计算机与通信专业英语

（修订版）

徐秀兰　主编

编　者　徐秀兰　成文德　徐　劲

ENGLISH FOR COMPUTERS & TELECOMMUNICATIONS

北京邮电大学出版社

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图书在版编目(CIP)数据

计算机与通信专业英语/徐秀兰等编著. -修订版. -北京：北京邮电大学出版社，1998.12

ISBN 7-5635-0335-8

Ⅰ.计… Ⅱ.徐… Ⅲ.①计算机-英语 ②通信-英语 Ⅳ.H31

中国版本图书馆 CIP 数据核字（98）第 29622 号

出版发行：北京邮电大学出版社　电话：(010) 62282185（发行部）

社　　址：北京市海淀区西土城路 10 号（100876）

经　　销：各地新华书店销售

印　　刷：河北省高碑店市印刷厂

开　　本：787 mm×1 092 mm　1/16

印　　张：22

字　　数：560 千字

版　　次：1998 年 12 月第一版　1998 年 12 月第一次印刷

印　　数：1—4 000 册

书　　号：ISBN 7-5635-0335-8/TN·148

定　　价：27.50 元

再版前言

本书的第一版是在1995年12月出版的。承蒙广大读者厚爱，本书在出版后的两年多的时间内即已脱销，本书是应出版社及读者的要求进行再版的。鉴于通信与计算技术的迅速发展，不得不对第一版进行大幅度的增删和改编。例如，在计算机硬件方面，增加了1994年以后受到广泛关注的有关新技术，如RISC方面的新内容。在软件方面，增加了面向对象的程序设计及可视化设计以及Java语言等方面的内容。在影视方面增加了图像处理并更新了多媒体技术的内容。在计算机网络方面，增加了Internet网及网络协议方面的内容。在通信技术方面，增加了近年来十分热门的宽带通信、B-ISDN等新内容。

在编写上，除对第一版的风格予以保留外，对课文中出现的生词及词组作了较多的补充以尽可能地帮助读者从不同的角度来理解一个生词。对文中出现的各种缩略词也一一作了查找和核对。在对课文中较难词句的注解上，除给出句子的参考译文外，还尽可能对句子的结构作出必要的分析。此外，在修订版中，还在书的末尾给出了生词速查表以利读者查询。

本书仍由徐秀兰同志主编并担任第1，3，4，5，6，7，9，12，14等九个单元的编写工作，成文德同志担任第2，8，10，11，13等五个单元的编写工作，徐劲同志担任第15，16，17，18，19，20等六个单元的编写工作。全书注解由成文德及徐秀兰同志编写，徐秀兰同志担任了全书的统稿工作，包括内容的增减及取舍等。

编者对修订后的习题解答也进行了仔细核对和修改。尽管如此，限于编者水平，各种错误怕仍难以避免。不足之处，恳请读者批评指正。

编者

1998.9于北京

内容简介

本书是为计算机与通信专业学生而编写的，全书共分20个单元。在内容安排上力求从基础到专业，从硬件到软件，从基本知识到新技术、新知识。本书主要取材于90年代以后国外的30余种最新材料。内容广泛，语言现象丰富。内容涉及基本逻辑元件，数字计算机，CISC及RISC中央处理单元，存储器的层次结构，输入与输出接口，操作系统，程序设计，数据库，并行处理，数据的完整性与安全性，计算机网的结构与协议，多媒体，人工智能，图像处理，宽带通信，ISDN及B-ISDN，ATM，卫星通信，光纤通信，移动通信及SDH等。所选内容既有基础理论，又尽量跟踪最近两三年内公众关心的热点与新技术。教材内容基本能覆盖计算机、通信这两个专业常用的技术词汇、词组及常见的科技语法。

教材的编写对于所选专题除正文外，还列出了较多的关键字、注释、习题及部分参考译文。对于某些较难的语法现象，除给出相应的参考译文外还对语法现象予以分析。在本书的最后还附有习题解答及生词的速查表，以供读者快速查阅。

