

# Logic Design CH1

## Q1

(A) 100001

$$1 \times 2^5 = 32$$

$$0 \times 2^4 = 0$$

$$0 \times 2^3 = 0$$

$$0 \times 2^2 = 0$$

$$0 \times 2^1 = 0$$

$$1 \times 2^0 = 1$$

$$(100001)_2 = 32 + 1 = (33)_{10}$$

(B) 101010

$$0 \times 2^5 = 0$$

$$1 \times 2^4 = 16$$

$$0 \times 2^3 = 0$$

$$1 \times 2^2 = 4$$

$$0 \times 2^1 = 0$$

$$1 \times 2^0 = 1$$

$$(101010)_2 = 16 + 4 + 1 = (21)_{10}$$

## Q2

(A) 12

$$\text{HEX} = 12/16 = 0 \text{ remainder } 12$$

$$(12)_{10} = (\text{C})_{16}$$

$$\text{BIN} = 12/2 \quad 0$$

$$6/2 \quad 0$$

$$3/2 \quad 1$$

$$1/2 \quad 1$$

$$(12)_{10} = (1100)_2$$

(B) 50

$$\text{HEX} = 50/16 \quad 2$$

$$3/16 \quad 3$$

$$(50)_{10} = (32)_{16}$$

$$\text{BIN} = 50/2 \quad 0$$

$$25/2 \quad 1$$

$$12/2 \quad 0$$

$$6/2 \quad 0$$

$$3/2 \quad 1$$

$$1/2 \quad 1$$

$$(50)_{10} = (110010)_2$$

### Q3

(A)  $(46)_{16}$

BIN =

$$(4)_{16} = (0100)_2$$

$$(6)_{16} = (0110)_2$$

$$(46)_{16} = (01000110)_2$$

DEC =

$$6 \times 16^0 = 6$$

$$4 \times 16^1 = 64$$

$$(46)_{16} = 64 + 6 = (70)_{10}$$

(B)  $(54)_{16}$

BIN =

$$(5)_{16} = (0101)_2$$

$$(4)_{16} = (0100)_2$$

$$(54)_{16} = (01010100)_2$$

DEC =

$$4 \times 16^0 = 4$$

$$5 \times 16^1 = 96$$

$$(54)_{16} = 96 + 4 = (100)_{10}$$

## Q4

(A)  $(1111)_2$

HEX

$$(1111)_2 = (F)_{16}$$

OCT

$$(001)_2 = (1)_8$$

$$(111)_2 = (7)_8$$

(B)  $(11111)_2$

HEX

$$(0001)_2 = (1)_{16}$$

$$(1111)_2 = (F)_{16}$$

OCT

$$(011)_2 = (3)_8$$

$$(111)_2 = (7)_8$$

## Q5

(A) 42

$$4 \times 16^1 = 64$$

$$2 \times 16^0 = 2$$

$$(42)_{16} = 64 + 2 = (66)_{10}$$

(B) 64

$$6 \times 16^1 = 128$$

$$4 \times 16^0 = 4$$

$$(64)_{16} = 128 + 4 = (132)_{10}$$

Q6

(A) 3652

$$\text{HEX} = 3652/16 \quad 4$$

$$228/16 \quad 4$$

$$14/16 \quad E$$

$$(3652)_{10} = (E44)_{16}$$

(B) 8925

$$\text{HEX} = 8925/16 \quad D$$

$$557/16 \quad D$$

$$34/16 \quad 2$$

$$2/16 \quad 2$$

$$(8925)_{10} = (22DD)_{16}$$

## Q7

(E) 67

DEC

$$6 \times 8^1 = 48$$

$$7 \times 8^0 = 7$$

$$(67)_8 = 48 + 7 = (55)_{10}$$

BIN

$$(6)_8 = (110)_2$$

$$(7)_8 = (111)_2$$

## Q8

(a)  $23_{10}$

$$23/8 \quad 7$$

$$2/8 \quad 2$$

$$(23)_{10} = (27)_8$$

(b)  $45_{10}$

$$45/8 \quad 5$$

$$5/8 \quad 5$$

$$(45)_{10} = (55)_8$$

## Q9

(A) 0011 0110<sub>BCD</sub>

$$0011 = (3)_{10}$$

$$0110 = (6)_{10}$$

$$0011\ 0110_{\text{BCD}} = (36)_{10}$$

(B) 0110 1001<sub>BCD</sub>

$$0110 = (6)_{10}$$

$$1001 = (9)_{10}$$

$$0110\ 1001_{\text{BCD}} = (69)_{10}$$

