

# Decimal $\rightarrow$ Binary

1)  $(5)_{10} = (?)_2$

2	5	
2	2	1
2	1	0
	0	1

$(101)_2$

$(5)_{10} = (101)_2$

2)  $(12)_{10} = (?)_2$

2	12	
2	6	0
2	3	0
2	1	1
	0	1

$(1100)_2$

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

3)  $(0.57)_{10} = (?)_2$

$0.57 \times 2 = 1.14$	1
$0.14 \times 2 = 0.28$	0
$0.28 \times 2 = 0.56$	0
$0.56 \times 2 = 1.12$	1
$0.12 \times 2 = 0.24$	0

$(10010)_2$

$(0.57)_{10} = (0.10010)_2$

4)  $(0.31)_{10} = (?)_2$

$0.31 \times 2 = 0.62$	0
$0.62 \times 2 = 1.24$	1
$0.24 \times 2 = 0.48$	0
$0.48 \times 2 = 0.96$	0
$0.96 \times 2 = 1.92$	1

$(01001)_2$

$(0.31)_{10} = (0.01001)_2$

5)  $(37.31)_{10} = (?)_2$

First converting  $(37)_{10}$  to Binary

2	37	1
2	18	0
2	9	1
2	4	0
2	2	0
2	1	1
	0	

$(100101)_2$

Now converting  $(0.31)_{10}$  to Binary

$0.31 \times 2 = 0.62$	0
$0.62 \times 2 = 1.24$	1
$0.24 \times 2 = 0.48$	0
$0.48 \times 2 = 0.96$	0
$0.96 \times 2 = 1.92$	1

$(0.01001)_2$

$\therefore (37.31)_{10} = (100101.01001)_2$

6)  $(195)_{10} = (?)_2$

2	195	1
2	97	1
2	48	0
2	24	0
2	12	0
2	6	0
2	3	1
2	1	1
	0	

$(195)_{10} = (11000011)_2$

$$\rightarrow (74)_{10} = (?)_2$$

2	74	0	↑
2	37	1	
2	18	0	
2	9	1	
2	4	0	
2	2	0	
2	1	1	
2	0	0	
2	0	0	

$$(1001010)_2$$

$$(74)_{10} = (1001010)_2$$

$$8) (255)_{10} = (?)_2$$

2	255	1	↑
2	127	1	
2	63	1	
2	31	1	
2	15	1	
2	7	1	
2	3	1	
2	1	1	
2	0	0	

$$(11111111)_2$$

$$(255)_{10} = (11111111)_2$$

Decimal → Octal

$$1) (15)_{10} \rightarrow (?)_8$$

8	15	7	↑
8	7	1	
8	0	0	
8	0	0	

$$(17)_8$$

$$(15)_{10} = (17)_8$$

(2)

$$2) (2552)_{10} = (?)_8$$

8	2552	0	↑
8	319	7	
8	39	7	
8	4	4	
8	0	0	

$$(4770)_8$$

$$(2552)_{10} = (4770)_8$$

$$3) (0.26)_{10} = (?)_8$$

0.26 × 8 =	2.08	2	↓
0.08 × 8 =	0.64	0	
0.64 × 8 =	5.12	5	
0.12 × 8 =	0.96	0	
0.96 × 8 =	7.68	7	

$$(0.26)_{10} = (0.20507)_8$$

$$4) (3000.45)_{10} = (?)_8$$

8	3000	0	↑
8	375	7	
8	46	6	
8	5	5	
8	0	0	

$$(5670)_8$$

0.45 × 8 =	3.6	3	↓
0.6 × 8 =	4.8	4	
0.8 × 8 =	6.4	6	
0.4 × 8 =	3.2	3	
0.2 × 8 =	1.6	1	

$$(0.34631)_8$$

$$(3000.45)_{10} = (5670.34631)_8$$

## Decimal $\rightarrow$ Hexadecimal

1)  $(35)_{10} = (?)_{16}$

16	35	3	↑	$(23)_{16}$
16	2	2		
	0			

$(35)_{10} = (23)_{16}$

2)  $(1023)_{10} = (?)_{16}$

16	1023	15 = F	↑	$(3FF)_{16}$
16	63	15 = F		
16	3	3		
	0			

$(1023)_{10} = (3FF)_{16}$

3)  $(0.122)_{10} = (?)_{16}$

$0.122 \times 16 = 1.952$	1	↓
$0.952 \times 16 = 15.232$	15 = F	
$0.232 \times 16 = 3.712$	3	
$0.712 \times 16 = 11.392$	11 = B	
$0.392 \times 16 = 6.272$	6	

