

ITI1100A
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	+	$1/2$		$a_0 = 1$
$13/2 =$	6	+	$1/2$		$a_1 = 1$
$6/2 =$	3	+	0		$a_2 = 0$
$3/2 =$	1	+	$1/2$		$a_3 = 1$
$1/2 =$	0	+	$1/2$		$a_4 = 1$

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

	Integer		Fraction		Coefficient
$.315 \times 2 =$	0	+	.630		$a_{-1} = 0$
$.630 \times 2 =$	1	+	.26		$a_{-2} = 1$
$.26 \times 2 =$	0	+	.52		$a_{-3} = 0$
$.52 \times 2 =$	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
$.6666_6666_67 \times 2 =$	1	+	$.3333_3333_34$		$a_{-1} = 1$

$$\begin{array}{rcll}
.333333334 \times 2 = & 0 & + .666666668 & a_2 = 0 \\
.666666668 \times 2 = & 1 & + .333333336 & a_3 = 1 \\
.333333336 \times 2 = & 0 & + .666666672 & a_4 = 0 \\
.666666672 \times 2 = & 1 & + .333333344 & a_5 = 1 \\
.333333344 \times 2 = & 0 & + .666666688 & a_6 = 0 \\
.666666688 \times 2 = & 1 & + .333333376 & a_7 = 1 \\
.333333376 \times 2 = & 0 & + .666666752 & a_8 = 0 \\
.666666667_{10} \cong .10101010_2 = .5 + .125 + .0313 + .0078 = .6641_{10}
\end{array}$$

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

1.14

(a) 0001_0000	(b) 0000_0000	(c) 1101_1010
1's comp: 1110_1111	1's comp: 1111_1111	1's comp: 0010_0101
2's comp: 1111_0000	2's comp: 0000_0000	2's comp: 0010_0110
(d) 1010_1010	(e) 1000_0101	(f) 1111_1111
1's comp: 0101_0101	1's comp: 0111_1010	1's comp: 0000_0000
2's comp: 0101_0110	2's comp: 0111_1011	2's comp: 0000_0001

1.16

	C3DF	C3DF: 1100_0011_1101_1111
15's comp:	3C20	1's comp: 0011_1100_0010_0000
16's comp:	3C21	2's comp: 0011_1100_0010_0001 = 3C21

1.17

- (a)** 2,579 \rightarrow 02,579 \rightarrow 97,420 (9s comp) \rightarrow 97,421 (10's comp)
 $4637 - 2,579 = 2,579 + 97,421 = 2058_{10}$
- (b)** 1800 \rightarrow 01800 \rightarrow 98199 (9s comp) \rightarrow 98200 (10's comp)
 $125 - 1800 = 00125 + 98200 = 98325$ (negative)
Magnitude: 1675
Result: $125 - 1800 = -1675$
- (c)** 4,361 \rightarrow 04361 \rightarrow 95638 (9s comp) \rightarrow 95639 (10s comp)
 $2043 - 4361 = 02043 + 95639 = 97682$ (Negative)
Magnitude: 2318
Result: $2043 - 6152 = -2318$
- (d)** 745 \rightarrow 00745 \rightarrow 99254 (9s comp) \rightarrow 99255 (10s comp)
 $1631 - 745 = 01631 + 99255 = 0886$ (Positive)
Result: $1631 - 745 = 886$

1.18

Note: Consider sign extension with 2s complement arithmetic.

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|--|---|
| <p>(a) 0_10010
 1's comp: 1_01101
 2's comp: 1_01110
 <u>0_10011</u>
 Diff: <u>0_00001</u> (Positive)
 Check: 19-18 = +1</p> | <p>(b) 0_100110
 1's comp: 1_011001 with sign extension
 2's comp: 1_011010
 <u>0_100010</u>
 Diff: <u>1_111100</u> 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</p> |
| <p>(c) 0_110101
 1's comp: 1_001010
 2's comp: 1_001011
 <u>0_001001</u>
 Diff: <u>1_010100</u> (negative)
 0_101011 (1s comp)
 0_101100 (2s complement)
 101100 (magnitude)
 -44₁₀ (result)</p> | <p>(d) 0_010101
 1's comp: 1_101010 with sign extension
 2's comp: 1_101011
 <u>0_101000</u>
 Diff: <u>0_010011</u> sign bit indicates that the result is positive
 Result: 19₁₀
 Check: 40 - 21 = 19₁₀</p> |