

1.14. Exercises

EXERCISE 1.1.– Conversions

1) Convert the following numbers to binary:

- a) 37_{10} b) 15_{10} c) 187_{10} d) $2\,014_{10}$ e) $2\,016_{10}$ f) 2.75_{10}
g) 25.25_{10} h) 243.3125_{10} i) 0.0625_{10} j) 62_8 k) 277_8 l) 12.6_8
m) 476.35_8 n) 92_{16} o) $37FD_{16}$ p) $7FF_{16}$ q) $1A6_{16}$ r) $2C0_{16}$
s) $1F.C_{16}$ t) $9.F_{16}$ u) $A7.EC_{16}$

2) Convert the following numbers to decimal:

- a) 10110_2 b) 10001_2 c) 10001101_2 d) 100100001001_2 e) 1111010111_2
f) 1011.101_2 g) 10011011001.10110_2 h) 30_8 i) 115_8 j) 55.4_8
k) 270.54_8 l) 356_{16} m) $2AF_{16}$ n) $2C1_{16}$ o) $10FF_{16}$
p) $1FCFA_{16}$ q) $DADA.C_{16}$ r) $F.4_{16}$ s) $EBA.C_{16}$

3) Convert the following numbers to hexadecimal:

- a) 320_{10} b) $6\,861_{10}$ c) $65\,535_{10}$ d) 100_8 e) 62.4_8 f) 500.25_8
g) 10001101_2 h) 1001000110100011110_2 i) 10000.1_2
j) 1000000.0000111_2 k) 1000111001.01_2

4) Convert the following BCD numbers to decimal:

- a) $0001\,1000\,0100_{BCD}$ b) $0100\,1001\,0010_{BCD}$
c) $1001\,0111\,0101\,0010_{BCD}$ d) $0111\,0111\,0111\,0101_{BCD}$

5) How many bits are required for the binary representation of the decimal numbers from 0 to 511?

6) What is the largest number that can be represented in 16-bit binary numeration system?

1.15. Solutions

SOLUTION 1.1.– Conversions

1) Conversions to binary representation

a) $37_{10} = 100101_2$

b) $15_{10} = 1111_2$

c) $187_{10} = 10111011_2$

d) $2\ 014_{10} = 11111011110_2$

e) $2\ 016_{10} = 2^{11} - 2^5 = 11111100000_2$

f) $2.75_{10} = 10.11_2$

g) $25.25_{10} = 11001.01$

h) $243.3125_{10} = 11110011.0101_2$

i) $0.0625_{10} = 0.0001_2$

j) $62_8 = 110010_2$

k) $277_8 = 10111111_2$

l) $12.6_8 = 1010.11_2$

m) $476.35_8 = 100111110.011101_2$

n) $92_{16} = 10010010_2$

o) $37FD_{16} = 11011111111101_2$

p) $7FF_{16} = 11111111111_2$

q) $1A6_{16} = 110100110_2$

r) $2C0_{16} = 1111000000_2$

s) $1F.C_{16} = 11111.11_2$

t) $9.F_{16} = 1001.1111_2$

u) $A7,EC_{16} = 10100111.111011_2$

2) Conversion to decimal representation

a) $10110_2 = 22_{10}$

b) $10001_2 = 17_{10}$

c) $10001101_2 = 141_{10}$

d) $100100001001_2 = 2313_{10}$

- e) $1111010111_2 = 983_{10}$
- f) $1011.101_2 = 11.625_{10}$
- g) $10011011001.10110_2 = 1241.6875_{10}$
- h) $30_8 = 36_{10}$
- i) $115_8 = 77_{10}$
- j) $55.4_8 = 45.5_{10}$
- k) $270.54_8 = 184.6875_{10}$
- l) $356_{16} = 854_{10}$
- m) $2AF_{16} = 687_{10}$
- n) $2C1_{16} = 705_{10}$
- o) $10FF_{16} = 4351_{10}$
- p) $1FCFA_{16} = 130298_{10}$
- q) $DADA.C_{16} = 56026.75_{10}$
- r) $F.4_{16} = 15.25_{10}$
- s) $EBA.C_{16} = 3770.75_{10}$

3) Conversion to hexadecimal representation

- a) $320_{10} = 140_{16}$
- b) $6\ 861_{10} = 1ACD_{16}$
- c) $65\ 535_{10} = 16^4 - 1 = FFFF_{16}$
- d) $100_8 = 40_{16}$
- e) $62.4_8 = 32.8_{16}$
- f) $500.25_8 = 140.54_{16}$
- g) $10001101_2 = 8D_{16}$
- h) $1001000110100011110_2 = 48D1E_{16}$
- i) $10000.1_2 = 10.8_{16}$
- j) $1000000.0000111_2 = 40.0E_{16}$
- k) $1000111001.01_2 = 239.4_{16}$

4) BCD – Decimal conversion

a) $0001\ 1000\ 0100_{BCD} = 184_{10}$

b) $0100\ 1001\ 0010_{BCD} = 492_{10}$

c) $1001\ 0111\ 0101\ 0010_{BCD} = 9\ 752_{10}$

d) $0111\ 0111\ 0111\ 0101_{BCD} = 7\ 775_{10}$

5) How many bits are required for the binary representations of the decimal numbers from 0 to 511?

With k bits, only the decimal numbers from 0 to $2^k - 1$ can be represented. Thus:

$$2^k - 1 = 511 \quad \text{and} \quad k = \log(512)/\log(2) = 9$$

6) What is the largest number that can be represented in 16 bit binary numeration?

The largest number that can be represented in 16 bits binary numeration system is $2^{16} - 1 = 65.535$.