



Assignment # 1

Digital Logic Design

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1 #

Sol $X = 1001110 \quad Y = 0100110,$

$(X - Y)$ using 2's Complement

$$X = 1001110$$

$$2\text{'s Complement of } Y = +1011010$$

$$\text{Sum} = 10101000$$

Discard end carry $- 10000000$

Answer = (0101000)

$(X - Y)$ using 1's Complement

$$X = 1001110$$

$$1\text{'s Complement of } Y = +1011001$$

$$\text{Sum} = 0100111$$

End around carry $+ 1$

Answer = (0101000)

2# $X = 1001010_2, Y = 0101001_2$

$\Rightarrow (X-Y)$ Using 2's Complement

$$\begin{array}{r} X = 1001010_2 \\ 2\text{'s Complement } Y = +1010111_2 \\ \hline \text{Sum} = 1010001 \end{array}$$

discard end carry - 10000000
Answer = (010001)₂

$\Rightarrow (X-Y)$ using 1's Complement

$$\begin{array}{r} X = 1001010_2 \\ 1\text{'s Complement } Y = +1010110_2 \\ \hline \text{Sum} = 0100000 \end{array}$$

← →

Answer = (010001)₂

3# $X = 1101010_2, Y = 0101101_2$

$\Rightarrow (X-Y)$ using 2's Complement

$$\begin{array}{r} X = 1101010_2 \\ 2\text{'s Complement } Y = +1010011_2 \\ \hline \text{Sum} = 1011101 \end{array}$$

Discard end carry - 10000000
Answer = (0111101)₂

$\Rightarrow X - Y$ using 1's Complement

$$\begin{array}{r} X = 1101010_2 \\ \text{1's Complement } Y = +\underline{1010010}_2 \\ \text{Sum} \quad = \underline{0111100} \\ \qquad \qquad \qquad +1 \text{ (end around carry)} \\ \text{Answer} = (0\underline{111101})_2 \end{array}$$

4#

$$X = 1110101_2 \quad Y = 0111001_2$$

$X - Y$ using 2's Complement

$$\begin{array}{r} X = 1110101_2 \\ \text{2's Complement } Y = +\underline{1000111}_2 \\ \text{Sum} \quad = \underline{10111100} \\ \text{Discard end carry} \quad -100000000 \\ \text{Answer} = (0\underline{111011})_2 \end{array}$$

$X - Y$ using 1's Complement

$$\begin{array}{r} X = 1110101_2 \\ \text{1's Complement } Y = +\underline{1000110}_2 \\ \text{Sum} \quad = \underline{0111011} \\ \qquad \qquad \qquad +1 \text{ (end around carry)} \\ \text{Answer} = (01\underline{11100})_2 \end{array}$$

5# $X = 1000010_2$
 $Y = 0100001_2$

→ using 2's Complement ($X - Y$)

$$\begin{array}{r} X = 1000010_2 \\ \text{2's Complement } Y = +\underline{101111}_2 \\ \text{Sum} = 1010001 \end{array}$$

Discard end carry
Answer = (0100001)

→ using 1's Complement ($X - Y$)

$$\begin{array}{r} X = 1000010_2 \\ \text{1's Complement } Y = +\underline{1011110}_2 \\ \text{Sum} = 0100000 \end{array}$$

$$\begin{array}{r} \dots +1 \text{ (end around carry)} \\ \text{Answer} = (\underline{\underline{0100001}})_2 \end{array}$$



6# $X = 1000110_2$ $Y = 0100001_2$

Using 2's Complement $X - Y$

$$\begin{array}{r} X = 1000110_2 \\ \text{2's Complement } Y = +\underline{1011111}_2 \\ \text{Sum} = 10100101 \\ \text{Discard end carry} \\ \text{Answer} = (\underline{\underline{0100101}})_2 \end{array}$$

using 1's Complement $X-Y$

$$\begin{array}{r} X = 1000110_2 \\ \text{1's Complement } Y = +\underline{1011110}_2 \\ \text{Sum} = 0100100 \\ \qquad \qquad \qquad +1 \quad \text{end around carry} \\ \text{Answer} = (01\underline{00101})_2 \end{array}$$

