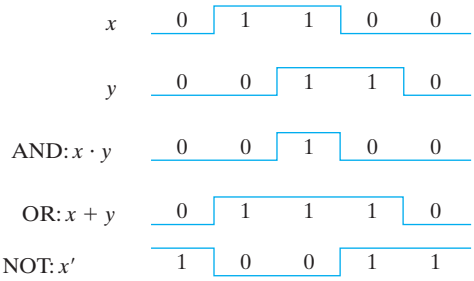
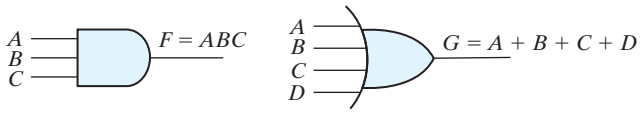


FIGURE 1.5
Input–output signals for gates



(a) Three-input AND gate (b) Four-input OR gate

FIGURE 1.6
Gates with multiple inputs

AND and OR gates may have more than two inputs. An AND gate with three inputs and an OR gate with four inputs are shown in Fig. 1.6. The three-input AND gate responds with logic 1 output if all three inputs are logic 1. The output produces logic 0 if any input is logic 0. The four-input OR gate responds with logic 1 if any input is logic 1; its output becomes logic 0 only when all inputs are logic 0.

PROBLEMS

(Answers to problems marked with * appear at the end of the text.)

1.1 List the octal and hexadecimal numbers from 16 to 32. Using A and B for the last two digits, list the numbers from 8 to 28 in base 12.

1.2* What is the exact number of bytes in a system that contains (a) 32K bytes, (b) 64M bytes, and (c) 6.4G bytes?

1.3 Convert the following numbers with the indicated bases to decimal:
(a)* $(4310)_5$ (b)* $(198)_{12}$
(c) $(435)_8$ (d) $(345)_6$

1.4 What is the largest binary number that can be expressed with 16 bits? What are the equivalent decimal and hexadecimal numbers?

1.5* Determine the base of the numbers in each case for the following operations to be correct:
(a) $14/2 = 5$ (b) $54/4 = 13$ (c) $24 + 17 = 40$.

1.6* The solutions to the quadratic equation $x^2 - 11x + 22 = 0$ are $x = 3$ and $x = 6$. What is the base of the numbers?

1.7* Convert the hexadecimal number 64CD to binary, and then convert it from binary to octal.

1.8 Convert the decimal number 431 to binary in two ways: (a) convert directly to binary; (b) convert first to hexadecimal and then from hexadecimal to binary. Which method is faster?

1.9 Express the following numbers in decimal:
(a)* $(10110.0101)_2$ (b)* $(16.5)_{16}$
(c)* $(26.24)_8$ (d) $(DADA.B)_{16}$
(e) $(1010.1101)_2$

1.10 Convert the following binary numbers to hexadecimal and to decimal: (a) 1.10010, (b) 110.010. Explain why the decimal answer in (b) is 4 times that in (a).

1.11 Perform the following division in binary: 111011 ÷ 101.

1.12* Add and multiply the following numbers without converting them to decimal.
(a) Binary numbers 1011 and 101.
(b) Hexadecimal numbers 2E and 34.

1.13 Do the following conversion problems:
(a) Convert decimal 27.315 to binary.
(b) Calculate the binary equivalent of 2/3 out to eight places. Then convert from binary to decimal. How close is the result to 2/3?
(c) Convert the binary result in (b) into hexadecimal. Then convert the result to decimal. Is the answer the same?

1.14 Obtain the 1's and 2's complements of the following binary numbers:
(a) 00010000 (b) 00000000
(c) 11011010 (d) 10101010
(e) 10000101 (f) 11111111.

1.15 Find the 9's and the 10's complement of the following decimal numbers:
(a) 25,478,036 (b) 63, 325, 600
(c) 25,000,000 (d) 00,000,000.

1.16 (a) Find the 16's complement of C3DF.
(b) Convert C3DF to binary.
(c) Find the 2's complement of the result in (b).
(d) Convert the answer in (c) to hexadecimal and compare with the answer in (a).

1.17 Perform subtraction on the given unsigned numbers using the 10's complement of the subtrahend. Where the result should be negative, find its 10's complement and affix a minus sign. Verify your answers.
(a) 4,637 − 2,579 (b) 125 − 1,800
(c) 2,043 − 4,361 (d) 1,631 − 745

1.18 Perform subtraction on the given unsigned binary numbers using the 2's complement of the subtrahend. Where the result should be negative, find its 2's complement and affix a minus sign.
(a) 10011 − 10010 (b) 100010 − 100110
(c) 1001 − 110101 (d) 101000 − 10101

1.19* The following decimal numbers are shown in sign-magnitude form: +9,286 and +801. Convert them to signed-10's-complement form and perform the following operations (note that the sum is +10,627 and requires five digits and a sign).
(a) (+9,286) + (+801) (b) (+9,286) + (−801)
(c) (−9,286) + (+801) (d) (−9,286) + (−801)