Homework #5 Key

* Problem 1

a)
$$\begin{array}{r} 111101010 \\ +\ 10100111 \\ \hline 100011101 \end{array}$$

b)
$$\begin{array}{r} 111000001100 \\ +\ 101000011 \\ \hline 111101010 \end{array}$$

c)
$$\begin{array}{r} 10001011 \\ 11010 \\ +\ 10001111 \\ \hline 1000000110 \end{array}$$

d)
$$\begin{array}{r} 10001111 \\ 10101 \\ +\ 11111110 \\ \hline 111000010 \end{array}$$

* Problem 2

a)
$$\begin{array}{r} 1111\not{0}\not{1}\not{0}\not{0} \\ -\ 10011 \\ \hline 11101011 \end{array}$$

b)
$$\begin{array}{r} 11\not{0}\not{1}\not{0}\not{0}\not{0}\not{1}\not{0}\not{0} \\ -\ 10100011 \\ \hline 11001100 11 \end{array}$$

c)
$$\begin{array}{r} \not{1}\not{0}\not{1}\not{0}\not{0}\not{1}\not{0}1 \\ -\ 1111 \\ \hline 11011010 \end{array}$$

d)
$$\begin{array}{r} \not{1}\not{0}\not{1}\not{0}\not{1}1111 \\ -\ 10101 \\ \hline 11010110 \end{array}$$

* Problem 3

a)
$$\begin{array}{r|l} & 101100 \\ \hline 1011 & 111101010 \\ -1011 & \\ \hline 10001 & \\ 1011 & \\ \hline 1100 & \\ 1011 & \\ \hline 110 & \end{array}$$

b)

```
          10110100
101 ) 1110000100
      101
      1000
       101
        110
       -101
          101
          101
           000
```

c)

```
           1011
110 ) 1000101
     - 110
       1010
      - 110
        1001
      - 110
          11
```

d)

```
            1110
1010 ) 10001111
      - 1010
         1111
       - 1010
          1011
        - 1010
            11
```

* Problem 4

a) 111101010 >> 3 = 111010

$2^5\ 2^4\ 2^3\ \ 2^1$

$32+16+8+2 = 58_{10}$

b) 1110000100 >> 3 = 1110000

$64+32+16 = 112_{10}$

c) 1000101 >> 3 = 1000

$8+0 = 8_{10}$

d) 10001111 >> 3 = 10001

$16+1 = 17$

* Problem 5

a) $1111010101 << 3 = 1111010101000$
$= 3920_{10}$

b) $1110000100 << 3 = 1110000100000$
$= 7200_{10}$

c) $1000101 << 3 = 1000101000$
$= 552_{10}$

d) $10001111 << 3 = 10001111000$
$= 1144_{10}$

* Problem 6

a) $1111010000 \Rightarrow 0000101111$
1's $-512-256-64-16 = -977_{10}$

b) $1110010100 \Rightarrow 0001101011$
1's $-512-256-128-16-4 = -917_{10}$

c) $1000111001 \Rightarrow 0111000110$
1's $= -570_{10}$

d) $1000111101 \Rightarrow 0111000010$
1's $= -574_{10}$

* Problem 7

a) $1111010000 \Rightarrow 0000101111$
1's $+1$
$0000110000 \Rightarrow$ 2's

0000110000
$-(512+256+128+64+8+4+2+1) = -976$, but since we added +1, we balance value by -1
$= -976-1 = -977$

b) 1110010100 ⇒ 0001101011 (1's)

$+1$

→ 0001101100 ⇒ 2's

$0001101100 = -916_{10}$

-1

-917_{10} ←

c) 1000111001 ⇒ 0111000110 (1's)

$+1$

0111000111 ⇒ 2's ←

$0111000111 = -569_{10}$

-1

-570_{10} ←

d) 1000111101 ⇒ 0111000010 (1's)

$+1$

0111000011 ⇒ 2's ←

$0111000011 = -573_{10}$

-1

-574_{10} ←