropped, and on November 26, 1976, the trade name "Microsoft" was registered with the Office of the Secretary of the State of New Mexico. Gates never returned to Harvard to complete his studies.

Gates stepped down as chief executive officer of Microsoft in January 2000. He remained as chairman and created the position of chief software architect. In June 2006, Gates announced that he would be transitioning from full-time work at Microsoft to part-time work, and full-time

work at the Bill & Melinda Gates Foundation.

Key Words

charitable	仁爱的，慈善的
endeavor	努力，尽力
entrepreneur	企业家，创业人
foundation	基金，基础，建设
hyphen	连字号，连字符
interpreter	解释器，翻译程序
pancake	薄煎饼，烙饼
philanthropist	慈善家
preparatory	预备的，准备的，筹备的
release	发布，放开
shareholder	股东
wealthiest	富人

1.1.3 Exercises

1. Translate the following phrases into English

(1)逻辑电路

(2)输出变量

(3)二进制信息

(4)组合电路

(5)正向脉冲

2. Translate the following phrases into Chinese

(1)Boolean Algebra

(2)chief executive officer

(3)full-time work

(4)Harvard College

(5)scientific research program

3. Identify the following to be True or False according to the text

(1)In a DC, or level-logic system, a bit is implemented as one of two voltage levels.

(2)Gates stepped down as chief executive officer of Microsoft in January 2010.

(3)In a pulse-logic system a bit is not recognized by the presence or absence of a pulse.

(4)The output values are a function of the combination of the inputs in a combination circuit.

(5)Gates had a definite study plan while a student at Harvard.

4. Reading Comprehension

(1)The parameters of a physical device are not identical from sample to sample, and they also vary with _____.

a. height

b. weight

c. temperature

d. length

(2)Unlike a traditional sorting _____, which attempts to sort with the fewest comparisons possible, the goal is to sort the sequence in as few reversals as possible.

a. algorithm

b. data

c. sequence

d. computer

(3)A combinational circuit transforms _____information from the given input data to the required output data.

a. hexadecimal

b. binary

c. octal

d. decimal

(4)The _____lists the corresponding output binary values for each of 2^n input combination.

a. paper

b. truth list

c. table

d. truth table

1.2 Central Processing Unit

1.2.1 Text A

The basic job of computers is the processing of information. For this reason, computers can be defined as devices which accept information in the form of instructions called a program and characters called data, perform mathematical and logical operations on the information, and then supply results of these operations. The program, which tells the computers what to do and the data, which provide the information needed to solve the problem, are kept inside the computer in a place called memory. [1]

Computers are thought to have many remarkable powers. However, most computers, whether large or small, have three basic capabilities.

First, computers have circuits for performing arithmetic operations, such as addition, subtraction, division, multiplication and exponentiation.

Second, computers have a means of communicating with the user. After all, if we couldn't feed information in and get results back, these machines would not be of much use.

Third, computers have circuits which can make decisions. The kinds of decisions which computer circuits can make are of the type: Is one number less than another? Are two numbers equal? And, is one number greater than another?

A CPU can be a single microprocessor chip, a set of chips, or a box of boards of transistors, chips, wires, and connectors. Differences in CPUs distinguish mainframes, mini-computers and micro-computers. A processor is composed of two functional units: a control unit and an arithmetic/logic unit, and a set of special workspaces called registers.

The control unit

The control unit is the functional unit that is responsible for supervising the operation of the entire computer system. In some ways, it is analogous to a telephone switchboard with intelligence because it makes the connections between various functional units of the computer system and calls into operation each unit that is required by the program currently in operation. The control unit fetches instructions from memory and determines their type or decodes them. It then breaks each instruction into a series of simple small steps or actions. By doing this, it controls the step-by-step operation of the entire computer system.

The Arithmetic/Logic Unit

The Arithmetic/Logic Unit (ALU) is the functional unit that provides the computer with logical and computational capabilities.[2] Data are brought into the ALU by the control unit, and the ALU performs whatever arithmetic or logic operations are required to help carry out the instructions. Arithmetic operations include adding, subtracting, multiplying, and dividing. Logic operations make a comparison and take action based on the results. For example, two numbers might be compared to determine if they are not equal. If they are equal, processing will continue; if they are not equal, processing will stop.

