

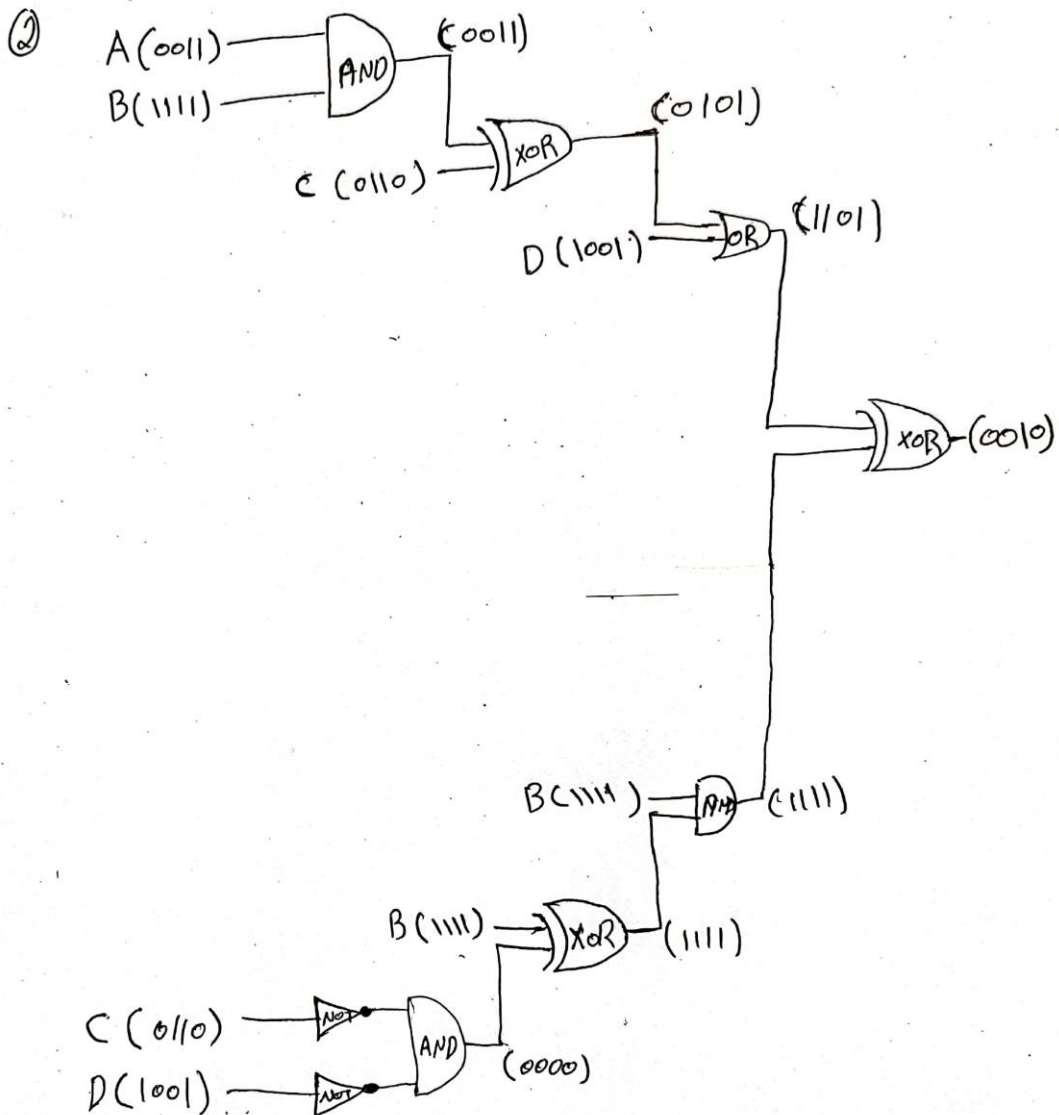
$$\textcircled{1} - (0011 \text{ XOR } 1111) \text{ AND } \text{NOT}(1001 \text{ XOR } (\text{NOT } 0000))$$

$$(0011 \text{ XOR } 1111) \text{ AND } \text{NOT}(1001 \text{ XOR } 1111)$$

$$(1100) \text{ AND } \text{NOT}(0110)$$

$$(1100) \text{ AND } (1001)$$

$$(1000)$$



③ - (10001101) → 2 bits, Arithmetic right shift

lose ← 10001101
1100011

original $\left[\begin{array}{l} 10001101 \\ 0110011 \end{array} \right] 2's \text{ complement}$
 $64 + 32 + 16 + 2 + 1 = (-15)_{10}$

