

# ITI1100Z

Professor: Qi Hao

## Assignment # 1

**Submission Deadline May 21, 2018 midnight (11h59 PM), Brightspace**

From the textbook Chapter 1 pages 37-40 in the 6<sup>th</sup> edition, 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

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

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

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

**1.7**  $64CD_{16} = 0110\_0100\_1100\_1101_2 = 110\_010\_011\_001\_101 = (62315)_8$

2 points

**1.9**

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

3 points

**(d)**  $DABA.B_{16} = 13 * 16^3 + 10 * 16^2 + 11 * 16 + 10 + 11/16 = 55,994.6875$

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

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**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)  $2/3 \approx .666666667$

|                   | 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   | $a_8 = 0$   |

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

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

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)                      1010\_0101 (f)                      1111\_1111  
 1s comp:    0101\_1010                      1s comp:    0000\_0000  
 2s comp:    0101\_1011                      2s comp:    0000\_0001

1.16

4 points

C3AF                      C3AF: 1100\_0011\_1010\_1111  
 15s comp:    3C50                      1s comp: 0011\_1100\_0101\_0000  
 16s comp:    3C51                      2s comp: 0011\_1100\_0101\_0001 = 3C51

1.17

5 points

(a)  $6,473 - 5297 = 1176$   
 $5297 \rightarrow 05297 \rightarrow 94702$  (9s comp)  $\rightarrow 94703$  (10s comp)  
 $6473 - 5297 = 6473 + 94703 = 101,176$  (positive)  
 Magnitude: 1,176  
 Result:  $6,473 - 5297 = 1176$

(b)  $1,076 - 3,217 = -2,141$   
 $3,217 \rightarrow 96,782$  (9s comp)  $\rightarrow 96,783$  (10s comp)  
 $1,076 - 3,217 = 1,076 + 96,783 = 97,858$  (negative)  
 Magnitude: 2,141  
 Result:  $1,076 - 3,217 = -2,141$

(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**

6 points

(a)  $0\_10110$  (22)      (b)  $0\_100110$   
 1s comp:  $1\_01001$       1s comp:  $1\_011001$  with sign extension  
 2s comp:  $1\_01010$       2s comp:  $1\_011010$   
 $0\_10111$  (23)       $0\_100010$   
 Diff:  $0\_00001$  (Positive)       $1\_111100$  sign bit indicates that the  
 result is negative  
 Result: +1       $0\_000011$  1s complement  
     $0\_000100$  2s complement  
     $0\_000100$  magnitude  
 Check:  $23 - 22 = +1$       Result: -4  
    Check:  $34 - 38 = -4$

(c)  $0\_110101$       (d)  $0\_010101$   
 1s comp:  $1\_001010$       1s comp:  $1\_101010$  with sign extension  
 2s comp:  $1\_001011$       2s comp:  $1\_101011$   
 $0\_001001$        $0\_101000$   
 Diff:  $1\_010100$  (negative)       $0\_010011$  sign bit indicates that the  
 result is positive  
 $0\_101011$  (1s comp)      Result:  $19_{10}$   
 $0\_101100$  (2s complement)      Check:  $40 - 21 = 19_{10}$   
 $101100$  (magnitude)  
 $-44_{10}$  (result)

**1.20**

3 points

$+49 \rightarrow 0\_110001$  (Needs leading zero extension to indicate + value);  
 $+29 \rightarrow 0\_011101$  (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 accommodate 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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