Registers

A register is a storage location inside the processor. Registers in the control unit are used to keep track of the overall status of the program that is running. Control unit registers store information such as the current instruction, the location of the next instruction to be executed, and the operands of the instruction. In the ALU, registers store data items that are added, subtracted, multiplied, divided, and compared. Other registers store the results of arithmetic and logic operations.

Instruction

An instruction is made up of operations that specify the function to be performed and operands that represent the data to be operated on. For example, if an instruction is to perform the operation of adding two numbers, it must know what the two numbers are and where the two numbers are. [3] When the numbers are stored in the computer's memory, they have an address to indicate where they are, so if an operand refers to data in the computer's memory it is called an address. The processor's job is to retrieve instructions and operands from memory and to perform each operation. Having done that, it signals memory to send it the next instruction.

The CPU executes each instruction in a series of small steps:

1. Fetch the next instruction from memory into the instruction register.
2. Change the program counter to point to the following instruction.
3. Determine the type of instruction just fetched.
4. If the instruction uses data in memory, determine where they are.
5. Fetch the data into internal CPU registers.
6. Execute the instruction.
7. Store the results in the proper place.

Go to step 1 to begin executing the following instruction.

This sequence of steps is frequently referred to as the fetch-decode-execute cycle. It is central to the operation of all computers. This step-by-step operation is repeated over and again at awesome speed. A timer called a clock releases precisely timed electrical signals that provide a regular pulse for the processor's work. [4] The term that is used to measure the computer's speed is borrowed from the domain of electrical engineering and is called a megahertz (MHz) which means million cycles per second.

Key Words

address	地址，寻址
analogous	类似的，相似的，可比拟的
arithmetic	算术的
awesome	惊人的，令人敬畏的
capability	性能，能力
distinguish	区别，辨别
exponentiation	幂运算
fetch	获取，取得
instruction	指令
intelligence	智能，智慧，智力
mainframe	大型机
manipulation	操作，处理
microelectronic	微电子的

operand	操作数
remarkable	显著的，不平常的
sequence	顺序，序列
supervise	监督，管理，指导
switchboard	配电盘，接线总机
workspace	工作空间，工作区

Notes

[1] The program, which tells the computers what to do and the data, which provide the information needed to solve the problem, are kept inside the computer in a place called memory.

这里的主语是“the program and the data”，由 which 引导的两个定语从句分别修饰 the program 和 the data。

译文：程序的作用是指示计算机如何工作，而数据则为解决问题提供所需要的信息，两者都存储在存储器里。

[2] The Arithmetic/Logic Unit (ALU) is the functional unit that provides the computer with logical and computational capabilities.

本句由“that”引导定语从句，修饰“the functional unit”。

译文：算术/逻辑单元（ALU）是为计算机提供逻辑及计算能力的功能部件。

[3] For example, if an instruction is to perform the operation of adding two numbers, it must know what the two numbers are and where the two numbers are.

这里的“what the two numbers are and where the two numbers are”是宾语，它由两个并列的从句组成。

译文：例如，如果一条指令要完成两数相加的操作，它就必须知道：这两个数是什么？这两个数在哪里？

[4] A timer called a clock releases precisely timed electrical signals that provide a regular pulse for the processor's work.

本句中的“that provide a regular pulse for the processor's work”修饰 electrical signals。

译文：一个称为时钟的计时器准确地发出定时电信号，该信号为处理器工作提供有规律的脉冲信号。

1.2.2 Text B

The CPU in a microcomputer is actually one relatively small integrated circuit or chip. Although most CPU chips are smaller than a lens of a pair of glasses, the electronic components they contain would have filled a room a few decades ago. Using advanced microelectronic techniques, manufacturers can cram tens of thousands of circuits into tiny layered silicon chips that work dependably and use less power. The CPU coordinates all the activities of the various components of the computer. It determines which operations should be carried out and in what order. The CPU can also retrieve information from memory and can store the results of

manipulations back into the memory unit for later reference.

