디지털회로개론 HW1

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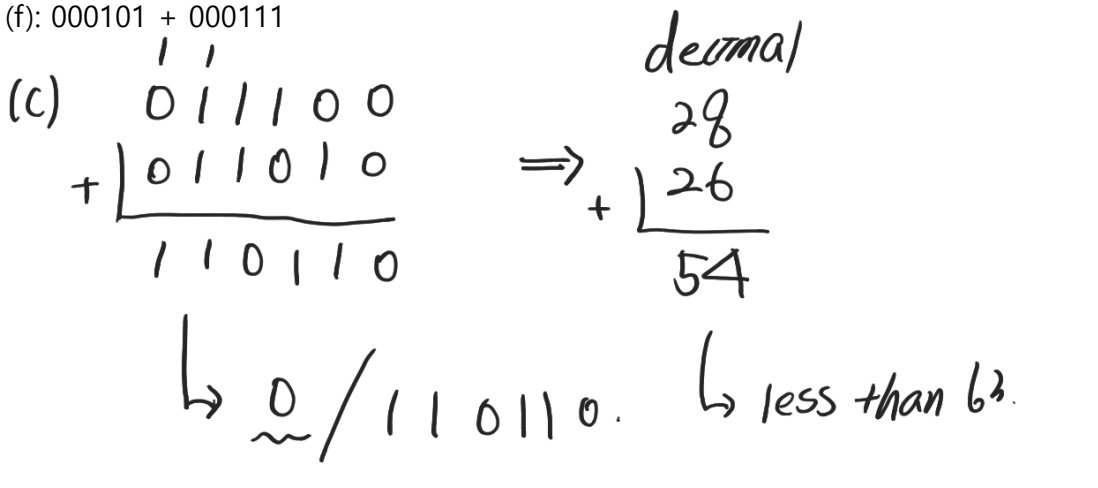
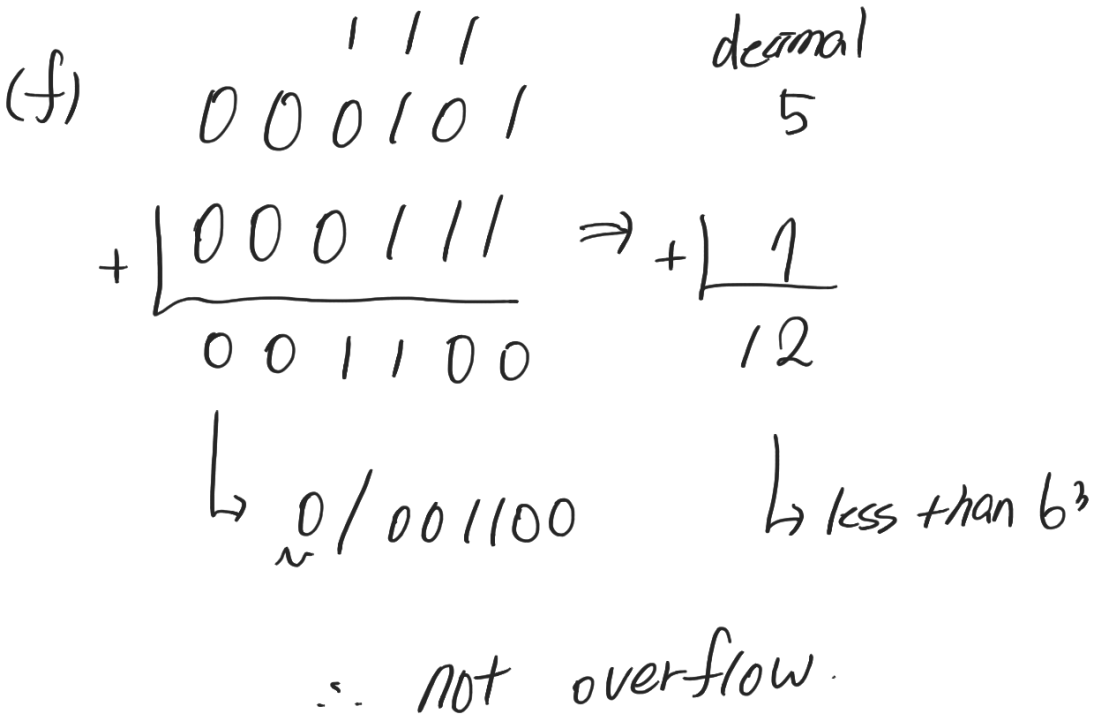
5. Compute the sub of the following pairs of 6-bit unsigned integers. If the answer is to be stored in a 6-bit location, indicate which of the sums produce overflow. Also, show the decimal equivalent of both operands and the result.

