HW 1 20191286 김나현

Ch 1 exercises

pg 31

#7) The following 6-bit two's complement integers were found in a computer. What decimal number do they present?

(a) 101010 If it is an unsigned 6-bit number,

$101010_2 = 2\times1 + 2^3\times1 + 2^5\times1 = 2+8+32 = 42$

Then, an signed number (two's complement integer) is

$42 - 2^6 = 42 - 32\times2 = 42 - 64 = -22$ $\therefore -22_{10}$

<proof> 1st $22 : 1\times2^4 + 1\times2^2 + 1\times2 \Rightarrow 010110$

2nd complement each bit

$$\begin{array}{r} 101001 \\ +\quad\quad 1 \\ \hline (-12) = 101010 \end{array}$$

3rd add 1

(f) 111001 If it is an unsigned 6-bit number,

$111001_2 = 2^0\times1 + 2^3\times1 + 2^4\times1 + 2^5\times1 = 1+8+16+32 = 57.$

Then, an signed number (two's complement integer) is

$57 - 2^6 = 57 - 64 = -7.$ $\therefore -7_{10}$

<proof> 1st $7 : 1\times2^2 + 1\times2^1 + 1\times2^0 \Rightarrow 000111$

2nd complement each bit

$$\begin{array}{r} 111000 \\ +\quad\quad 1 \\ \hline (-7) = 111001 \end{array}$$

3rd add 1

#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.

(c) 001100
110100

1st) $001100_2 \Rightarrow 2^2 + 2^3 = 4 + 8 = 12$

$110100_2 \Rightarrow (2^5 + 2^4 + 2^2) - 2^6 = 52 - 64 = -12$

2nd)

$$\begin{array}{r} 12 \\ +(-12) \\ \hline 0 \end{array} : \begin{array}{r} 001100 \\ +110100 \\ \hline \boxed{1}000000 \end{array}$$

Ignored carry

It is not overflow

Cf $100000_2 = -32$

So, decimal number zero have to be expressed as 000000_2 if it is a two's complement integer

#10) For each of the following pairs of integers, subtract the second from the first. Show the operands and the answers in decimal, assuming

i. the numbers are unsigned

ii. the numbers are signed (two's complement).

Indicate overflow where appropriate.

(a) 010101 ① under condition i,

001100

$010101_2 \Rightarrow 1\times1 + 1\times2^2 + 1\times2^4 = 1+4+16 = 21$

$001100_2 \Rightarrow 1\times2^2 + 1\times2^3 = 4+8 = 12$

$21 - 12 = 9 \Rightarrow 001001_2$ $\therefore 001001_2$

② under condition ii,

$010101_2 \Rightarrow 21$

$001100_2 \Rightarrow 12$, $-12 \Rightarrow 110100_2$

cf) $001100 \Rightarrow 12$

$$\begin{array}{r} 110011 \\ + \quad\quad 1 \\ \hline 110100 \end{array}$$

↙ complement each bit

↙ add 1

$(= -12)$

$$\begin{array}{rl} 21 & : 010101 \\ -12 & : -(001100) \end{array} \rightarrow \begin{array}{rl} 21 & : 010101 \\ +(-12) & : 110100 \\ \hline & \boxed{1}001001 \end{array}$$

↳ ignored carry.

$\therefore 001001_2$

No overflow

pg. 32

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

i. BCD 8421 ii. BCD 5421 iii. BCD 2421 iv. BCD excess 3

v. binary unsigned vi. binary signed.

(f) 0100 1000

(i) Since $0100 \Rightarrow 4$, $1000 \Rightarrow 8$, 48

(ii) Since $0100 \Rightarrow 4$, $1000 \Rightarrow 5$, 45

(iii) Since 1000 is not used, it does not mean any decimal number.

(iv) Since $0100 \Rightarrow 1$, $1000 \Rightarrow 5$, 15

(v) Since $0100\ 1000 \Rightarrow 1\times2^3 + 1\times2^6 = 8+64 = 72$

(vi) Since $0100\ 1000 \Rightarrow +72$

pg 33.

#1) Convert the decimal number 347 to

a. binary

b. hexademical.

(a) $347 = 2^8 + 2^6 + 2^4 + 2^3 + 2^1 + 1 \Rightarrow 101011011_2$

(b) $347 = 101011011_2 = 0001\ 0101\ 1011 = 15B_{16}$

$\therefore$ (a) 101011011_2, (b) $15B_{16}$ ☒

Ch2 exercises

pg 101.

#2-9) The problem is to design a ball and strike counter for base ball. The inputs are how many balls (0, 1, 2 or 3) before this pitch, how many strikes (0, 1, 2) before this pitch, and what happens on this pitch. The outputs are how many balls after this pitch (0, 1, 2, 3, 4) or how many strikes after this pitch (0, 1, 2)

In the baseball, there are four outcomes of any pitch (from the point of view of this problem). It can be a strike, a foul ball, a ball, or anything else that will end this batter's turn (such as a hit or a fly out).