Microcomputer, or micro for short, is a kind of computers. It was born in the early 1970s. The computer's brain is called the microprocessor. That's the main chip in a computer that does all the work. It's also the center of activity on the motherboard. It interprets and executes the instructions which comprise a computer program. The CPU consists of an arithmetic unit and its associated circuitry, known as the arithmetic and logic unit, and an instruction counter and decoder. The CPU can perform only one operation at a time. Essentially, numerically coded instructions are stored in the computer's high-speed storage, or primary storage. The CPU takes the instructions one at a time and executes them. The numerical coding of the instruction tells the CPU which operation to perform and where the data upon which the operation is to take place is stored.

The central processor of the micro, called the microprocessor, is built as a single semiconductor device; that is, the thousands of individual circuit elements necessary to perform all the logical and arithmetic functions of a computer are manufactured as a single chip. A complete microcomputer system is composed of a microprocessor, a memory and some peripheral equipment. The processor, memory and electronic controls for the peripheral equipment are usually put together on a single or on a few printed circuit boards. Systems using microprocessors can be hooked up together to do the works that until recently only minicomputer systems were capable of doing. Micros generally have somewhat simpler and less flexible instruction sets than minis, and are typically much slower. Similarly, minis are available with much larger primary memory sizes. Micros are becoming more powerful and converging with minicomputer technology.

The microprocessor is essentially a small calculator. It does basic calculator like things—adding, subtracting, multiplying, and dividing values stored in the computer's memory. Computer programs tell the microprocessor what to do, which is how everything works inside a PC.

Other terms for the microprocessor include the processor; the central processing unit (CPU); and the number of the microprocessor, such as 8088, 80286, 80386,80486, and so on . There are three main varieties of microprocessors for PCs: the 8088/8086; the 80286, or AT microprocessor; and the 386 family of microprocessor. There is no 586 microprocessor. Instead of calling it a number, the company that manufactured it (Intel) called it the Pentium. It's the micro part of microprocessor that led old-time computer users to call PCs microprocessor. This may have applied to the first microprocessor, but today's powerhouse PCs are anything but micro.

Key Words

calculator	计算器，计算者
circuitry	电路学，电路系统
dependably	可信任地

essentially	本质上，基本上
flexible	灵活的，易适应的
numerically	数字化地，用数表示地
peripheral	周围的，外围的
powerhouse	发电所，动力室
reference	参考，参照
relatively	相对地，比较地
somewhat	有点，有些，稍微

1.2.3 Exercises

1. Translate the following phrases into English

(1)取指—译码—执行

(2)算术/逻辑运算

(3)微电子技术

(4)印制电路板

(5)外围设备

2. Translate the following phrases into Chinese

(1)current instruction

(2)instruction register

(3)program counter

(4)retrieve information

(5)high-speed storage

3. Identify the following to be True or False according to the text

(1)In the ALU, registers store data items that are added, subtracted, multiplied, divided, and compared.

(2)Registers in the control unit are used to keep track of the overall status of the program.

(3)In the ALU, registers only store the results of arithmetic and logic operations.

(4)Microcomputer was born in the early 1970s.

(5)To store the results in the proper place is done by ALU.

4. Reading Comprehension

(1)A processor is composed of two functional units, they are_____.

a. an arithmetic/logic unit and a storage unit

b. a control unit and some registers

c. a control unit and an arithmetic/logic unit

d. some registers and an arithmetic/logic unit

(2)The control unit fetches _____from memory and decodes them.

a. data

b. information
c. results
d. instructions
(3)_____ is a storage location inside the processor.
a. A register
b. ALU
c. Control unit
d. Memory
(4)The CPU executes each instruction in a series of steps, the sequence is_____.
a. execute-fetch-decode
b. fetch-decode-execute
c. decode-execute-fetch
d. fetch-execute-storage

1.3 Memory

1.3.1 Text A

A memory cell is a circuit, or in some cases just a single device, that can store a bit of information. A systematic arrangement of memory cells constitutes a memory. The memory must also include peripheral circuits to address and write data into the cells as well as detect data that are stored in the cells.

