Exercise 1.9 What is the largest 16-bit binary number that can be represented with

(a) unsigned numbers?

(b) two's complement numbers?

(c) [redacted]

a.) 65,536

b.) 65,536

Exercise 1.13 Convert the following unsigned binary numbers to decimal. Show your work.

(a) 1010_2

(b) 110110_2

(c) 11110000_2

(d) 0001000010100111_2

a.) 1 0 1 0
8 4 2 1 = 8+2 = 10_{10}

b.) 1 1 0 1 1 0
32 16 8 4 2 1 = 32+16+4+2 = 54_{10}

c.) 0 0 0 1 0 0 0 0 1 0 1 0 0 1 1 1
2048 128 32 4 2 1 = 2048+128+32+4+2+1 = $2,215_{10}$

Exercise 1.17 Convert the following hexadecimal numbers to decimal. Show your work.

(a) $A5_{16}$

(b) $3B_{16}$

(c) $FFFF_{16}$

(d) $D0000000_{16}$

a.) A 5 = 10x16 + 5x1 = 165_{10}
16 1

b.) 3 B = 3x16 + 11x1 = 59_{10}
16 1

c.) F F F F = 15x4096 + 15x256 + 15x16 + 15x1 = $65,535_{16}$
4096 256 16 1

D.) D 0 0 0 0 0 0 0 0 = 13x268435456 = $3,489,660,928_{10}$
268435456

Exercise 1.21 Convert the following two's complement binary numbers to decimal.

(a) 1010_2

(b) 110110_2

(c) 01110000_2

(d) 10011111_2

a.) #1 0101 $\quad 1010_2 = -6_{10}$

#2 $+\ 1$

$0110 = 6$

b.) #1 $00100\overset{1}{1}0$ $\quad 110110_2 = -10_{10}$

#2 $+\ 1$

$00101\overset{1}{0} = 10$

c.) $0\ 1\ 1\ 1\ 0\ 0\ 0\ 0 = 64 + 32 + 16 = 112_{10}$

$64\ 32\ 16\ 8\ 4\ 2\ 1$

D.) #1 01100000 $\quad 10011111_2 = -97_{10}$

#2 $+\ 1$

$01100001 = 97$

$64\ 32\ \ \ \ \ 1$

Exercise 1.29 Convert the following decimal numbers to 8-bit two's complement numbers or indicate that the decimal number would overflow the range.

(a) 42_{10}

(b) -63_{10}

(c) 124_{10}

(d) -128_{10}

(e) 133_{10}

a.)

0	1
1	2
2	4
3	8
4	16
5	32
6	64
7	128

$42 - 32 = 10$ (5)

$10 - 8 = 2$ (3)

$2 - 2 = 0$ (1)

$00101010_2 = 42_{10}$

b.) $63 - 32 = 31$ (5)

$31 - 16 = 15$ (4)

$15 - 8 = 7$ (3)

$7 - 4 = 3$ (2)

$3 - 2 = 1$ (1)

$1 - 1 = 0$ (0)

$00111111 = 63_{10}$

$11000001 = -63_{10}$

C.) $124 - 64 = 60$ (6)

$60 - 32 = 28$ (5)

$28 - 16 = 12$ (4)

$12 - 8 = 4$ (3)

$4 - 4 = 0$ (2)

$0\ 1\ 1\ 1\ 1\ 1\ 0 = 124_{10}$

D.) $128 - 128 = 0$ (7)

$10000000 = -128$

E.) In 8-bit $\Rightarrow$ TC range is -128 to 127, so overflow

Exercise 1.40 Convert each of the following octal numbers to binary, hexadecimal, and decimal.

(a) 23_8

(b) 45_8

(c) 371_8

(d) 2560_8

a.) 2 3 = 010 011 = 10011_2 = 13_{16} = $1 \times 16 + 3 \times 1 = 19_{10}$

b.) 45_8 = 100 101 = 25_{16} = $2 \times 16 + 5 \times 1 = 37_{10}$

c.) 3 7 1 = 011 111 001 = $F9_{16}$ = $15 \times 16 + 9 \times 1 = 249_{10}$

D.) 2 5 6 0 = 010 101 110 000 = 570_{16} = $5 \times 256 + 7 \times 16 = 1392_{10}$

Exercise 1.43 How many bytes are in a 32-bit word? How many nibbles are in the 32-bit word?

a.) 4-bytes in a 32-bit Word

b.) 8 nibbles in a 32-bit Word

Exercise 1.46 USB 3.0 can send data at 5 Gbits/sec. How many bytes can it send in 1 minute?

5 Gbits/sec is 0.625 GBytes/Sec

Which is 37.5 GB/Min.