本书可作为计算机与通信两个专业学生的英语教材，也可供其他工程专业作为专业英语教材或参考书，还可作为从事计算机、通信、信息等工作的技术人员的自学教材或参考书。

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UNIT 1

Fundamental Logic Elements

1-1 Types of Logic and Memory Devices

In this chapter, we shall present a brief and rather general discussion of some of the basic types of logic and memory devices used in digital computers. The actual design of these devices is not the concern of the system designer, who generally regards them as "black boxes" with certain known characteristics. On the other hand, intelligent selection and application of these devices does require some understanding of their operation and an appreciation of their limitations. In addition, without some physical interpretation of registers, memory, and the like, much of the material in following chapters may seem too abstract to many readers. Readers who are already familiar with digital hardware may skip the majority of the topics in this chapter without loss of continuity.

Logic circuits are implemented in a tremendous variety of technologies. There are, for example, transistor-transistor logic (TTL), MOS logic, and emitter-coupled logic (ECL). These various types differ in matters of speed, cost, power consumption, physical dimensions, immunity to environmental influences, and other factors;[1] but they all accomplish the same basic purpose, and from the point of view of this book, the differences are of little importance. All of them accept input signals in which the voltage levels represent the values of certain logical (binary) variables and produce output signals in which the voltage levels correspond to logical functions of the input variables.

The purpose of logic circuits, then is to process signals and produce outputs that are functions of the inputs. The outputs are available only during the duration of the input signals. The purpose of memory devices is to store information for later use, generally returning it without alteration, in the same form in which it was originally stored. The definition of memory is elusive. We shall simply settle for the intuitive idea that it is a memory device that we place in a specific, identifiable physical state for the specific purpose of preserving information, without alteration, until a later time. The terms memory and storage are often used interchangeably, but many authors make a distinction between main memory and secondary storage. In main memory, the storage medium is a permanent physical component of the computer system. The information stored cannot be removed from the system except by reading it out of the main memory. In secondary storage systems, the storage media, for example, magnetic tape, can be physically removed from the system, with the information stored there available for later use when the storage

media are put back into the system.

Memory or storage devices may be classified in a number of different ways. First, most may be classified as being either magnetic or electronic. Magnetic devices use ferro magnetic materials, which can be placed in a specific magnetic state by the passage of electric currents through them or near them, and which then maintain these states indefinitely until interrogated. The chief types of magnetic memory are tape, disk, and core. Electronic memory devices are primarily transistor circuits in which the outputs can be set to certain voltage levels by the application of certain input signals and will be maintained even when the input signals are removed. A common electronic memory device is the bistable latch, or flip-flop, which can be used to construct register memories (RM).

Memories may also be classified by the type of access to the stored information. In random access memories (RAM), all stored information is equally accessible, in the sense that any given piece of information may be retrieved in exactly the same length of time as any other piece of information. Semiconductor memories are usually classified as RAM. Tape, by contrast , is sequential access storage (SAS), in which information can be retrieved only in the same order in which it was stored. When you want a particular piece of information off tape, you simply start running the tape until the desired information comes into position to be read. The access time is thus dependent on where the desired information is located relative to the starting point.

Between these two categories is disk memory, which is classified as direct access storage (DAS). Disks store information in the same sequential manner as tapes, but the total storage area is divided into segments that can be accessed directly, without reading through all the information between the current and desired segment. Once the desired segment has been accessed, information will then be read out sequentially in the same manner as with tape.

A final special category, which resembles logic as well as memory, is the read only memory (ROM).[2] The stored information is actually built into the structure of the device. The stored information can then be read out electronically but can be changed only by alteration of the structure of the device.

The foregoing classification and listing is quite broad and general and is not intended to be complete. There are many other specialized memory devices, some fitting into the preceding categories, some not really fitting into any category.

