

ITI1100C
Assignment # 1
SOLUTIONS

1.3

$$(4310)_5 = 4 * 5^3 + 3 * 5^2 + 1 * 5^1 = 580_{10}$$

$$(198)_{12} = 1 * 12^2 + 9 * 12^1 + 8 * 12^0 = 260_{10}$$

$$(445)_8 = 4 * 8^2 + 4 * 8^1 + 5 * 8^0 = 293_{10}$$

$$(345)_6 = 3 * 6^2 + 4 * 6^1 + 5 * 6^0 = 137_{10}$$

1.7

$$64CD = 0110_0100_1100_1101_2 = 110_010_011_001_101 = (62315)_8$$

1.9

(a) $10110.0101_2 = 16 + 4 + 2 + .25 + .0625 = 22.3125$

(b) $16.5_{16} = 16 + 6 + 5*(.0615) = 22.3125$

(c) $26.24_8 = 2 * 8 + 6 + 2/8 + 4/64 = 22.3125$

(d) $DABA.B_{16} = 13*16^3 + 10*16^2 + 11*16 + 10 + 11/16 = 55994.6875$

(e) $1011.1001_2 = 8 + 2 + 1 + .5 + .0625 = 11.5625$

1.13

(a) Convert 27.315 to binary:

	Integer Quotient		Remainder	Coefficient
27/2 =	13	+	1	a ₀ = 1
13/2	6	+	1	a ₁ = 1
6/2	3	+	0	a ₂ = 0
3/2	1	+	1	a ₃ = 1
1/2	0	+	1	a ₄ = 1

$$27_{10} = 11011_2$$

	Integer		Fraction	Coefficient
.315 x 2 =	0	+	.630	a ₁ = 0
.630 x 2 =	1	+	.26	a ₂ = 1
.26 x 2 =	0	+	.52	a ₃ = 0
.52 x 2 =	1	+	.04	a ₄ = 1

$$.315_{10} \cong .0101_2 = .25 + .0625 = .3125$$

$$27.315 \cong 11011.0101_2$$

(b) $2/3 \cong .666666667$

	Integer		Fraction	Coefficient
.6666_6666_67 x 2 =	1	+	.3333_3333_34	a ₋₁ = 1
.3333333334 x 2 =	0	+	.6666666668	a ₂ = 0
.6666666668 x 2 =	1	+	.3333333336	a ₃ = 1
.3333333336 x 2 =	0	+	.6666666672	a ₄ = 0
.6666666672 x 2 =	1	+	.3333333344	a ₅ = 1
.3333333344 x 2 =	0	+	.6666666688	a ₆ = 0
.6666666688 x 2 =	1	+	.3333333376	a ₇ = 1
.3333333376 x 2 =	0	+	.6666666752	a ₈ = 0

$$.666666667_{10} \cong .10101010_2 = .5 + .125 + .0313 + .0078 = .6641_{10}$$

(c). $10101010_2 = .1010_2 = .AA_{16} = 10/16 + 10/256 = .6641_{10}$ (Same as (b)).

1.14

(a) 1001_0000

1s comp: 0110_1111

2s comp: 0111_0000

(b) 0000_0000

1s comp: 1111_1111

2s comp: 0000_0000

(c) 1101_1010

1s comp: 0010_0101

2s comp: 0010_0110

(d) 1010_1010

1s comp: 0101_0101

2s comp: 0101_0110

(e) 1010_0101

1s comp: 0101_1010

2s comp: 0101_1011

(f) 1111_1111

1s comp: 0000_0000

2s comp: 0000_0001

1.16

15s comp: C3AF
3C50
16s comp: 3C51

C3AF: 1100_0011_1010_1111
1s comp: 0011_1100_0101_0000
2s comp: 0011_1100_0101_0001 = 3C51

1.17

(a) $5,297 \rightarrow 05297 \rightarrow 94702$ (9s comp) $\rightarrow 94703$ (10s comp)

$$6,473 - 5,297 = 06473 + 94703 = 101176 \text{ (Positive)}$$

Result: $6,473 - 5,297 \rightarrow 1176$

(b) $1800 \rightarrow 01800 \rightarrow 98199$ (9s comp) $\rightarrow 98200$ (10 comp)

$$125 - 1800 = 00125 + 98200 = 98325 \text{ (negative)} \rightarrow 1675 \text{ (10's comp)}$$

Magnitude: 1675

Result: $125 - 1800 = -1675$

(c) $3,217 \rightarrow 03217 \rightarrow 96782$ (9s comp) $\rightarrow 96783$ (10s comp)

$$1076 - 3217 = 01076 + 96783 = 97859 \text{ (Negative)} \rightarrow 2141 \text{ (10's comp)}$$

Magnitude: 2141

Result: $1076 - 3217 = -2141$

(d) $745 \rightarrow 00745 \rightarrow 99254$ (9s comp) $\rightarrow 99255$ (10s comp)
 $1631 - 745 = 01631 + 99255 = 100886$ (Positive)
 Result: $1631 - 745 = 886$

1.18

Note: Consider sign extension with 2s complement arithmetic.

(a) 0_10010

1s comp: 1_01101

2s comp: 1_01110

0_10011

Diff: 0_00001 (Positive)

Check: $19 - 18 = +1$

(b) 0_100110

1s comp: 1_011001 with sign extension

2s comp: 1_011010

0_100010

1_111100 sign bit indicates that the result is negative

0_000011 1s complement

0_000100 2s complement

000100 magnitude

Result: -4

Check: $34 - 38 = -4$

(c) 0_110101

1s comp: 1_001010

2s comp: 1_001011

0_001001

Diff: 1_010100 (negative)

0_101011 (1s comp)

0_101100 (2s complement)

101100 (magnitude)

-44₁₀ (result)

(d) 0_010101

1s comp: 1_101010 with sign extension

2s comp: 1_101011

0_101000

0_010011 sign bit indicates that the result is positive

Result: 19₁₀

Check: $40 - 21 = 19_{10}$