(c): 011100 + 011010

(f): 000101 + 000111





9. Each of the following pairs of signed (two's complement) integers are stored in computer words (6 bits). Compute the sum as it is stored in a 6-bit computer word. Show the decimal equivalents of each operand and the sum. Indicate if there is overflow.

(b): 111010
000111

(e): 011010
001100

(b)

```
 1 1 1 1 1
   1 1 1 0 1 0
 + 0 0 0 1 1 1
 ---------------
 1 0 0 0 0 0 1
 ~
 carry
 (Ignored)
```

⇒

111010을 decimal로 변환

```
 - 1 1 1 0 1 0
 ---------------
   1 1 1 0 0 1
```

111001 ⇒ complement

⇒ 000110

∴ -6.

∴

```
   -6.
 + 7
 ---
   1.
```

not overflow.

(e)

```
     1 1
   0 1 1 0 1 0
 + 0 0 1 1 0 0
 ---------------
 0 1 0 0 1 1 0
```

⇒

```
   26
   12
 ----
   38
```

two's complement 이므로 15를 넘어가면 안됨 ∴ overflow

15. We have toe following numbers stored in a computer. What is the decimal value represented if number is stored as;

I. BCD 8421	**II. BCD 5421**	**iii. BCD 2421**
iv. BCD excess 3	**v. binary unsigned**	**vi. Binary signed**

(e): 1110 1101

(e) i) BCD 8421

1110 ⇒ 8+4+2 = 14 ⇒ unused.

1101 ⇒ 8+4+1 = 13 → unused

ii) BCD 5421

1110 ⇒ 5+4+2 = 11 ⇒ unused

1101 ⇒ 5+4+1 = 10 ⇒ unused

iii) BCD 2421

1110 ⇒ 2+4+2 = 8

1101 ⇒ 2+4+1 = 7 ∴ 8?.

iv) BCD excess 3.

1110 ⇒ unused

1101 ⇒ unused

v) binary unsigned.

11101101

⇒ 128 + 64 + 32 + 8 + 4 + 1 = 237

vi) binary signed.

11101101

− 1

10010010 → complement

∴ −18

5. Subtract the two pairs of numbers. Show the operands and the results in decimal and binary

a. assuming they are unsigned

b. assuming they are signed

1 1 0 1 – 1 1 0 0 1 0 1 0 – 0 1 1 0

Indicate if there is overflow.

(a)

decimal

$$\begin{array}{r} 1101 \\ -\ 1100 \\ \hline 0001 \end{array} \Rightarrow \begin{array}{r} 13 \\ -\ 12 \\ \hline 1 \end{array} \Rightarrow \text{not overflow}$$

$$\begin{array}{r} 1010 \\ -\ 0110 \\ \hline 0100 \end{array} \Rightarrow \begin{array}{r} 10 \\ -\ 6 \\ \hline 4 \end{array}$$

(b)

$$\begin{array}{r} 1101 \\ -\ 1100 \\ \hline \end{array} \Rightarrow \begin{array}{r} {\scriptstyle 1\ 1\ 1\ 1} \\ 1101 \\ +\ 0011 \\ \hline 1)\ 0000 \end{array} \Rightarrow \begin{array}{r} \text{decimal} \\ -3 \\ +\ 3 \\ \hline 0 \end{array} \therefore \text{not overflow}$$

$$\begin{array}{r} 1010 \\ -\ 0110 \\ \hline \end{array} \Rightarrow \begin{array}{r} 1010 \\ +\ 1001 \\ \hline 1)\ 0011 \end{array} \Rightarrow \begin{array}{r} -6 \\ -7 \\ \hline -13 \end{array} \therefore \text{overflow}$$

↳ look like positive.