Key words

bistable	双稳态锁存器
device	器件，元件
direct access storage (DAS)	直接访问存储器
emitter-coupled logic	发射极耦合逻辑
ferro magnetic	铁磁体的
flip-flop	触发器
main memory	主存储器
memory	存储器

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random access memory (RAM)	随机访问存储器
read-only memory (ROM)	只读存储器
register	寄存器
resemble	相似
retrieve	检索
segment	段，扇区
secondary storage	辅助存储器
sequential access storage (SAS)	顺序访问存储器
transistor-transistor logic	三极管-三极管逻辑

Notes

1. These various types differ in matters of speed, cost, power consumption, physical dimensions, immunity to environmental influences, and other factors;
   in matters of 在…事情上，在…方面
   immunity to 免除，不受影响
2. A final special category, which resembles logic as well as memory, is the read only memory (ROM).
   最后一种特殊元件类，它既像逻辑元件，也像存储元件，那就是只读存储器(ROM)。

1-2 Logic Elements

In this section, we shall present what will be to many of you a review of fundamental logic elements. We shall briefly introduce the circuits that implement the combinational logic operations AND, OR, NOT, NAND, and NOR, which will be used freely in subsequent chapters. There are several families of logic elements, each with its unique circuit properties. We shall introduce one such family that is easily described and is used extensively in the design of very-large-scale integrated circuits (VLSI) such as microprocessors.

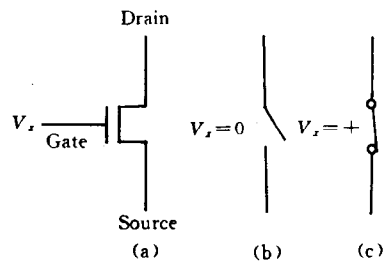


Figure 1.1 Operation of a MOS transistor.

The MOS (metal oxide semiconductor) logic family is based almost entirely on a single device, a MOS field effect transistor, that very closely approximates an ideal switch. Shown in Figure 1.1 (a) is the standard symbol for the MOS transistor with the accepted names for its three terminals. Actually, the device is symmetric, and the source and drain can be readily interchanged. The gate may be regarded as the input line. As shown in Figure 1.1 (b), the device is a close approximation of an open switch when the gate voltage V_x is close to 0. When V_x is a positive voltage, typically 1 to 5 volts, the switch is

closed and behaves as a very small electrical resistance. This situation is depicted in Figure 1.1 (c). In the logic circuits to be described following, we shall let 0 volts represent logical 0 and the positive voltage represent logical 1. To be consistent with the prior edition, we shall let the nominal positive voltage be +5 volts.

The fundamental MOS logic element is the inverter shown in Figure 1.2 (a). The upper (pull-up) device is actually a depletion mode transistor designed to function as a relatively large resistor when connected as given and when the lower transistor switch is closed. For purposes of this simplified discussion, you should simply regard it as a large resistor, as shown in Figure 1.2 (b). When x is logical 0 and V_x is 0 volts, as in Figure 1.2 (c), the lower transistor (pull-down) switch is open. Because no current is present in the resistor R_D, the output voltage is +5 volts and the logical output z is 1. When $x = 1$ and V_x is positive, the lower transistor switch is closed, as depicted in Figure 1.2 (d). Now the output is connected to 0 volts, and $z = 0$. These values are tabulated in Figure 1.2 (e). We observe from this table that the circuit of Figure 1.2 (a) implements the logical NOT operation and is indeed an inverter, as asserted at the beginning of the paragraph. The standard symbol for the inverter is given in Figure 1.2 (f).

