## NUMBER SYSTEM

| BINARY (2) | OCTAL (8) | DECIMAL (10) | HEXADECIMAL (16) |
|---|---|---|---|

```
0          0          0          0
1          1          1          1
BASE = 2   2          2          2
           3          3          3
           4          4          4
           5          5          5
           6          6          6
           7          7          7
        BASE = 8      8          8
                      9          9
                  BASE = 10      A
                                 B
                                 C
                                 D
                                 E
                                 F
                              BASE = 16
```

**The number systems of Binary are:**

After 0, 1 → 10, 11, 100, 101, 110, 111, 1000, 1001, 1010, 1011, 1100, 1110, 1111......... Etc.
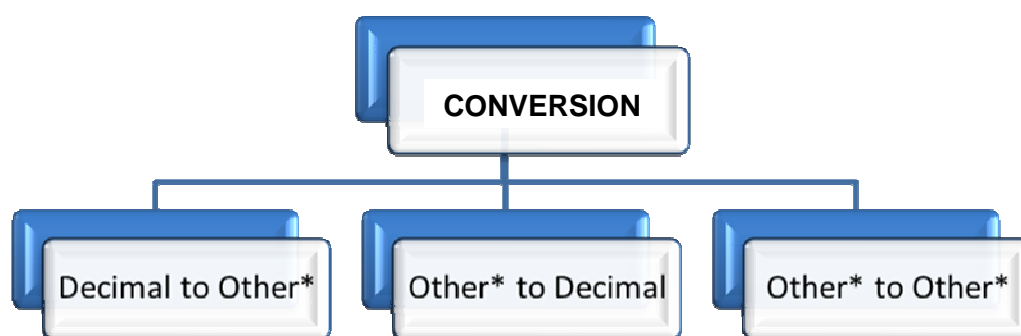
**The number system of Octal are:**

After 0 to 7 → 10, 11, 12, 13, 14, 15, 16, 17, 20, 21, 22, 23, 24, 25, 26, 27, 30, 31, 32, 33, 34, 35, 36, 37, 40..Etc.

**The number systems of decimal are:**

After 0 to 9 → 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 33, 33........Etc.

**The number systems of hexadecimal are:**

After 0 to F →10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 1A, AB, 1C, 1D, 1E, 1F, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 2A, 2B, 2C, 2D, 2E, 2F, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 3A, 3B, 3C, 3D, 3E, 3F, 40, 41, 42, 42, 44, 45.......Etc.

```
                    CONVERSION

   Decimal to Other*   Other* to Decimal   Other* to Other*
```

*Other = Binary, Octal, Hexadecimal.

# 1. Decimal to Other

## A). Decimal to Binary

### i). $(25)_{10} = (?)_2$

```
2 | 25
   2 | 12    ------- 1
      2 | 6    ------ 0
         2 | 3    ----0
            1    ----1
```

**The Answer is: $(11001)_2$**

### ii). $(1295)_{10} = (?)_2$

```
2 | 1295
   2 | 647                    -- 1
      2 | 323                 -- 1
         2 | 161              -- 1
            2 | 80            -- 1
               2 | 40         -- 0
                  2 | 20      -- 0
                     2 | 10   -- 0
                        2 | 5   -- 0
                           2 | 2   -- 1
                              1    -- 0
```

**The Answer is: $(10100001111)_2$**

## B). Decimal to Octal

### i). $(525)_{10} = (?)_8$

```
8 | 525
   8 | 65 ----   5
      8 | 8 ---   1
          1 ---   0
```

## The Answer is: $(1015)_8$

### ii). $(1295)_{10} = (?)_8$

```
8 | 1295
   8 | 161      --  7
      8 | 20     --  1
          2      --  4
```

## The Answer is: $(2417)_8$

## C). Decimal to Hexadecimal

### i). $(2450)_{10} = (?)_{16}$

```
16 | 2450
    16 | 153     -- 2
         9        -- 9
```

## The Answer is: $(992)_{16}$

### ii). $(4850)_{10} = (?)_{16}$

```
16 | 4850
   16 | 303      --  2
      16 | 18     -- 15
           1      --  2
```

## The Answer is: $(12F2)_{16}$

## 2. Other to Decimal

### A). Binary to Decimal

#### i). $(11001)_2 = (?)_{10}$

11001

$= 1 \times 2^4 + 1 \times 2^3 + 0 \times 2^2 + 0 \times 2^1 + 1 \times 2^0$

$= 1 \times 16 + 1 \times 8 + 0 \times 4 + 0 \times 2 + 1 \times 1$

$= 16 + 8 + 0 + 0 + 1$

$= 25$

## The Answer is: $(25)_{10}$

> **IMPORTENT NOTE**
>
> POWER ALWAYS SITS ON REVERSE SIDE OF NUMBER AND IT WILL BE STARTS ON "0".
>
> IF "0" POWER IS TOP OF ANY NUMBER. THE NUMBER VALUE WILL BE "1" EXAMPLE: $8^0 = 1$

#### ii). $(10100001111)_2 = (?)_{10}$

10100001111

$= 1 \times 2^{10} + 0 \times 2^9 + 1 \times 2^8 + 0 \times 2^7 + 0 \times 2^6 + 0 \times 2^5 + 0 \times 2^4 + 1 \times 2^3 + 1 \times 2^2 + 1 \times 2^1 + 1 \times 2^0$

