ITI1100C
Assignment # 1
SOLUTIONS

1.3

$(4310)_5 = 4 * 5^3 + 3 * 5^2 + 1 * 5^1 = 580_{10}$
$(198)_{12} = 1 * 12^2 + 9 * 12^1 + 8 * 12^0 = 260_{10}$
$(435)_8 = 4 * 8^2 + 3 * 8^1 + 5 * 8^0 = 285_{10}$
$(345)_6 = 3 * 6^2 + 4 * 6^1 + 5 * 6^0 = 137_{10}$

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) $DADA.B_{16} = 13*16^3 + 10*16^2 + 13*16 + 10 + 11/16 = 56{,}026.6875$
(e) $1010.1101_2 = 8 + 2 + .5 + .25 + .0625 = 10.8125$

1.13

(a) Convert 27.315 to binary:

	Integer Quotient		Remainder	Coefficient
27/2 =	13	+	1/2	a0 = 1
13/2	6	+	1/2	a1 = 1
6/2	3	+	0	a2 = 0
3/2	1	+	1/2	a3 = 1
1/2	0	+	1/2	a4 = 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) $2/3 \cong .6666666667$

	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	$a_{-8} = 0$

$.6666666667_{10} \cong .10101010_2 = .5 + .125 + .0313 + ..0078 = .6641_{10}$

(c).$10101010_2 = .1010\_1010_2 = .AA_{16} = 10/16 + 10/256 = .6641_{10}$ (Same as (b)).

1.14

(a) 0001_0000
1's comp: 1110_1111
2's comp: 1111_0000

(b) 0000_0000
1's comp: 1111_1111
2's comp: 0000_0000

(c) 1101_1010
1's comp: 0010_0101
2's comp: 0010_0110

(d) 1010_1010
1's comp: 0101_0101
2's comp: 0101_0110

(e) 1000_0101
1's comp: 0111_1010
2's comp: 0111_1011

(f) 1111_1111
1's comp: 0000_0000
2's comp: 0000_0001

1.16

C3DF
15's comp: 3C20
16's comp: 3C21

C3DF: 1100_0011_1101_1111
1's comp: 0011_1100_0010_0000
2's comp: 0011_1100_0010_0001 = 3C21

1.17

(a) 2,579 → 02,579 →97,420 (9s comp) → 97,421 (10's comp)
$4637 – 2,579 = 2,579 + 97,421 = 2058_{10}$

(b) 1800 → 01800 → 98199 (9s comp) → 98200 (10's comp)
125 – 1800 = 00125 + 98200 = 98325 (negative)
Magnitude: 1675
Result: 125 – 1800 = -1675

(c) 4,361 → 04361 → 95638 (9s comp) → 95639 (10s comp)
2043 – 4361 = 02043 + 95639 = 97682 (Negative)
Magnitude: 2318
Result: 2043 – 6152 = -2318

(d) 745 → 00745 → 99254 (9s comp) → 99255 (10s comp)
1631 -745 = 01631 + 99255 = 0886 (Positive)
Result: 1631 – 745 = 886

1.18

Note: Consider sign extension with 2s complement arithmetic.

(a) 0_10010
1's comp: 1_01101
2's comp: 1_01110
0_10011
Diff: 0_00001 (Positive)
Check:19-18 = +1

(**b**) 0_100110
1's comp: 1_011001 with sign extension
2's comp: 1_011010
0_100010
1_111100 sign bit indicates that the result is negative
0_000011 1's complement
0_000100 2's complement
000100 magnitude
Result: -4
Check: 34 -38 = -4

(c) 0_110101
1's comp: 1_001010
2's comp: 1_001011
0_001001
Diff: 1_010100 (negative)
0_101011 (1s comp)
0_101100 (2s complement)
101100 (magnitude)
-44_{10} (result)

(**d**) 0_010101
1's comp: 1_101010 with sign extension
2's comp: 1_101011
0_101000
0_010011 sign bit indicates that the result is positive
Result: 19_{10}
Check: $40 - 21 = 19_{10}$