Class exercise section 1.3 | Christopher Koepke

- convert the following decimal numbers to binary.

a) $35.625_{10} = \boxed{100011.101_2}$

35/2 = 17 R=1
17/2 = 8 R=1
8/2 = 4 R=0
4/2 = 2 R=0
2/2 = 1 R=0
1/2 = 0 R=1
100011

.625x2 = 1.25
.25x2 = 0.5
.05x2 = 1.0
101

b) $-78.125_{10} = \boxed{-1001110.001_2}$

78/2 = 39 R=0
39/2 = 19 R=1
19/2 = 9 R=1
9/2 = 4 R=1
4/2 = 2 R=0
2/2 = 1 R=0
1/2 = 0 R=1
1001110

.125x2 = 0.25
.25x2 = 0.5
.5x2 = 1.0
.001

- convert the following numbers to IEEE single point representations

a) -22.15 = $\boxed{11000001101100010011001100110011_{(2)}} = C1B13333_{(16)}$

22/2 = 11 R=0
11/2 = 5 R=1
5/2 = 2 R=1
2/2 = 1 R=0
1/2 = 1 R=1
10110

.15x2 = 0.3
.3x2 = 0.6
.6x2 = 1.2
.2x2 = 0.4
.4x2 = 0.8
.8x2 = 1.6
repeat 1001
.001001
repeat

-22.15 = 10110.001001 = 1.0110001001×2^4
C = 127+4 = 131
131 = 1000 0011

Sign	exp	mantissa
1	1000 0011	0110 0010 0110 0110 0110 0110

1100 0001 1011 0001 0011 0011 0011 0011
C 1 B 1 3 3 3 3

b) 325.825 = $\boxed{01000011101000101110100110011001_{(2)}} = 43A2E999_{(16)}$

325/2 = 162 R=1
162/2 = 81 R=0
81/2 = 40 R=1
40/2 = 20 R=0
20/2 = 10 R=0
10/2 = 5 R=0
5/2 = 2 R=1
2/2 = 1 R=0
1/2 = 0 R=1
101000101

.825x2 = 1.65
.65x2 = 1.3
.3x2 = 0.6
.6x2 = 1.2
.2x2 = 0.4
.4x2 = 0.8
.8x2 = 1.6
repeating
.1101001
repeat

101000101.1101001 = $1.0100010111101001 \times 2^8$
C = 127+8 = 135
135 = 1000 0111

Sign	exp	mantissa
0	1000 0111	0100 0101 1101 0011 0011 0011

0100 0011 1010 0010 1110 1001 1001 1001
4 3 A 2 E 9 9 9

• convert the following single precision FP representations to decimal numbers

a) $CA3F2900_{(16)} = \boxed{-3131968.0_{(10)}}$

C A 3 F 2 9 0 0

1100 1010 0011 1111 0010 1001 0000 0000

sign | exp | mantissa

1 | 1001 0100 | 0111 1110 0101 0010 0000 000

$exp = 148 - 127 = 21 = C$

$1.01111110010100100000000 \times 2^{21}$

1 0 1111 1100 1010 0100 0000.00

$2^{21} + 2^{19} + 2^{18} + 2^{17} + 2^{16} + 2^{15} + 2^{14} + 2^{11} + 2^{9} + 2^{6}$

b) $C553E000_{(16)} = \boxed{-3390.0_{(10)}}$

C 5 5 3 E 0 0 0

1100 0101 0101 0011 1110 0000 0000 0000

sign | exp | mantissa

1 | 1000 1010 | 1010 0111 1100 0000 0000 000

$exp = 140 - 127 = 11 = C$

$1.10100111110000000000000 \times 2^{11}$

1101001111110.000000000000

$2^{11} + 2^{10} + 2^{8} + 2^{5} + 2^{4} + 2^{3} + 2^{2} + 2^{1}$