After shift $\left[\begin{array}{l} 11100011 \\ 00011101 \end{array} \right] 2's \text{ complement}$
 $16 + 8 + 4 + 1 = (-29)_{10}$

$$(-15)_{10} \div 2^2 = (-29)_{10}$$

④ - (11010010) arithmetic left shift

lose ← 11010010
10100100

original $\left[\begin{array}{l} 11010010 \\ 00101110 \end{array} \right] 2's \text{ complement}$
 $32 + 8 + 4 + 2 = (-46)_{10}$

After shift $\left[\begin{array}{l} 10100100 \\ 01011100 \end{array} \right] 2's \text{ complement}$
 $64 + 16 + 8 + 4 = (-92)$

⑤ - (100 11011) unset five rightmost bits

100 11011 input
 AND 111 00000 mask
 100 00000 output

⑥ - $(-27) - (+15) = (-42)$

(27)/2 R=1
 (13)/2 R=1
 (6)/2 R=0
 (3)/2 R=1
 (1)/2 R=1

(15)/2 R=1
 (7)/2 R=1
 (3)/2 R=1
 (1)/2 R=1

2's complement
 $A = (-27)_{10} = (000 11011)_2$
 $(111 00101)_2$

$B = (+15)_{10} = (0000 1111)_2$
 $(1111 0001)_2$

① 111 00101 A

$R = (11010110)_2$

$(\bar{R}+1) = (00101010)_2$

111 0001 ($\bar{B}+1$)
 11010110 R

⑦ $(-27) + (+15) = (-12)$

$(27)/2 \quad R=1$

$(13)/2 \quad R=1$

$(6)/2 \quad R=0$

$(3)/2 \quad R=1$

$(1)/2 \quad R=1$

$(15)/2 \quad R=1$

$(7)/2 \quad R=1$

$(3)/2 \quad R=1$

$(1)/2 \quad R=1$

2's complement $A = (-27)_{10} = (00011011)_2$
 $(11100101)_2$

$B = (+15)_{10} = (00001111)_2$

$11100101 \quad A$

$00001111 \quad B$

$11110100 \quad R$

$R = (11110100)_2$

$(\bar{R} + 1) = (00001100)_2$

⑧ $(-28) - (+15) = (-43)$, sign-and-magnitude

$(28)/2 \quad R=0$

$(14)/2 \quad R=0$

$(7)/2 \quad R=1$

$(3)/2 \quad R=1$

$(1)/2 \quad R=1$

$A = (10011100)_2$
 \downarrow
 $(-)$

$(15)/2 \quad R=1$

$(7)/2 \quad R=1$

$(3)/2 \quad R=1$

$(1)/2 \quad R=1$

$B = (00001111)_2$
 \downarrow
 $(+)$

$00111000 \quad A$

$00011111 \quad B$

$10101011 \quad R$
 \downarrow
 $(-)$

$R = (10101011)_2$

$R = (-43)_{10}$

⑨ $(-28) + (+15) = (-13)$, sign-and-magnitude

$(28)/2$	$R=0$		$(15)/2$	$R=1$
$(14)/2$	$R=0$		$(7)/2$	$R=1$
$(7)/2$	$R=1$		$(3)/2$	$R=1$
$(3)/2$	$R=1$		$(1)/2$	$R=1$
$(1)/2$	$R=1$			
$A = (\downarrow 1001100)_2$			$B = (\downarrow 0001111)_2$	
$(-)$			$(+)$	

overflow ← ① $\begin{array}{ccccccc} 1 & 1 & 1 & 1 & 1 & 0 & 0 & A \\ 1 & 1 & 1 & 0 & 0 & 0 & 1 & (\bar{B}+1) \\ \hline 1 & 0 & 0 & 0 & 1 & 1 & 0 & 1 & R \end{array}$

$R = (10001101)_2$

$R = (-13)_{10}$

$(-)$

⑩ $(-28) + (+83) = 55$, sign-and-magnitude

$(28)/2$	$R=0$		$(83)/2$	$R=1$
$(14)/2$	$R=0$		$(41)/2$	$R=1$
$(7)/2$	$R=1$		$(20)/2$	$R=0$
$(3)/2$	$R=1$		$(10)/2$	$R=0$
$(1)/2$	$R=1$		$(5)/2$	$R=1$
$(1)/2$	$R=1$		$(2)/2$	$R=0$
$A = (\downarrow 1001100)_2$			$B = (\downarrow 01010011)_2$	
$(-)$			$(+)$	

$R = (00110111)_2$
 $R = (55)_{10}$

$\begin{array}{ccccccc} 1 & 1 & 1 & 1 & 1 & 0 & 0 & A \\ 0 & 1 & 0 & 1 & 1 & 0 & 1 & (\bar{B}+1) \\ \hline 1 & 0 & 0 & 1 & 0 & 0 & 1 & B \\ 0 & 0 & 1 & 1 & 0 & 1 & 1 & (\bar{B}+1) \end{array}$

$(+)$