Exercises 02 - Data Representation

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0.0.1 Data Representation Exercises

Exercise 1 – What is the largest 32-bit binary number that can be represented with:

- (a) **Unsigned numbers**
- (b) **Two's complement numbers**
- (c) **Sign/magnitude numbers**

Exercise 2 – What is the smallest (most negative) 16-bit binary number that can be represented with:

- (a) **Unsigned numbers**
- (b) **Two's complement numbers**
- (c) **Sign/magnitude numbers**

Exercise 3 – What is the smallest (most negative) 32-bit binary number that can be represented with:

- (a) **Unsigned numbers**
- (b) **Two's complement numbers**
- (c) **Sign/magnitude numbers**

Exercise 4 – Convert the following unsigned binary numbers to decimal and to hexadecimal:

- (a) 1110_2
- (b) 100100_2
- (c) 11010111_2
- (d) 011101010100100_2
- (e) 0110_2
- (f) 101101_2
- (g) 10010101_2
- (h) 110101001001_2

Exercise 5 – Convert the following hexadecimal numbers to decimal and to unsigned binary:

- (a) $4E_{16}$
- (b) $7C_{16}$

- (c) $ED3A_{16}$
- (d) $403FB001_{16}$
- (e) $2B_{16}$
- (f) $9F_{16}$
- (g) $42CE_{16}$
- (h) $E34F_{16}$

Exercise 6 – Convert the following two's complement binary numbers to decimal:

- (a) 1110_2 (4-bit)
- (b) 100011_2 (6-bit)
- (c) 01001110_2 (8-bit)
- (d) 10110101_2 (8-bit)
- (e) 1001_2 (4-bit)
- (f) 110101_2 (6-bit)
- (g) 01100010_2 (8-bit)
- (h) 10111000_2 (8-bit)

Exercise 7 – Convert the following decimal numbers to unsigned binary and to hexadecimal:

- (a) 42_{10}
- (b) 63_{10}
- (c) 229_{10}
- (d) 845_{10}
- (e) 56_{10}
- (f) 75_{10}
- (g) 183_{10}
- (h) 754_{10}

Exercise 8 – Convert the following decimal numbers to 8-bit two's complement numbers or indicate overflow. Range of 8-bit two's complement: $-128 \leq N \leq +127$.

- (a) 24
- (b) -59

- (c) 128
- (d) -150
- (e) 127
- (f) 48
- (g) -34
- (h) 133
- (i) -129

Exercise 9 How many bytes are in a 32-bit word? How many nibbles are in the 32-bit word? How many bytes are in a 64-bit word? How many nibbles are in the 64-bit word? How many bits are in 2 bytes? How many bits are in 6 bytes?

Exercise 10 Convert the following decimal numbers to IEEE 754 single-precision format:

- (a) 45.375_{10}
- (b) -13.25_{10}
- (c) 0.1_{10}
- (d) -0.125_{10}

Exercise 11 Convert the following IEEE 754 single-precision numbers into decimal values:

- (a) 0 10000010 01100000000000000000000
- (b) 1 10000001 01000000000000000000000
- (c) 0 01111101 10000000000000000000000
- (d) 1 01111100 00000000000000000000000

Exercise 12 – A particular modem operates at 768 Kb/sec. How many bytes can it receive in 1 minute?

Exercise 13 USB 3.0 can send data at 5 Gb/sec. How many bytes can it send in 1 minute?