Two basic types of semiconductor memory are considered. The first is the Random Access Memory (RAM), a read-write memory, in which each individual cell can be addressed at any particular time. The access time to each cell is virtually the same. Implicit in the definition of the RAM is that both the read and the write operations are permissible in each cell with also approximately the same access time.

A second class of semiconductor memory is the Read-Only Memory (ROM). The set of data in this type of memory is generally considered to be fixed, although in some designs the data can be altered.[1] However, the time required to write new data is considerably longer than the read access time of the memory cell. A ROM may be used, for example, to store the instructions of a system operating program.

A volatile memory is one that loses its data when power is removed from the circuit, while non-volatile memory retains its data even when power is removed. In general, a Random Access Memory is a volatile memory, while Read-Only Memories are nonvolatile.

Two type of RAM are the static RAM (SRAM) and dynamic RAM (DRAM). A static RAM consists of a basic bi-stable flip-flop circuit that needs only a DC current or voltage applied to retain its memory. Two stable states exist, defined as logic 1 and logic 0. A dynamic RAM is an

MOS memory that stores one bit of information as charge on a capacitor. Since the charge on the capacitor delays with a finite time constant (milliseconds), a periodic refresh is needed to restore the charge so that the dynamic RAM does not lose its memory.

The advantage of the SRAM is that this circuit does not need the additional complexity of a refresh cycle and refresh circuitry, but the disadvantage is that this circuit is fairly large. In general, a SRAM requires six transistors. The advantage of a DRAM is that it consists only one transistor and one capacitor, but the disadvantage is the required refresh circuitry and refresh cycles.

There are two general types of ROM. The first is programmed either by the manufacturer (mask programmable) or by the user (programmable, or PROM). Once the ROM has been programmed by either method, the data in the memory are fixed and cannot be altered. The second type of ROM may be referred to as an alterable ROM in that the data in the ROM may be reprogrammed if desired. This type of ROM may be called an EPROM (erasable programmable ROM), EEPROM (electrically erasable PROM), or flash memory. As mentioned, the data in these memories can be reprogrammed although the time involved is much longer than the read access time. In some cases, the memory chip may actually have to be removed from the circuit during the reprogramming process.

The basic memory architecture has the configuration shown in Figure 1-2. The terminal connections may include inputs, outputs, addresses, and read and write controls. The main potion of the memory involves the data storage. A RAM memory will have all of the terminal connections mentioned, whereas a ROM memory will not have the inputs and the write controls.

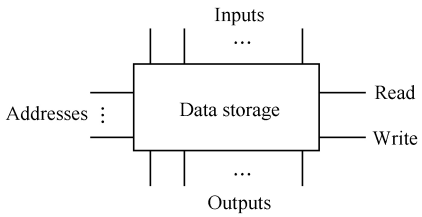

Fig. 1-2 Basic memory architecture

Computer memory is measured in kilobytes or megabytes of information. A byte is the amount of storage needed to hold one character, such as a letter or a numeric digit. One kilobyte (KB) equals 1024 bytes, and one megabyte (MB) is about 1 million bytes. Software requires the correct amount of RAM to work properly. If you want to add new software to your computer, you can usually find the exact memory requirements on the software packaging.[2]

Memories consist of a number of cells, each of which can store a piece of information. Each cell has a number, called its address, by which programs can refer to it. If a memory has n cells, they will have addresses 0 to $n-1$. All cells in a memory contain the same number of bits. If a cell consists of k bits, it can hold any one of 2^k different bit combinations. Note that adjacent cells have consecutive addresses.

Computers that use the binary number system also express memory addresses as binary numbers. If an address has *m* bits, the maximum number of cells directly addressable is 2^m. The number of bits in the address is related to the maximum number of directly addressable cells in the memory and is independent of the number of bits per cell. [3] A memory with 2^{12} cells of 8 bits each and a memory with 2^{12} cells of 64 bits each would each need 12-bit addresses.