$(0.122)_{10} = (0.6B7F1)_{16}$

4)  $(2003.31)_{10} = (?)_{16}$

First converting  $(2003)_{10}$  to hexadecimal

16	2003	3	↑	$(7D3)_{16}$
16	125	13 = D		
16	7	7		
	0			

Now converting  $(0.31)_{10}$  to hexadecimal

$0.31 \times 16 = 4.96$	4	↓
$0.96 \times 16 = 15.36$	15 = F	
$0.36 \times 16 = 5.76$	5	
$0.76 \times 16 = 12.16$	12 = C	
$0.16 \times 16 = 2.56$	2	

$(0.4F5C2)_{16}$

$\therefore (2003.31)_{10} = (7D3.4F5C2)_{16}$

### NOTE

To convert Decimal No. to any other number, divide the decimal no. by base/radix of the other no. and record the remainders.

- for integer part, remainder should be recorded in backward direction.
- for fractional part, remainder should be recorded in forward direction.

Binary → Decimal

$$\begin{aligned}
 1) (110101)_2 &= 1 \times 2^5 + 1 \times 2^4 + 0 \times 2^3 + 1 \times 2^2 + 0 \times 2^1 + 1 \times 2^0 \\
 &= 1 \times 32 + 1 \times 16 + 0 \times 8 + 1 \times 4 + 0 \times 2 + 1 \times 1 \\
 &= 32 + 16 + 0 + 4 + 0 + 1 \\
 &= (53)_{10}
 \end{aligned}$$

Ans  $(110101)_2 = (53)_{10}$

$$\begin{aligned}
 2) (1101.101)_2 &= 1 \times 2^3 + 1 \times 2^2 + 0 \times 2^1 + 1 \times 2^0 + 1 \times 2^{-1} + 0 \times 2^{-2} + 1 \times 2^{-3} \\
 &= 1 \times 8 + 1 \times 4 + 0 \times 2 + 1 \times 1 + 1 \times \frac{1}{2} + 0 \times \frac{1}{4} + 1 \times \frac{1}{8} \\
 &= 8 + 4 + 2 + 1 + 1 \times 0.5 + 0 \times 0.25 + 1 \times 0.125 \\
 &= 8 + 4 + 2 + 1 + 0.5 + 0 + 0.125 \\
 &= (15.625)_{10}
 \end{aligned}$$

Ans  $(1101.101)_2 = (15.625)_{10}$

Octal → Decimal

$$\begin{aligned}
 1) (543)_8 &= 5 \times 8^2 + 4 \times 8^1 + 3 \times 8^0 \\
 &= 5 \times 64 + 4 \times 8 + 3 \times 1 \\
 &= 320 + 32 + 3 \\
 &= (355)_{10}
 \end{aligned}$$

Ans  $(543)_8 = (355)_{10}$

$$\begin{aligned}
 2) (321.54)_8 &= 3 \times 8^2 + 1 \times 8^1 + 0 \times 8^0 + 5 \times 8^{-1} + 4 \times 8^{-2} \\
 &= 3 \times 64 + 1 \times 8 + 0 \times 1 + 5 \times \frac{1}{8} + 4 \times \frac{1}{64} \\
 &= 3 \times 64 + 1 \times 8 + 0 \times 1 + \frac{5}{8} + \frac{1}{16} \\
 &= 192 + 8 + 0 + 0.625 + 0.0625 \\
 &= (200.6875)_{10}
 \end{aligned}$$

Ans  $(321.54)_8 = (200.6875)_{10}$

## Hexadecimal $\rightarrow$ Decimal

$$\begin{aligned} 1) (2FA)_{16} &= 2 \times 16^2 + F \times 16^1 + A \times 16^0 \\ &= 2 \times 16^2 + 15 \times 16^1 + 10 \times 16^0 \\ &= 2 \times 256 + 15 \times 16 + 10 \times 1 \\ &= 512 + 240 + 10 \\ &= (762)_{10} \end{aligned}$$