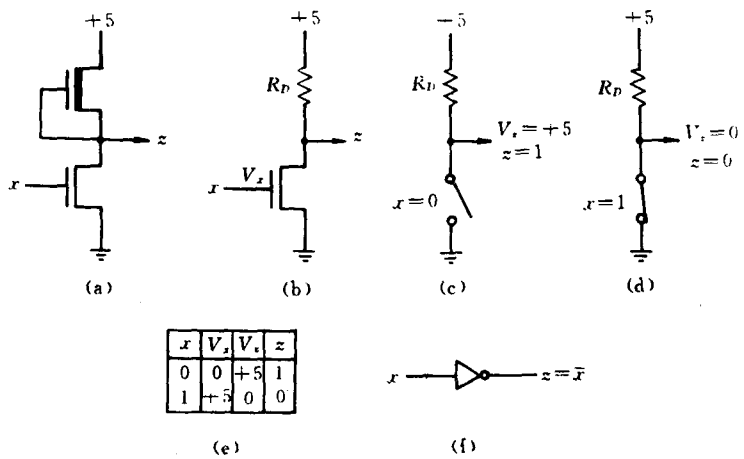
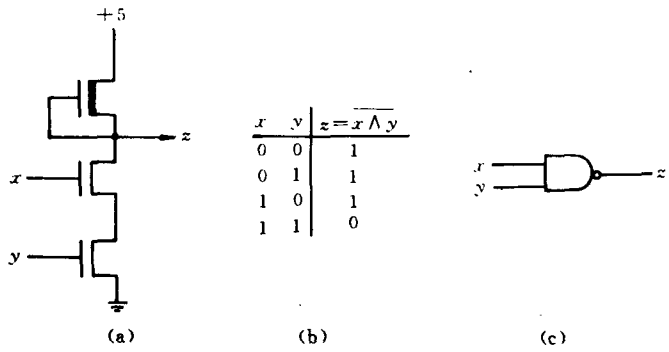


Figure 1.2 A MOS inverter.

Next consider the circuit of Figure 1.3 (a), in which a second pull-down transistor has been added in series. Now both inputs must be logical 1 if the output is to be pulled down to 0 volts. If either or both devices have a 0 input, the output will be +5 volts or logical 1. The tabulation of these values in Figure 1.3 (b) describes a device that is called a logical NAND (NOT AND) gate. The standard symbol for this device is given in Figure 1.3 (c). Figure 1.4 shows a similar device in which the two pull-down transistors are connected in parallel. Now the output z will be 0 if either input is 1. It will be logical 1 if both inputs are 0. This device is a NOR (NOT OR) gate.

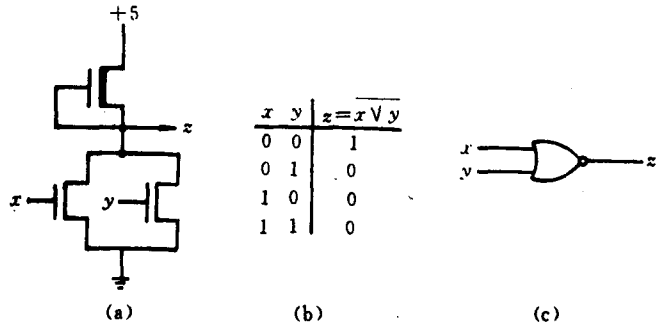
As we shall see shortly, it is possible to represent any logical function using only NAND gates, and this is often done in practice.[1] In this book, we shall find it convenient to express designs in terms of

AND, OR, and NOT gates rather than in terms of NAND gates only or NOR gates only. An AND gate may be realized by adding an inverter to the output of a NAND gate ($\bar{\bar{z}} = z$), as shown in Figure 1.5.



x	y	$z=\overline{x \wedge y}$
0	0	1
0	1	1
1	0	1
1	1	0

Figure 1.3 MOS NAND gate.



x	y	$z=\overline{x \vee y}$
0	0	1
0	1	0
1	0	0
1	1	0

Figure 1.4 MOS NOR gate.

The standard symbol for an AND gate is given in Figure 1.5 (c). Adding an inverter to the NOR yields an OR gate, the standard symbol for which is given in Figure 1.5 (d).