The significance of the cell is that it is the smallest addressable unit. In recent years, most computer manufactures have standardized on an 8-bit cell, which is called a byte. Bytes are grouped into words. A computer with a 16-bit word has 2 bytes/word, whereas a computer with a 32-bit word has 4 bytes/word. The significance of a word is that most instructions operate on entire words, for example, adding two words together. Thus a 32-bit machine will have 32-bit registers and instructions for moving, adding, subtracting, and otherwise manipulating 32-bit words. [4]

Key Words

adjacent	邻近的，接近的
alterable	可改变的，可修改的
approximately	近似地，大约地
capacitor	电容
considerably	相当地，非常地
dynamic	动态的，动力的
erasable	可消除的，可擦拭的，可删除的
kilobyte	千字节（KB）
manufacturer	厂商，制造业者
megabyte	兆字节（MB）
millisecond	毫秒
nonvolatile	非易失性的
programmable	可编程的
refresh	刷新，更新
stable	稳定的
systematic	有系统的，成体系的
volatile	易失去的，易变的

Notes

[1] The set of data in this type of memory is generally considered to be fixed, although in some designs the data can be altered.

说明：本句的主句用被动语态表示客观事实，“although”引导的是让步状语从句。

译文：尽管这类存储器中所设置的数据在某些设计中可以改变，但这些数据通常是固定的。

[2] If you want to add new software to your computer, you can usually find the exact

memory requirements on the software packaging.

说明：本句由“if”引导条件状语从句，“on the software packaging”是状语。

译文：如要给计算机增加新的软件，在软件包装上通常可以找到该软件所需要的确切内存容量。

[3] The number of bits in the address is related to the maximum number of directly addressable cells in the memory and is independent of the number of bits per cell.

说明：本句中，of directly addressable cells in the memory 修饰 the maximum number。

译文：地址的位数与存储器可直接寻址的最大单元数量有关，而与每个单元的位数无关。

[4] Thus 32-bit machine will have 32-bit registers and instructions for moving, adding, subtracting, and otherwise manipulating 32-bit words.

说明：本句的“for moving, adding…”是宾语补足语，进一步说明宾语“registers and instructions”的功能。

译文：因而 32 位机器则有 32 位的寄存器和指令，以实现传送、加法、减法和其他 32 位字的操作。

1.3.2 Text B

In the 1970s, there was a further development which revolutionized the computer field. This was the ability to etch thousands of integrated circuits onto a tiny piece (chip) of silicon, which is a non-metallic element with semiconductor characteristics. Chips have thousands of identical circuits, each one capable of storing one bit. Because of the very small size of the chip, and consequently of the circuits etched on it, electrical signals do not have to travel far; hence, they are transmitted faster. Moreover, the size of the components containing the circuitry can be considerably reduced, a step which has led to the introduction of both minis and micros. As a result, computers have become smaller, faster, and cheaper. There is one problem with semiconductor memory, however, when power is removed, information in the memory is lost, unlike core memory, which is capable of retaining information during a power failure.

The 80x86 processors, operating in real mode, have physical address-ability to 1 megabyte of memory. EMS was developed to allow real mode processing to have access to additional memory. It uses a technique called paging, or bank switching. The requirements for expanded memory include additional hardware and a software device driver. The bank switching registers act as gateways between the physical window within the 1 megabyte space and the logical memory that resides on the expanded memory board. The device driver, called the expanded memory manager (EMM), controls the registers so that a program’s memory accesses can be redirected throughout the entire of available expanded memory.

To access expanded memory, a program needs to communicate with the EMM. Communication with the EMM is similar to making calls to DOS. The program sets up the proper CPU registers and makes a software interrupt request. More than 30 major functions are defined, and applications and operating systems are given control over expanded memory. When

a program allocates expanded memory pages, the EMM returns a handle to the requesting program. This handle is then used in future calls to the EMM to identify which block of logical pages is being manipulated.

A variety of different types of cache (disk cache, memory cache, processor cache) can improve overall system performance. Although most high-level systems include cache in system design, a cache can be optionally implemented on almost any system—from a low-level 8086 system on up to the highest performance i486-based system.

