

ITI1100B&C

Professor: Qi Hao

Assignment # 1

Submission Deadline Jan. 29, 2017 midnight (11h59 PM), BlackBoard Learn

From the textbook Chapter 1 pages 33-35, solve the following problems

1-3, 1-7, 1-9 (c)(d)(e), 1-11, 1-13, 1-14(b)(c)(e)(f), 1-16, 1-17, 1-18, 1-20, 1-29.

1.3 $(4310)_5 = 4 * 5^3 + 3 * 5^2 + 1 * 5^1 = 580_{10}$

4 points

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

$$(435)_8 = 4 * 8^2 + 3 * 8^1 + 5 * 8^0 = 285_{10}$$

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

1.7 $64CD_{16} = 0110_0100_1100_1101_2 = 110_010_011_001_101 = (62315)_8$

2 points

1.9

3 points

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

(d) $DADA.B_{16} = 14*16^3 + 10*16^2 + 14*16 + 10 + 11/16 = 60,138.6875$

Note: error in 1.9(d) in the solution manual. Correction for 1.9 (d):

$$(DADA.B)_{16} = (13x16^3) + (10x16^2) + (13x16^1) + (10x16^0) + (11x16^{-1}) = \mathbf{56,026.6875}$$

(e) $1010.1101_2 = 8 + 2 + .5 + .25 + .0625 = 10.8125$

1.11

$$\begin{array}{r}
 \underline{1011.11} \\
 101 \overline{) 111011.0000} \\
 \underline{101} \\
 01001 \\
 \underline{101} \\
 1001 \\
 \underline{101} \\
 1000 \\
 \underline{101} \\
 0110
 \end{array}$$

2 points

The quotient is carried to two decimal places, giving 1011.11
 Checking: $111011_2 / 101_2 = 59_{10} / 5_{10} \cong 1011.11_2 = 58.75_{10}$

1.13 (a) Convert 27.315 to binary:

6 points

	Integer		Remainder	Coefficient
	Quotient			
$27/2 =$	13	+	$\frac{1}{2}$	$a_0 = 1$
$13/2$	6	+	$\frac{1}{2}$	$a_1 = 1$
$6/2$	3	+	0	$a_2 = 0$
$3/2$	1	+	$\frac{1}{2}$	$a_3 = 1$
$\frac{1}{2}$	0	+	$\frac{1}{2}$	$a_4 = 1$

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

	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) $2/3 \cong .666666667$

	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

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

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

1.14

(b) 0000_0000 (c) 1101_1010
 1s comp: 1111_1111 1s comp: 0010_0101
 2s comp: 0000_0000 2s comp: 0010_0110

4 points

(e) 1000_0101 (f) 1111_1111
 1s comp: 0111_1010 1s comp: 0000_0000
 2s comp: 0111_1011 2s comp: 0000_0001

1.16

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

4 points

1.17

(a) 2,579 → 02,579 → 97,420 (9s comp) → 97,421 (10s comp)
 4637 - 2,579 = 2,579 + 97,421 = 2058₁₀

5 points

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

Note: error in 1.17(b). Correction:
 Result: 125 - 1800 = -1675

You can also use 4 bits to represent numbers.
 125 - 1800 = (0125 + 8,200)_{10's} = (8,325)_{10's} = **-1,675**

(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.

6 points

(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)
 -44_{10} (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: 19_{10}
 Check: $40 - 21 = 19_{10}$

1.20 $+49 \rightarrow 0_110001$ (Needs leading zero extension to indicate + value);

3 points

$+29 \rightarrow 0_011101$ (Leading 0 indicates + value)
 $-49 \rightarrow 1_001110 + 0_000001 \rightarrow 1_001111$
 $-29 \rightarrow 1_100011$ (sign extension indicates negative value)

(a) $(+29) + (-49) = 0_011101 + 1_001111 = 1_101100$ (1 indicates negative value.)
 Magnitude = $0_010011 + 0_000001 = 0_010100 = 20$; Result $(+29) + (-49) = -20$

(b) $(-29) + (+49) = 1_100011 + 0_110001 = 0_010100$ (0 indicates positive value)
 $(-29) + (+49) = +20$

- (c) Must increase word size by 1 (sign extension) to accomodate overflow of values:
 $(-29) + (-49) = 11_100011 + 11_001111 = 10_110010$ (1 indicates negative result)
Magnitude: $01_001110 = 78_{10}$
Result: $(-29) + (-49) = -78_{10}$

1.29 Steve Jobs

1 points

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