7#

$$X = 1001010_2, Y = 0100011_2$$

→ Using 2's Complement ($X-Y$)

$$\begin{array}{r} X = 1001010_2 \\ \text{2's Complement } Y = +\underline{1011101}_2 \\ \text{Sum} = 1010011 \\ \text{Discard end carry} \quad -10000000 \\ \text{Answer} = (01\underline{00111})_2 \end{array}$$

→ using 1's Complement $X-Y$

$$\begin{array}{r} X = 1001010_2 \\ \text{1's Complement } Y = +\underline{1011100}_2 \\ \text{Sum} = 0100110 \\ \qquad \qquad \qquad +1 \quad \text{end around} \\ \text{Answer} = (01\underline{00111})_2 \end{array}$$

8# $X = 1100100_2, Y = 010111_2$

→ using 2's Complement ($X-Y$)

$$X = 1100100_2$$

2's Complement $Y = \underline{1010001}_2$

$$\text{Sum} = \underline{10110101}$$

$$\begin{array}{r} -10000000 \\ \hline \end{array} \quad (\text{Discard end carry})$$

$$\text{Answer} = (01\underline{10101})_2$$

→ using 1's Complement ($X-Y$)

$$X = 1100100_2$$

1's Complement $Y = +\underline{1010000}_2$

$$\text{Sum} = \underline{0110100}$$

$$+1 \quad (\text{end around carry})$$

$$\text{Answer} = (01\underline{10101})_2$$

↔

9#

 $X = 1011101_2, Y = 0111100_2$

→ using 2's Complement ($X-Y$)

$$X = 1011101_2$$

2's Complement $Y = +\underline{1000100}_2$

$$\text{Sum} = \underline{10100001}$$

Discard end carry -10000000

$$\text{Answer} = (01\underline{00001})_2$$

Using 1's Complement ($X-Y$)

$$X = 1011101_2$$

$$1\text{'s Complement } Y = +1000011_2$$

$$\text{Sum} = 10100000$$

+ 1 end around carry

$$\text{Answer} = (01\underline{0000}1)_2$$



$$\begin{array}{c} \cancel{1} \\ \cancel{0} \\ \hline \end{array} \quad X = 1011101_2 \quad Y = 0100001_2$$

→ $(X-Y)$ Using 2's Complement

$$X = 1011101_2$$

$$2\text{'s Complement } Y = +1011111_2$$

$$\text{Sum} = 10111100$$

Discard end carry -10000000

$$\text{Answer} = (01\underline{11100})_2$$

→ $(X-Y)$ using 1's Complement

$$X = 1011101_2$$

$$1\text{'s Complement } Y = +1011110_2$$

$$\text{Sum} = 0111011$$

+ 1 end around

$$\text{Answer} = (01\underline{11100})_2$$

11# $X = 1011000_2, Y = 0110110_2$

$\rightarrow (X-Y)$ using 2's Complement.

$$X = \begin{array}{r} 1 \\ 0 \\ 1 \\ 1 \\ 0 \\ 0 \\ 0 \end{array}_2$$

$$2\text{'s Complement } Y = \begin{array}{r} + \\ 1 \\ 0 \\ 0 \\ 1 \\ 0 \\ 1 \end{array}_2$$

$$\text{Sum} = \begin{array}{r} 1 \\ 0 \\ 1 \\ 0 \\ 0 \\ 0 \\ 1 \end{array}_2$$

$$(\text{Discard end carry}) - \underline{\begin{array}{r} 1 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \end{array}_2}$$

$$\text{Answer} = \begin{array}{r} (0 \\ 1 \\ \underline{0 \\ 0 \\ 0} \\ 1 \\ 0) \end{array}_2$$