In the case of hard disk cache, there are two general approaches to cache implementation. The two approaches primarily differ in terms of where the memory in the cache resides. The first and most commonly implemented form of disk cache uses extended memory. In a microcomputer, the extended memory of 1 megabyte or larger can be assigned as disk cache memory. The higher the percentage of "hits" (calls to the disk that can be read from cache, rather than from the disk) , the greater the overall performance of the system. For word processing or manipulation of small files, a huge cache may be overkill. For manipulation of large database files of complex graphics, a cache using extended memory can provide a significant performance increase. The second form of disk cache is performed by cache controllers. These controllers not only control the read/write operations of the attached hard disk drives, they also provide a cache that performs many of the functions of the system-based extended memory caches. However, by placing the cache on the controller, performance of a cache can be enhanced over that of most extended memory caches.

High-speed memory is used on cache controllers. When the system makes a call to the hard disk, the controller in cache determines whether or not the data that's being called for is in the cache or on the disk. When using an extended memory cache, the cache intercepts calls for reads from the hard disk and checks to see if the data called for by the system resides in the cache. If the data is not in the cache, a read instruction is sent to the disk controller. This process takes time. Not only is the extended memory used for such caches usually slower than that used in cache controllers, an extra step is involved before the disk controller can be instructed to go to the disk to retrieve the data it seeks. However, by allowing the processor to make calls to the cache controller, which then determines whether or not the disk actually must be read, performance can be significantly enhanced. With intelligent cache controllers, significant performance improvements have been claimed by a number of cache controller manufacturers. Cache controllers have been used on mainframe computer systems for many years; their migration to the micro could be seen as a logical next step.

Key Words

communicate	通信，传递
etch	蚀刻
expanded	扩展的，扩充的，延伸的
failure	失败，缺乏，不足

gateway	网关，信闸，入口处
migration	迁移，移植，移动
optionally	随意地
percentage	百分率，百分比
throughout	遍及，贯穿，在所有方面

1.3.3 Exercises

1. Translate the following phrases into English

(1)易失性存储器
(2)实模式
(3)寻址能力
(4)闪存
(5)刷新电路

2. Translate the following phrases into Chinese

(1)software interrupt
(2)expanded memory
(3)refresh cycle
(4)Read Only Memory
(5)Random Access Memory

3. Identify the following to be True or False according to the text

(1)Both static and dynamic RAM cells are read-write memory.
(2)Nonvolatile memory loses its data when power is removed from the circuit.
(3)ROM does not have the inputs and the write controls.
(4)The memory addresses are expressed as binary numbers.
(5)RAM can be used to store the instructions of a system program.

4. Reading Comprehension

(1)One megabyte equals approximately _____.
a. 1,048,576 bytes
b. 1024 bytes
c. 65,535 bytes
d. 10,000 bytes
(2)If a cell consist of *n* bits, it can hold any one of _____.
a. 2*n* different bit combinations
b. 2^{n-1} different bit combinations
c. 2^{n} different bit combinations
d. *n* different bit combinations
(3)When power is removed, information in the semiconductor memory is _____.

a. reliable
b. lost
c. manipulated
d. remain
(4)A periodic refresh is needed to restore the information for the _____.
a. SRAM
b. EPROM
c. DRAM
d. EEPROM

1.4 Input/Output Systems

1.4.1 Text A

Keyboard

If you are familiar with a typewriter, you'll find the layout of the computer keyboard very similar. You can use your keyboard for many purposes:

- Typing information.
- Entering numbers with the numeric keypad.
- Requesting specific functions.
- Performing system functions with key combinations.
- Moving around the computer screen.

The keyboard has letter keys, punctuation keys, and a spacebar. It also has functions, numeric, and arrow keys. How you use the keys depends on the software installed on your computer. The documentation that comes with your software has information about specific key functions. You will probably notice a difference between the touch（response）on a computer keyboard and the response of a typewriter. A computer keyboard is so responsive that you can type using a light touch. When you hold down a character key, the character continues to type. This is called the typematic effect of a computer keyboard.

Monitor

Monitors maybe are one of the most important output devices. Computers only use monitors to show you exciting operation results or marvelous and vivid pictures. Monitors also are the best windows for conversation between users and computers. So, many users select monitors carefully. Which parameters or indexes ought be paid attention to when you select a monitor? We provide some here for your reference.

Element Distance: The distance between two picture elements in horizontal direction is

called element distance here and its current value in most PC monitors is 0.28mm. If the value is smaller, the screen is more distinct.