2. Show truth tables for each of the following.

(c). The system has four inputs. The first two, a and b, represent a number in the range 1 to 3 (0 is not used). The other two, c and d, represent a second number in the same range. The output, y, is to be 1 if and only if the first number is greater than the second or the second is 2 greater than the first.

A	B	C	D	First	Second	Y
0	0	0	0	0	0	X
0	0	0	1	0	1	X
0	0	1	0	0	2	X
0	1	0	0	1	0	X
1	0	0	0	2	0	X
0	0	1	1	0	3	X
0	1	0	0	1	0	X
1	0	0	0	2	0	X
0	1	1	0	1	2	0
1	0	1	0	2	2	0
1	1	0	0	3	0	X
0	1	1	1	1	3	1
1	0	1	1	2	3	0
1	1	0	1	3	1	1
1	1	1	0	3	2	1
1	1	1	1	3	3	0

8. Using properties 1 to 10, reduce the following expressions to a minimum SOP form. Show each step (number of terms and number of literals in minimum shown in parentheses).

(h): $a'b'c' + a'bc' + a'bc + ab'c + abc' + abc$ $(3\ terms, 5\ literals)$

(h) : $\underbrace{a'b'c' + a'bc'}_{i)} + \underbrace{a'bc + ab'c + abc' + abc}_{ii)}$

i) $a'b'c' + a'bc' = a'c'(b'+b)$

$= a'c'$ ∵ Adjacency.

$abc = abc + abc + abc$ ∵ Idempotency.

ii) $(abc + a'bc) + (abc + ab'c) + (abc + abc')$

$= bc + ac + ab$ ∵ Adjacency

∴ $a'c' + b(a+c) + ac$ ∵ Distributive

$= a'c' + b + ac$ ∵ simplification

9. Using properties 1 to 10, reduce the following expressions to a minimum POS form. The number of terms and number of literals are shown in parentheses.

(a): $(a+b+c)(a+b'+c)(a+b'+c')(a'+b'+c')$ $\quad (2\ terms, 4\ literals)$

$(a+b+c)(a+b'+c)$

$= a+c$ $\quad \because$ Adjacency.

$(a+b'+c')(a'+b'+c')$

$= b'+c'$ $\quad \because$ Adjacency.

$\therefore (a+c)(b'+c')$

13. For each of the following functions:

$\boldsymbol{f(x,y,z) = \sum m(1,3,6)}$, $\boldsymbol{g(x,y,z) = \sum m(0,2,4,6)}$

(c): Show a minimum SOP expression (a: 2terms, 5literals; b: 1 term, 1 literals)

(f): Show a minimum POS expression (f: 2 solutions, 3 terms, 6 literals; g: 1 term, 1 literal)

$f : x'y'z + x'yz + xyz'$

$g : x'y'z' + x'yz' + xy'z' + xyz'$

(c) i) f.

$x'y'z + x'yz = x'z$ ∵ Adjacency

∴ $x'z + xyz'$

ii) g.

$x'y'z' + x'yz' = x'z'$ ∵ Adjacency

$xy'z' + xyz' = xz'$ ∵ Adjacency

$x'z' + xz' = z'$ ∵ Adjacency

∴ z'

(f)

① f': $x'y'z' + x'yz' + xy'z' + xy'z + xyz$

f: $\underbrace{(x+y+z)(x+y'+z)}_{i)}\ \underbrace{(x'+y+z)(x'+y+z')(x'+y'+z')}_{ii)}$

i) $(x+y+z)(x+y'+z) = x+z$

ii) $(x'+y+z)(x'+y+z') = x'+y$ $\Big\}$ ∵ Adjacency

∴ $(x+z)(x'+y)(x'+y'+z')$

② g': $x'y'z + x'yz + xy'z + xyz$

g: $\underbrace{(x+y+z')(x+y'+z')}_{i)}\ \underbrace{(x'+y+z')(x'+y'+z')}_{ii)}$

i) $(x+y+z')(x+y'+z') = x+z'$

ii) $(x'+y+z')(x'+y'+z') = x'+z'$ $\Big\}$ ∵ Adjacency

∴ $(x+z')(x'+z') = z'$ ∵ Adjacency.