$\rightarrow (X-Y)$ using 1's Complement

$$X = \begin{array}{r} 1 \\ 0 \\ 1 \\ 1 \\ 0 \\ 0 \\ 0 \end{array}_2$$

$$1\text{'s Complement } Y = \begin{array}{r} + \\ 1 \\ 0 \\ 0 \\ 1 \\ 0 \\ 0 \end{array}_2$$

$$\text{Sum} = \begin{array}{r} 0 \\ 1 \\ 0 \\ 0 \\ 0 \\ 0 \\ 1 \end{array}$$

+1 end around carry

$$\text{Answer} = \begin{array}{r} (0 \\ 1 \\ \underline{0 \\ 0 \\ 0} \\ 1 \\ 0) \end{array}_2$$



12#

 $X = 1110001, Y = 0111111_2$

$(X-Y)$ using 2's Complement.

$$X = \begin{array}{r} 1 \\ 1 \\ 1 \\ 0 \\ 0 \\ 0 \\ 1 \end{array}_2$$

$$2\text{'s Complement } Y = \begin{array}{r} + \\ 1 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 1 \end{array}_2$$

$$\text{Sum} = \begin{array}{r} 1 \\ 0 \\ 1 \\ 1 \\ 0 \\ 0 \\ 1 \end{array}_2$$

-10000000 (Discard end carry)

$$\text{Answer} = \begin{array}{r} (0 \\ 1 \\ \underline{1 \\ 0 \\ 0} \\ 1 \\ 0) \end{array}_2$$

$\rightarrow (X-Y)$ using 1's Complement

$$\begin{array}{r} X = 1110001_2 \\ \text{1's Complement } Y = +\underline{1000000}_2 \\ \text{Sum.} = \quad \underline{0110001} \\ \qquad \qquad \qquad + 1 \quad (\text{end around carry}) \\ \text{Answer} = \quad \underline{(01\underline{1}0010)}_2 \end{array}$$

13 #

$$X = 1101111_2, \quad Y = 0110100_2$$

$\rightarrow (X-Y)$ using 2's Complement)

$$\begin{array}{r} X = 1101111_2 \\ \text{2's Complement } Y = +\underline{1001100}_2 \\ \text{Sum} = \quad \underline{1011101} \\ \qquad \qquad \qquad - 10000000 \quad (\text{discard end carry}) \\ \text{Answer} = \quad \underline{(0111011)}_2 \end{array}$$

$\rightarrow (X-Y)$ using 1's Complement

$$\begin{array}{r} X = 1101111_2 \\ \text{1's Complement } Y = +\underline{1001011}_2 \\ \text{Sum} = \quad \underline{0111010} \\ \qquad \qquad \qquad + 1 \quad (\text{end around carry}) \\ \text{Answer} = \quad \underline{(0111011)}_2 \end{array}$$

14 #

$$X = 1101111_2, Y = 0110100_2$$

→ $(X-Y)$ using 2's Complement.

$$\begin{array}{r} X = 1101111_2 \\ 2's \text{ Complement } Y = +1001100_2 \end{array}$$

$$\begin{array}{r} \text{Sum} = 10111011 \\ - 10000000 \quad (\text{Discard end carry}) \end{array}$$

$$\text{Answer} = (011\underline{1}011)_2$$

→ $(X-Y)$ using 1's Complement

$$\begin{array}{r} X = 1101111_2 \\ 1's \text{ Complement } Y = +1001011_2 \end{array}$$

$$\text{Sum} = 0111010$$

+1 (end around carry)

$$\text{Answer} = (0111\underline{0}11)_2$$

15 #

$$X = 1101110_2, Y = 0110001_2$$

$(X-Y)$ using 2's Complement.