Looking again at Figure 1.5 (a) will reveal a capacitor depicted at the gate input of the second inverter. This capacitor is not a separate component but instead represents an inherent property of the MOS

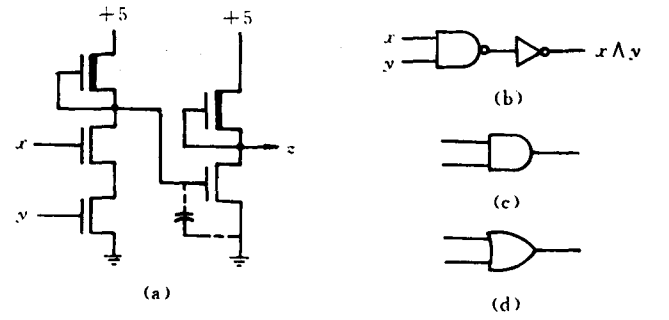


Figure 1.5 MOS AND and OR gates.

device. The gate of a MOS transistor will draw no steady-state current. The input resistance is infinite. However, when the value of the line connected to the device input changes, time is required for the charging or discharging of the capacitor to the new value.

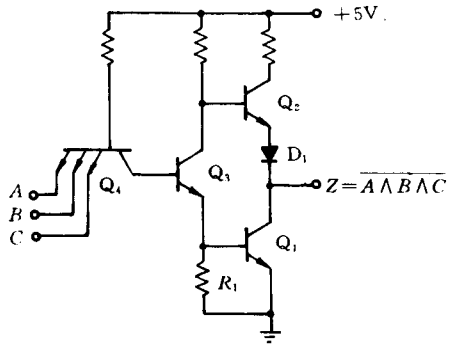


Figure 1.6 TTL NAND gate.

Space will not permit the detailed analysis of all logic families in use.[2] A second family of considerable importance is bipolar TTL (transistor-transistor logic). Usually, TTL gates can change values at higher speeds than MOS can but require a larger area on the integrated circuit chip to implement. For this reason, TTL is used where relatively less complex digital networks are implemented within an integrated circuit package. TTL is the most widely used technology where only a few individually accessible gates or memory elements are included in a package. A TTL NAND gate is shown in Figure 1.6.

The logical inversion noted in MOS occurs in most types of electronic logic, so that NAND and NOR are often cheaper and more convenient to realize than AND and OR are. In this book, we shall find it convenient to rely on the AND and OR functions. This does not present a problem, since networks of AND, OR, and NOT gates can always be converted to NAND or NOR networks.

Consider the simple logical circuit of Figure 1.7 (a), which consists of three NAND gates driving another NAND gate. From De Morgan's law,

$$\overline{X \wedge Y \wedge Z} = \bar{X} \vee \bar{Y} \vee \bar{Z}$$

we see that the final NAND gate can be replaced by an OR gate with inversion on the inputs (Figure 1.7 (b)). Next,

$$\bar{\bar{X}} = X$$

so that the two successive inversions on the lines between the input and output gates cancel, giving the circuit of Figure 1.7 (c). Thus we see that a two-level NAND circuit is equivalent to a two-level AND-OR circuit. In a similar fashion, we can show that a two-level NOR circuit is equivalent to a two-level

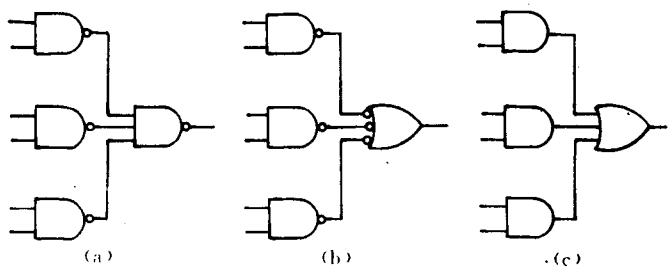


Figure 1.7 Conversion of NAND-NAND to AND-OR circuit.

OR-AND circuit.

Until about 1970, gate circuits such as those discussed in this section were commonly realized from discrete components-resistors, transistors, diodes-mounted on plastic cards and wired together. Today, logic circuits are almost invariably realized in integrated circuit form. An integrated circuit is a complete electronic circuit implemented by electrochemical methods on a single chip of silicon. The earliest integrated circuits typically realized a few gates on a single chip. As the technology advanced, the circuit density steadily increased, until today complete computers, comprising tens of thousands of components, can be placed on 1/4-in.square chips.

