

Number System

(Digital Electronic)

Important to CCC, O-LEVEL, ADCA &

Number System

Number system used to represent the computer data & Information.

Four Types of Number System.

Number System	Used Digits	Base (Radix)	Number
Binary Number	0 - 1	2	$(11001010)_2$
Decimal Number	0 - 9	10	$(58470)_{10}$
Octal Number	0 - 7	8	$(46201)_8$
Hexadecimal Number	0 - F (15)	16	$(8FA01)_{16}$

Valid Number

$(100110)_2$

$(1001011)_8$

$(8745)_{10}$

$(B320)_{16}$

Invalid number

$(100400)_2$

$(87010)_8$

$(45AH0)_{16}$

$(450E0)_{10}$

Number System Conversion

Q.1

Binary to Decimal ?

$$(100101)_2 = ?$$

$$\begin{array}{cccccc} 1 & 0 & 0 & 1 & 0 & 1 \\ 32 & 16 & 8 & 4 & 2 & 1 \end{array}$$

$$32 + 4 + 1 = 37$$

Ans. $(37)_{10}$

Number	Table	Growth
1	2	1
2	4	2
3	6	4
4	8	8
5	10	16
6	12	32
7	14	64
8	16	128
9	18	256

Q.2

Decimal to Binary ?

$$(25)_{10} = ?$$

1 1 0 0 1

16 8 4 2 1

Ans. $(11001)_2$

$$(54)_{10} = ?$$

1 1 0 1 1 0

32 16 8 4 2 1

Ans. $(110110)_2$

Growth
1
2
4
8
16
32
64
128
256
512
1024
2048

Q.3

Binary to Octal ?

$$(10110011)_2 = ?$$

010 110 011
2 6 3

Ans. $(263)_8$

$$(110010100101)_2 = ?$$

110 010 100 101
6 2 4 5

Ans. $(6245)_8$

Decimal	Binary
0	0
1	1
2	10
3	11
4	100
5	101
6	110
7	111

Q.4

Octal to Binary ?

$$(326)_8 = ?$$

011 010 110

Ans. (11010110)₂

$$(2531)_8 = ?$$

010 101 011 001

Ans. (10101011001)₂

Decimal	Binary
0	0
1	1
2	10
3	11
4	100
5	101
6	110
7	111

Q.5

Binary to Hexadecimal ?

$$(10111010110)_2 = ?$$

0101 1101 0110

5 13 6

Ans. (5D6)₁₆

$$(11101100101010)_2 = ?$$

0011 1011 0010 1010

3 11 2 10

Ans. (3B2A)₁₆

Decimal	Binary
0	0
1	1
2	10
3	11
4	100
5	101
6	110
7	111
8	1000
9	1001
A —10	1010
B —11	1011
C —12	1100
D —13	1101
E —14	1110
F —15	1111

Q.6

Hexadecimal to Binary ?

$$(3F6)_{16} = ?$$

0011 1111 0110

Ans. $(1111110110)_2$

$$(A120)_{16} = ?$$

1010 0001 0010 0000

Ans. $(1010000100100000)_2$

Decimal	Binary
0	0
1	1
2	10
3	11
4	100
5	101
6	110
7	111
8	1000
9	1001
A—10	1010
B—11	1011
C—12	1100
D—13	1101
E—14	1110
F—15	1111

Q.7

Decimal to Octal ?

Decimal \rightarrow Binary \rightarrow Octal

$$(43)_{10} = ?$$

1 0 1 0 1 1

32 16 8 4 2 1

101 011

5 3

Ans. $(53)_8$

$$(210)_{10} = ?$$

1 1 0 1 0 0 1 0
128 64 32 16 8 4 2 1

011 010 010

3 2 2

Ans. $(322)_8$

Q.8

Octal to Decimal ?

Octal \longrightarrow **Binary** \longrightarrow **Decimal**

$$(63)_8 = ?$$

110 011

1 1 0 0 1 1

32 16 8 4 2 1

$$32 + 16 + 2 + 1 = 51$$

Ans. (51)₁₀

Q.9

Decimal to Hexadecimal ?

Decimal → Binary → Hexadecimal

$(43)_{10} = ?$

1 0 1 0 1 1

32 16 8 4 2 1

0010 1011

2 11

Ans. $(2B)_{16}$

$(210)_{10} = ?$

1 1 0 1 0 0 1 0

128 64 32 16 8 4 2 1

1101 0010

13 2

Ans. $(D2)_{16}$

Q.10

Hexadecimal to Decimal ?

Hexadecimal \rightarrow Binary \rightarrow Decimal

$$(6A3)_{16} = ?$$

0110 1010 0011

0	1	1	0	1	0	1	0	0	0	1	1
2048	1024	512	256	128	64	32	16	8	4	2	1

$$1024 + 512 + 128 + 32 + 2 + 1 = 1699 \quad \text{Ans. } (1699)_{10}$$

Q.11

Octal to Hexadecimal ?

Octal → **Binary** → **Hexadecimal**

$$(63)_8 = ?$$

110 011

110011

0011 0011

3 3

Ans. (33)₁₆

$$(542)_8 = ?$$

101 100 010

101100010

0001 0110 0010

1 6 2

Ans. (162)₁₆

Q.12

Hexadecimal to Octal ?

Hexadecimal \rightarrow Binary \rightarrow Octal

$$(A50)_{16} = ?$$

1010 0101 0000

101001010000

101 001 010 000

5 1 2 0

Ans. $(5120)_8$

Binary Arithmetic

- **Binary Addition**
- **Binary Multiplication**
- **Binary Subtraction**
- **Binary Division**

Binary Multiplication

$$\begin{array}{r} 101101 \\ \times 110 \\ \hline 000000 \\ 101101 \\ 101101 \\ \hline 10000110 \end{array}$$

The diagram illustrates the binary multiplication of 101101 and 110. The multiplicand (101101) and multiplier (110) are shown in black. The first row of the product (000000) is shown in red. The second and third rows (101101 and 101101) are also shown in red. The final product (10000110) is shown in green and enclosed in a red box. Blue arrows point downwards from the multiplier's 1s to the corresponding rows of the product.