A foul ball is considered a strike, except when there are already two strikes, in which case the number of strikes remain 2. The output is to indicate the number of balls and strikes after this pitch (Even if the pitch is the fourth ball on the third strike, in which case the batter's turn is over.) If the batter's turn is over for any other reason, the output should indicate 0 balls and 0 strikes.

Show the code for the inputs (there are six inputs, two for what happened on that pitch, two for the number of balls, and two for the number of strikes) and for the outputs (there should be 5: 3 for balls and 2 for strikes).

Then show the 64 line truth table.

① Let 'what happens on this pitch' be a binary number $p_1 p_2$, strike be 00, ball be 01, foul ball be 10 and 'anything else that ends the turn of the batter who hit the ball right before' be 11.

② The number of balls before this pitch → $b_1 b_2$

The number of strikes before this pitch → $s_1 s_2$

③ The number of strikes after this pitch → $s_3 s_4$

The number of balls after this pitch → $b_3 b_4$

④ Truth table

Input						Output			
p_1	p_2	b_1	b_2	s_1	s_2	b_3	b_4	s_3	s_4
0	0	0	0	0	0	0	0	0	1
0	0	0	0	0	1	0	0	1	0
0	0	0	0	1	0	0	0	0	0
0	0	0	0	1	1	—	—	—	—
0	0	0	1	0	0	0	1	0	1
0	0	0	1	0	1	0	1	1	0
0	0	0	1	1	0	0	0	0	0
0	0	0	1	1	1	—	—	—	—
0	0	1	0	0	0	1	0	0	1
0	0	1	0	0	1	1	0	1	0
0	0	1	0	1	0	0	0	0	0
0	0	1	0	1	1	—	—	—	—
0	0	1	1	0	0	1	1	0	1
0	0	1	1	0	1	1	1	1	0
0	0	1	1	1	0	0	0	0	0
0	0	1	1	1	1	—	—	—	—
0	1	0	0	0	0	0	1	0	0
0	1	0	0	0	1	0	1	0	1
0	1	0	0	1	0	0	1	1	0
0	1	0	0	1	1	—	—	—	—
0	1	0	1	0	0	1	0	0	0
0	1	0	1	0	1	1	0	0	1
0	1	0	1	1	0	1	0	1	0
0	1	0	1	1	1	—	—	—	—
0	1	1	0	0	0	1	1	0	0
0	1	1	0	0	1	1	1	0	1
0	1	1	0	1	0	1	1	1	0
0	1	1	0	1	1	—	—	—	—
0	1	1	1	0	0	0	0	0	0
0	1	1	1	0	1	0	0	0	0
0	1	1	1	1	0	0	0	0	0
0	1	1	1	1	1	—	—	—	—

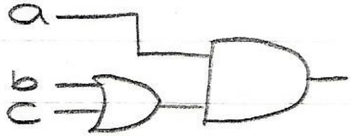
Input						Output			
p_1	p_2	b_1	b_2	s_1	s_2	b_3	b_4	s_3	s_4
1	0	0	0	0	0	0	0	0	1
1	0	0	0	0	1	0	0	0	2
1	0	0	0	1	0	0	0	1	0
1	0	0	0	1	1	—	—	—	—
1	0	0	1	0	0	0	1	0	1
1	0	0	1	0	1	0	1	1	0
1	0	0	1	1	0	0	1	1	0
1	0	0	1	1	1	—	—	—	—
1	0	1	0	0	0	1	0	0	1
1	0	1	0	0	1	1	0	1	0
1	0	1	0	1	0	1	0	1	0
1	0	1	0	1	1	—	—	—	—
1	0	1	1	0	0	1	1	0	1
1	0	1	1	0	1	1	1	1	0
1	0	1	1	1	0	1	1	1	0
1	0	1	1	1	1	—	—	—	—
1	1	0	0	0	0	—	—	—	—
1	1	0	0	0	1	—	—	—	—
1	1	0	0	1	0	0	0	0	0
1	1	0	0	1	1	—	—	—	—
1	1	0	1	0	0	—	—	—	—
1	1	0	1	0	1	—	—	—	—
1	1	0	1	1	0	0	0	0	0
1	1	0	1	1	1	—	—	—	—
1	1	1	0	0	0	—	—	—	—
1	1	1	0	0	1	—	—	—	—
1	1	1	0	1	0	0	0	0	0
1	1	1	0	1	1	—	—	—	—
1	1	1	1	0	0	0	0	0	0
1	1	1	1	0	1	0	0	0	0
1	1	1	1	1	0	0	0	0	0
1	1	1	1	1	1	—	—	—	—

pg 102

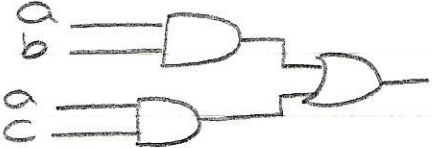
#3) Show a block diagram of a circuit using AND and OR gates for each side of each of the following equality.

b. P8a. $a(b+c) = ab+ac$

① $a(b+c)$



② $ab+ac$



③