Integrated circuits can be classified in a variety of ways. One classification is in terms of the type of electronic technology used. Currently popular technologies include TTL, ECL, CMOS, and PMOS. NMOS and PMOS are two slightly different physical realizations of the MOS model discussed in this section. These five technologies differ in such characteristics as speed, power consumption, and packing density. ECL is very fast but consumes a lot of power. CMOS is slower but consumes so little power that it is suitable for battery-powered applications, such as electronic watches. NMOS has the highest packing density and is used in very complex circuits, such as microprocessors. TTL, which falls about in the middle in all characteristics, is by far the most popular technology and is available in more different circuits than all the others put together.

Integrated circuits can also be classified in terms of circuit complexity. Small scale integration (SSI) encompassed circuits with up to 10 gates per chip. Medium scale integration (MSI) includes circuits with from 10 to 100 gates per chip. From 100 to about 5000 gates per chip we have large-scale integration (LSI), and above this, we have very large scale integration (VLSI). In SSI chips, we have individual gates and flip-flops, MSI chips realize more complex logic functions, such as code conversion and arithmetic operations. LSI and VLSI chips realize complete digital systems, such as memory units and microprocessors.

Key words

approximation	近似值
bipolar	双极性
charge	充电，电荷
comprise	包含
component	成份，元件，部分
depletion	耗尽
discharge	放电
drain	漏极
inverter	反向器
metal oxide semiconductor (MOS)	金属氧化物半导体
MOS field effect transistor (MOS)	场效应三极管
nominal	标称的，名义上的

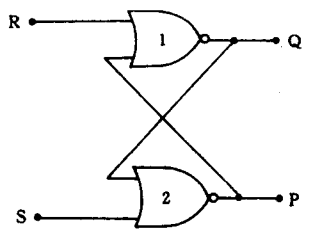
source	源极，源
symmetric	对称的

Notes

1. As we shall see shortly, it is possible to represent any logical function using only NAND gates, and this is often done in practice. 正如我们很快就将看到的那样，只用 NAND 门，就可能表示任何逻辑功能。而在实践中常常是如此做的。
2. Space will not permit the detailed analysis of all logic families in use. 实际应用的所有逻辑系列，恕不一一赘述。

1-3 Flip-Flops and Register Memory (RM)

As we have seen, memory, the ability to store information, is essential in a digital system. The most common type of electronic memory device is the flip-flop. Figure 1.8 shows the circuit for a flip-flop constructed from two NOR gates and the timing diagram for a typical operating sequence. We have also repeated the truth table for NOR for convenience in explaining the operation.



A	B	NOR
0	0	1
0	1	0
1	0	0
1	1	0

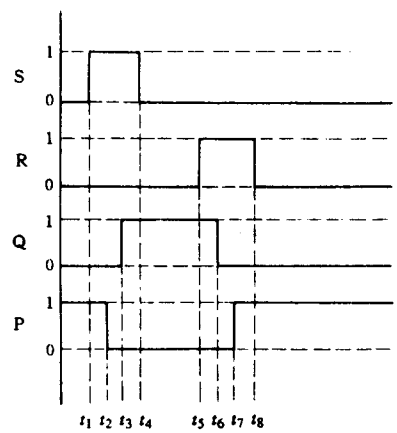


Figure 1.8 Operation of flip-flop.

At the start, both inputs are at 0, the Q output is at 0, and the P output at 1. Since the outputs are fed back to the inputs of the gates, we must check to see that the assumed conditions are consistent. Gate 1 has inputs of R = 0 and P = 1, giving an output Q = 0, which checks. Similarly, at gate 2 we have S = 0 and Q = 0, giving P = 1. At time t_1, input S goes to 1. The inputs of gate 2 are thus changing from 00 to 01. After a delay (as discussed in the last section), P changes from 1 to 0 at time t_2. This changes the inputs of gate 2 from 01 to 11, but has no effect on the outputs. Similarly, the change of S from 1 to 0 at t_4 has no effect. When R goes to 1, Q goes to 0, driving P to 1, thus locking-in Q, so that the return of R to 0 has no further effect.

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