

# HOMEWORK 2

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Chapter 1 problem 1: convert to decimal

c) 10 0110 1101

$$\begin{aligned} & 1 \times 2^0 + 0 \times 2^1 + 1 \times 2^2 + 1 \times 2^3 + 0 \times 2^4 + 1 \times 2^5 + 1 \times 2^6 \\ & + 0 \times 2^7 + 0 \times 2^8 + 1 \times 2^9 \\ & = 1 + 0 + 4 + 8 + 0 + 32 + 64 + 0 + 0 + 512 \\ & = 621_{10} \end{aligned}$$

f) 0000 1111 0000

$$\begin{aligned} & 0 \times 2^0 + 0 \times 2^1 + 0 \times 2^2 + 0 \times 2^3 + 1 \times 2^4 + 1 \times 2^5 + 1 \times 2^6 \\ & + 1 \times 2^7 + 0 \times 2^8 + 0 \times 2^9 + 0 \times 2^{10} + 0 \times 2^{11} \\ & = 0 + 0 + 0 + 0 + 16 + 32 + 64 + 128 + 0 + 0 + 0 + 0 \\ & = 240_{10} \end{aligned}$$

g) 1100 1100 1100

$$\begin{aligned} & 0 \times 2^0 + 0 \times 2^1 + 1 \times 2^2 + 1 \times 2^3 + 0 \times 2^4 + 0 \times 2^5 + 1 \times 2^6 \\ & + 1 \times 2^7 + 0 \times 2^8 + 0 \times 2^9 + 1 \times 2^{10} + 1 \times 2^{11} \\ & = 0 + 0 + 4 + 8 + 0 + 0 + 64 + 128 + 0 + 0 + 1024 + 2048 \\ & = 3276_{10} \end{aligned}$$

Chapter 1 problem 2: decimal to binary  
represent using 12-bit

a) 73

$$\begin{array}{r} 2 \overline{) 73} \\ 2 \overline{) 36} \rightarrow 1 \\ 2 \overline{) 18} - 0 \\ 2 \overline{) 9} - 0 \\ 2 \overline{) 4} - 1 \\ 2 \overline{) 2} - 0 \\ 1 - 0 \end{array} \quad (0000\ 0100\ 1001)_2$$

b) 127

$$\begin{array}{r} 2 \overline{) 127} \\ 2 \overline{) 63} - 1 \\ 2 \overline{) 31} - 1 \\ 2 \overline{) 15} - 1 \\ 2 \overline{) 7} - 1 \\ 2 \overline{) 3} - 1 \\ 1 - 1 \end{array} \quad (0000\ 0111\ 1111)_2$$

Chapter 1 problem 3: convert to hexadecimal

b)  $10110100000101_2$

group into 4s : 0010 1101 0000 0101  
                  ↓      ↓      ↓      ↓  
                  2      D      0      5

$(2D05)_{16}$

c)  $791_{10}$

$$\begin{array}{r} 16 \overline{) 791} \\ 16 \overline{) 49} - 7 \\ \quad 3 - 1 \end{array}$$

$(317)_{16}$

Chapter 1 problem 4: convert to decimal

c)  $3FF_{16}$

$$15 \times 16^0 + 15 \times 16^1 + 3 \times 16^2$$

$$= 15 + 240 + 768$$

$$= (1023)_{10}$$



Chapter 1 problem 5 : compute sums of 6-bit unsigned numbers, indicate overflow : decimal operation

$$\begin{array}{r}
 \text{a)} \quad \begin{array}{r} 000011 \\ + 001100 \\ \hline 001111 \end{array} \longleftrightarrow \begin{array}{r} \phantom{0}3 \\ + 12 \\ \hline 15 \end{array}
 \end{array}$$

$$\begin{array}{r}
 \text{b)} \quad \begin{array}{r} 010100 \\ + 101101 \\ \hline \boxed{1}000001 \end{array} \longleftrightarrow \begin{array}{r} \phantom{0}20 \\ + 45 \\ \hline 65 \end{array} \\
 \rightarrow \text{overflow}
 \end{array}$$

Chapter 1 problem 6 : 6-bit signed binary format

$$\text{d)} \quad +15 \longrightarrow 001111$$

$$\text{e)} \quad -15 \longrightarrow +15 : 001111$$

take 1s complement : 110000

add 1 to 1s complement :

$$\begin{array}{r} 110000 \\ + 00001 \\ \hline 110001 \end{array}$$

$$-15 \longrightarrow 110001$$

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Chapter 1 problem 7: 6 bit signed binary converted to decimal

e) 011111

$$1 \times 2^0 + 1 \times 2^1 + 1 \times 2^2 + 1 \times 2^3 + 1 \times 2^4 + 0 \times 2^5 =$$
$$1 + 2 + 4 + 8 + 16 + 0 = 31$$

$$(31)_{10}$$

f) 111001

first number is 1, so this indicates it's negative

1's complement: 000110

add 1:

$$\begin{array}{r} 000110 \\ + \quad 1 \\ \hline 000111 \end{array}$$

convert to decimal:  $1 \times 2^0 + 1 \times 2^1 + 1 \times 2^2$

$$= 1 + 2 + 4$$
$$= 7$$

answer is -7 because it is negative number

$$(-7)_{10}$$

Chapter 1, problem 9: adding 2 signed integers stored in 6-bit, convert to decimal & show overflow

$$\begin{array}{r}
 \text{a)} \quad \begin{array}{r} \overset{1}{1}\overset{1}{1}\overset{1}{0}\overset{1}{0}\overset{1}{0}\overset{1}{1} \\ + \quad \overset{1}{0}\overset{1}{0}\overset{1}{1}\overset{1}{1}\overset{1}{1}\overset{1}{1} \\ \hline \overset{1}{1}\overset{1}{0}\overset{1}{0}\overset{1}{0}\overset{1}{0}\overset{1}{0} \end{array} \longleftrightarrow \begin{array}{r} \quad \quad \quad (-11) \\ + \quad \quad (15) \\ \hline \quad \quad \quad 4 \end{array}
 \end{array}$$

There is no overflow because the carry into the MSB & carry-out are both 1

$110101$   
 ↗  
 First digit indicates it is negative number

1's complement:  $001010$

$$\begin{array}{r}
 \text{add 1:} \quad \begin{array}{r} 001010 \\ + \quad \quad \quad 1 \\ \hline 001011 \end{array}
 \end{array}$$

$$\begin{aligned}
 \text{convert to decimal: } & 1 \times 2^0 + 1 \times 2^1 + 0 \times 2^2 + 1 \times 2^3 \\
 & = 1 + 2 + 0 + 8 \\
 & = -11 \quad \leftarrow \text{is negative}
 \end{aligned}$$

$$\begin{aligned}
 001111 & \rightarrow 1 \times 2^0 + 1 \times 2^1 + 1 \times 2^2 + 1 \times 2^3 \\
 & = 1 + 2 + 4 + 8 \\
 & = 15
 \end{aligned}$$



## Chapter 2 problem 2: Truth Tables

c)

c.

a	b	c	d	y
0	1	0	1	0
0	1	1	0	0
0	1	1	1	1
1	0	0	1	1
1	0	1	0	0
1	0	1	1	0
1	1	0	1	1
1	1	1	0	1
1	1	1	1	0

f)

f.

a	b	c	d	y
0	0	0	0	1
0	0	0	1	1
0	0	1	0	0
0	1	0	0	1
0	1	0	1	1
0	1	1	0	1
1	0	0	0	0
1	0	0	1	1
1	0	1	0	1