Video Bandwidth: It is an important concept in monitor technology. It is related to the highest work frequency of the monitor. It is from tens MHz to hundreds MHz.

Solution: It is another important parameter of a monitor. It's higher, the view on a screen is clearer. Solution means the sum of all picture elements on a screen.

Scan Style: The scan style of a electron gun in a tube is divided into two styles: interlace and non-interlace. In interlace style, electron-beam sweeps elements in odd rows first time and does elements in even rows second time. [1] A frame to be renewed needs sweeping two times. In non-interlace style, electron-beam sweeps all elements only in one time. In non-interlace work style, the monitor works better and gives clear pictures without flash.

Mouse

The interface between a mouse and a system can take one of two forms: the mouse either generates a series of pulses when it is moved (using the LED and detector to generate the pulses), or it increments and decrements counters. The processor can periodically read these counters, or count up the pulses, and determine how far the mouse has moved since it was last examined. The system then moves the cursor on the screen appropriately. This motion appears smooth because the rate at which you can move the mouse is slow compared with the rate at which the processor can read the mouse status and move the cursor on the screen.

Most mice also include one or more buttons, and the system must be able to detect when a button is depressed. By monitoring the status of the button, the system can also differentiate between clicking the button and holding it down. [2] Of course, the mapping between the counters and the button position and what happens on the screen is totally controlled by software. That's why, for example, the rate at which the mouse moves across the screen and the rate at which single and double clicks are recognized can usually be set by the user. Similarly, software interpretation of the mouse position means that the cursor doesn't jump completely off the screen when the mouse is moved a long distance in one direction. [3]

Optical Disks

An optical disk is a disk on which data are encoded for retrieval by a laser. Optical disks offer information densities far beyond the range of current magnetic mass-storage devices. Similar devices have been on the market for several years in the form of laser videodisks and audio compact disks (CDs) for consumer use. These laser videodisks are analog, that is, the disk contains one spiral track, like the track on a phonograph record. Optical disks for computer applications are digital and store their information on concentric tracks, like their magnetic cousins. Currently, three versions of optical disk technology are competing for the mass-storage market, they are read-only optical disks, write-once optical disks, and erasable optical disks.

Unlike conventional magnetic disks, read-only optical disks cannot be written on and so have the functional equivalence of read-only memory. The most popular version of read-only optical disks employs the same technology as the CD that has become popular for audio recording. The technology is digital and based on a 4¾ inch optical disk that can store 540 MB on a single side. The devices are called Compact Disk Read-Only Memories (CD-ROMs).

Write-once optical disks (also called write-once, read-mostly, or WORM) are blank disks that are recorded on by the user. To write data, a powerful beam of laser light burns tiny spots or pits into the coating that covers the surface of these disks.[4] Once burnt in, the spots are not erasable. To retrieve the data, a less powerful laser is used to read the pattern of spots and convert the patterns into audiovisual signals that can be played back on a television set. Write-once optical disks are being used to replace microfilm storage. Because optical disks have the ability to store images as well as sound, their use is quite versatile. Anything that can be digitized, such as documents, pictures, photographs, line drawings, and music, can be recorded and stored on an optical disk.

Erasable optical disks use lasers to read and write information to and from the disk but also use a magnetic material on the surface of the disk and a magnetic write head to achieve erasability. To write on such as disk, a laser beam heats a tiny spot on it; then a magnetic field is applied to reverse the magnetic polarity of the spot. Erasable optical disk systems offer the same storage capabilities of the non-erasable optical disks, along with the same reusability capabilities of conventional magnetic disks, such as Winchester systems.

Key Words

bandwidth	带宽
compact	紧密的，结实的，紧凑的
concentric	集中的，同心的
conversation	对话，会话
cursor	光标
decrement	减量，递减
differentiate	区分，区别，使有差异
equivalence	等价，等值，等效
erasability	可擦除性
horizontal	水平的，横的
increment	增加，增量，递增
interlace	隔行，交错
mouse	鼠标
non-interlace	非隔行
optical	光学的
periodically	定期地
phonograph	唱机，留声机