## Q10

(c) 94<sub>10</sub>

$$(9)_{10} = (1001)_2$$

$$(4)_{10} = (0100)_2$$

$$94_{10} = (10010100)_2$$

(d) 44<sub>10</sub>

$$(4)_{10} = (0100)_2$$

$$(4)_{10} = (0100)_2$$

$$(44)_{10} = (01000100)_2$$

# Q1

(a)  $1111_2$  and  $1010_2$

$$\begin{array}{r} 1111 \\ + 1010 \\ \hline \end{array}$$

11001

$$\begin{array}{r} 1111 \\ - 1010 \\ \hline \end{array}$$

0101

$$\begin{array}{r} 1111 \\ \times 1010 \\ \hline \end{array}$$

0000

1111

0000

1111

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10010110



(b)  $1111_2$  and  $1001_2$

$$\begin{array}{r} 1111 \\ + 1001 \\ \hline 1100 \end{array}$$

$$\begin{array}{r} 1111 \\ - 1001 \\ \hline 0110 \end{array}$$

$$\begin{array}{r} 1111 \\ \times 1001 \\ \hline 1111 \\ 0000 \\ 0000 \\ 1111 \\ \hline 10000111 \end{array}$$

## Q3

$$(a) 11110100_2 - 1000111_2$$

$$\begin{array}{r} 11110100 \\ - 1000111 \\ \hline 10101101 \end{array}$$

$$(c) 1110110_2 - 111101_2$$

$$\begin{array}{r} 1110110 \\ - 111101 \\ \hline 111001 \end{array}$$

## Q4

$$(b) 0001101_2 \div 110_2$$

$$\begin{array}{r} 110 \overline{)1101} \\ -110 \\ \hline 01 \end{array}$$

## Q4

$$(a) 25_{16} + 33_{16} = 58_{16}$$

$$(b) 43_{16} + 62_{16} = A5_{16}$$

## Q5

$$(a) 60_{16} - 39_{16} = 27_{16}$$

$$(d) AC_{16} - 10_{16} = 9C_{16}$$

## Q6

$$(a) (-12)_{10} + 13_{10} = -12 = 00001100 \text{ 1s complement } 11110011$$

$$\text{2s complement } 11110011 + 1 = 11110100$$

$$11110100 + 00001101 = 00000001 = 1_2$$

$$(b) (-11)_{10} + (-21)_{10} = 11110101 + 11101011 = 11100000$$

## Q8

(a)  $100 = 011$

(b)  $111 = 000$

## Q9

(a)  $11 = 1s \text{ complement} = 00$ ,  $2s \text{ complement} = 00+1 = 01$

(b)  $111 = 1s \text{ complement} = 000$ ,  $2s \text{ complement} = 000+1 = 001$

## Q10

(a)  $-34_{10} = 00100010$  1s complement =  $11011101_2$

(b)  $+57_{10} = 00111001_2$

## Q11

(a)  $+12_{10} = 00001100_2$

(c)  $+101_{10} = 01010011_2$

## Q12

(a)  $10011001_2 = 25_{10}$

(b)  $01110100_2 = 116_{10}$

## Q13

(a)  $10011001_2 = -25_{10}$

## Q14

(a)  $10011001_2 = 1\text{s complement} = 01100110_2$  ,

2s complement =  $01100111_2 = -103_{10}$

## Q15

(a)  $98_{10} = 10011000_{\text{BCD}}$

(b)  $170_{10} = 000101110000_{\text{BCD}}$

## Q16

(a)  $001101010001_{\text{BCD}} = 351_{10}$

## Q17

(a)  $1001 + 0100 = 9+4 = 13$

## Q18

$101101_2 = 110110_{\text{gray}}$

Q19

$$100111_{\text{gray}} = 111010_2$$