Ans  $(2FA)_{16} = (762)_{10}$

$$\begin{aligned} 2) (2F59)_{16} &= 2 \times 16^3 + F \times 16^2 + 5 \times 16^1 + 9 \times 16^0 \\ &= 2 \times 16^3 + 15 \times 16^2 + 5 \times 16^1 + 9 \times 16^0 \\ &= 2 \times 4096 + 15 \times 256 + 5 \times 16 + 9 \times 1 \\ &= 8192 + 3840 + 80 + 9 \\ &= (12121)_{10} \end{aligned}$$

$$\begin{aligned} 3) (10A.2C)_{16} &= 1 \times 16^2 + 0 \times 16^1 + A \times 16^0 + 2 \times 16^{-1} + C \times 16^{-2} \\ &= 1 \times 256 + 0 \times 16 + 10 \times 1 + 2 \times \frac{1}{16} + 12 \times \frac{1}{256} \\ &= 256 + 0 + 10 + 0.125 + 0.0468 \\ &= (266.1718)_{10} \end{aligned}$$

Ans  $(10A.2C)_{16} = (266.1718)_{10}$

### Binary → Octal

$$1) (111010111 \cdot 110101)_2 = (?)_8$$

$$\begin{array}{ccccccc} \overleftarrow{111} & \overleftarrow{010} & \overleftarrow{111} & \cdot & \overrightarrow{110} & \overrightarrow{101} & \\ 7 & 2 & 7 & \cdot & 6 & 5 & \end{array} \quad (\text{groups of 3})$$

$$\underline{\text{Ans}} (111010111 \cdot 110101)_2 = (727 \cdot 65)_8$$

### Octal → Binary

$$1) (1234 \cdot 567)_8 = (?)_2$$

$$\begin{array}{ccccccc} 1 & 2 & 3 & 4 & \cdot & 5 & 6 & 7 \\ 001 & 010 & 011 & 100 & \cdot & 101 & 110 & 111 \end{array}$$

$$\underline{\text{Ans}} (1234 \cdot 567)_8 = (001010011100 \cdot 101110111)_2$$

### Binary → Hexadecimal

$$1) (101101 \cdot 101011)_2 = (?)_{16}$$

$$\begin{array}{ccccccc} \overleftarrow{0010} & \overleftarrow{1101} & \cdot & \overrightarrow{1010} & \overrightarrow{1100} & & \\ 2 & 13=D & \cdot & 10=A & 12=B & & \end{array} \quad (\text{groups of 4})$$

$$\underline{\text{Ans}} (101101 \cdot 101011)_2 = (2D \cdot AB)_{16}$$

### Hexadecimal → Binary

$$1) (A32 \cdot 56)_{16} = (?)_2$$

$$\begin{array}{ccccccc} A=10 & 3 & 2 & \cdot & 5 & 6 & \\ 1010 & 0011 & 0010 & \cdot & 0101 & 0110 & \end{array}$$

$$\underline{\text{Ans}} (A32 \cdot 56)_{16} = (101000110010 \cdot 01010110)_2$$

## Octal $\rightarrow$ Hexadecimal

(7)

To go from Octal to Hexadecimal, first we will convert Octal to Binary and then Binary to Hexadecimal.

Octal  $\rightarrow$  Binary  $\rightarrow$  Hexadecimal.  
(3-bit)

1)  $(3712)_8$

$$\begin{array}{cccc} 3 & 7 & 1 & 2 \\ \hline 0111 & 1100 & 1010 & \\ \hline 7 & 12=C & 10=A & \end{array}$$

Ans  $(3712)_8 = (7CA)_{16}$

## Hexadecimal $\rightarrow$ Binary

To go from Hexadecimal to Binary, first we will convert Hexadecimal to Binary and then Binary to Octal.

Hexadecimal  $\rightarrow$  Binary  $\rightarrow$  Octal  
(4-bit)

1)  $(A23C)_{16}$

$$\begin{array}{cccc} A=10 & 2 & 3 & C=12 \\ \hline 001010 & 0010 & 0011 & 1100 \\ \hline 12 & 10 & 7 & 4 \end{array}$$

Ans  $(A23C)_{16} = (121074)_8$