$$\begin{array}{r} X = 1101110_2 \\ 2's \text{ Complement } Y = +1001111_2 \end{array}$$

$$\begin{array}{r} \text{Sum} = 10111101 \\ - 10000000 \quad (\text{Discard end carry}) \end{array}$$

$$\text{Answer} = (01111\underline{0}1)_2$$

$(X-Y)$ using 1's Complement

$$\begin{array}{r} X = 1101110_2 \\ 1\text{'s Complement } Y = +1001110_2 \\ \text{Sum} = 0111100 \end{array}$$

$$\text{Answer} = \frac{+1}{(01\underline{11101})_2} \quad (\text{end around carry})$$

16 #

$$X = 1101001_2, \quad Y = 0111010_2$$

$\rightarrow (X-Y)$ using 2's Complement

$$\begin{array}{r} X = 1101001_2 \\ 2\text{'s Complement } Y = 1000110_2 \\ \text{Sum} = 1010111 \end{array}$$

$$\text{Answer} = \frac{-10000000}{(01\underline{01111})_2} \quad (\text{Discard end carry})$$

$\rightarrow (X-Y)$ using 1's Complement

$$\begin{array}{r} X = 1101001_2 \\ 1\text{'s Complement } Y = +1000101_2 \\ \text{Sum} = 0101110 \end{array}$$

$$\text{Answer} = \frac{+1}{(01\underline{01111})_2} \quad (\text{end around carry})$$

17# $X = 1100101, Y = 0100111_2$

$\rightarrow (X-Y)$ using 2's Complement.

$$X = 1100101$$

$$2\text{'s Complement } Y = +1011001_2$$

$$\text{Sum} = 1011110$$

$$-10000000 \quad (\text{Discard end carry})$$

$$\text{Answer} = (0111110)_2$$

$\rightarrow (X-Y)$ using 1's Complement.

$$X = 1100101_2$$

$$1\text{'s Complement } Y = +1011000_2$$

$$\text{Sum} = 0111101$$

$$+ 1 \quad (\text{end around carry})$$

$$\text{Answer} = (011\underline{1}110)_2$$



18#

$$X = 1100000_2, Y = 0101010_2$$

$(X-Y)$ using 2's Complement.

$$X = 1100000_2$$

$$2\text{'s Complement } Y = +1010110_2$$

$$\text{Sum} = 10110110$$

$$-10000000 \quad (\text{Discard end carry})$$

$$\text{Answer} = (0110110)_2$$

$(X-Y)$ using 1's Complement

$$X = 1100000_2$$

$$1\text{'s Complement } Y = + \underline{1010101}_2$$

$$\text{Sum} = \begin{array}{r} 0110101 \\ +1 \end{array}$$

$$\text{Answer} = (0\underline{10110})_2$$



19#

$$X = 1100001_2, Y = 0100010_2$$

$(X-Y)$ using 2's Complement

$$X = 1100001_2$$

$$2\text{'s Complement } Y = + \underline{1011110}_2$$

$$\text{Sum} = \begin{array}{r} 1011111 \\ -10000000 \end{array}$$

(Discard end carry)

$$\text{Answer} = (0\underline{11111})_2$$

$(X-Y)$ using 1's Complement.

$$X = 1100001_2$$

$$1\text{'s Complement } Y = \underline{1011101}_2$$

$$\text{Sum} = \begin{array}{r} 0111110 \\ +1 \end{array}$$

end around carry

$$\text{Answer} = (\underline{0111111})_2$$

Q# $X = 1110001_2$
 $Y = 0110010_2$

$\rightarrow (X-Y)$ using 2's Complement

$X = 1110001_2$
2's Complement $Y = +1001110_2$

Sum = $\begin{array}{r} 1011111 \\ -10000000 \end{array}$ (Discard end carry)

Answer = $(0\underset{\sim}{11111})_2$

$\rightarrow (X-Y)$ using 1's Complement

$X = 1110001_2$
1's Complement $Y = +1001101_2$

Sum = $\begin{array}{r} 0111110 \\ +1 \end{array}$ end around carry

Answer = $(0\underset{\sim}{11111})_2$