$= 1024 + 0 + 256 + 0 + 0 + 0 + 0 + 8 + 4 + 2 + 1$

$= 1295$

## The Answer is = $(1295)_{10}$

## B). Octal to Decimal

### i). $(1015)_8 = (?)_{10}$

1015

$= 1 \times 8^3 + 0 \times 8^2 + 1 \times 8^1 + 5 \times 8^0$

$= 1 \times 512 + 0 \times 64 + 1 \times 8 + 5 \times 1$

$= 512 + 0 + 8 + 5$

$= 525$

**The Answer is = $(525)_{10}$**

### ii). $(2417)_8 = (?)_{10}$

2417

$= 2 \times 8^3 + 4 \times 8^2 + 1 \times 8^1 + 7 \times 8^0$

$= 2 \times 512 + 4 \times 64 + 1 \times 8 + 7 \times 1$

$= 1024 + 256 + 8 + 7$

1295

**The Answer is = $(1295)_{10}$**

## C). Hexadecimal to Decimal

### i). $(992)_{16} = (?)_{10}$

992

$= 9 \times 16^2 + 9 \times 16^1 + 2 \times 16^0$

$= 9 \times 256 + 9 \times 16 + 2 \times 1$

$= 2304 + 144 + 2$

$= 2450$

**The Answer is $(2450)_{10}$**

## ii). $(12F2)_{16} = (?)_{10}$

12F2

$= 1 \times 16^3 + 2 \times 16^2 + F \times 16^1 + 2 \times 16^0$

$= 1 \times 4096 + 2 \times 256 + 15 \times 16 + 2 \times 1$

$= 4096 + 512 + 240 + 2$

$= 4850$

**The Answer is $(4850)_{10}$**

## 3. Other to Other

### A). Binary to Octal

#### i). $(1000001101)_2 = (?)_8$

1000001101

**The number will be group with last 3(Three) digits; the group is given bellow:**

001 000 001 101

| 4 | 2 | 1 | | $2^2$ | $2^1$ | $2^0$ |
|---|---|---|---|---|---|---|
| 0 | 0 | 1 | | | | |
| 0 | 0 | 0 | | | | |
| 0 | 0 | 1 | | | | |
| 1 | 0 | 1 | | | | |

**= 1015**
**The Answer is $(1015)_8$**

NOTE : একই লাইনে 1 NUMBER টির ওপরে যে যে NUMBER গুলো আছে তাদের যোগফল ANSWER এ লিখতে হবে।

EXAMPLE

| | | 4 | 2 | 1 | | | | 4 | 2 | 1 |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | ← | 0 | 0 | 1 | | 5 | ← | 1 | 0 | 1 |
| 2 | ← | 0 | 1 | 0 | | 6 | ← | 1 | 1 | 0 |
| 3 | ← | 0 | 1 | 1 | | 7 | ← | 1 | 1 | 1 |
| 4 | ← | 1 | 0 | 0 | | | | | | |

#### ii). $(101010101)_2 = (?)_8$
**101010101**
= 101 010 101

| 4 | 2 | 1 |
|---|---|---|
| 1 | 0 | 1 |
| 0 | 1 | 0 |
| 1 | 0 | 1 |

= 525

The Answer is $(525)_8$

## B). Binary to Hexadecimal

i). $(100110010010)_2 = (?)_{16}$

100110010010

The number will be group with last 4(Four) digits; the group is given bellow:

1001 1001 0010

| 8 | 4 | 2 | 1 | $\leftarrow$ | $2^3$ | $2^2$ | $2^1$ | $2^0$ |
|---|---|---|---|---|---|---|---|---|
| 1 | 0 | 0 | 1 | | | | | |
| 1 | 0 | 0 | 1 | | | | | |
| 0 | 0 | 1 | 0 | | | | | |

= 992

The Answer is $(992)_{16}$

ii). $(1110101110010)_2 = (?)_{16}$

1110101110010

0001 1101 0111 0010

| 8 | 4 | 2 | 1 |
|---|---|---|---|
| 0 | 0 | 0 | 1 |
| 1 | 1 | 0 | 1 |
| 0 | 1 | 1 | 1 |
| 0 | 0 | 1 | 0 |

=1D72

The Answer is $(1D72)_{16}$

### C). Octal to Binary

#### i). $(1015)_8 = (?)_2$

1015

1 0 1 5

| 4 | 2 | 1 |
|---|---|---|
| 0 | 0 | 1 |
| 0 | 0 | 0 |
| 0 | 0 | 1 |
| 1 | 0 | 1 |

$2^2$  $2^1$  $2^0$

= 001000001101

= 1000001101

The answer is $(1000001101)_2$

**NOTE :** যে NUMBER টি বসাব সেটি ওপরের NUMBER এর যে কটি NUMBER এর যোগফল হবে তার নিচে 1 হবে এবং বাকি গুলোর নিচে 0 হবে,

**EXAMPLE**

|   | 4 | 2 | 1 |   |   | 4 | 2 | 1 |
|---|---|---|---|---|---|---|---|---|
| 1 → | 0 | 0 | 1 | 5 → | 1 | 0 | 1 |
| 2 → | 0 | 1 | 0 | 6 → | 1 | 1 | 0 |
| 3 → | 0 | 1 | 1 | 7 → | 1 | 1 | 1 |
| 4 → | 1 | 0 | 0 |   |   |   |   |

#### ii). $(525)_8 = (?)_2$

5 2 5

| 4 | 2 | 1 |
|---|---|---|
| 1 | 0 | 1 |
| 0 | 1 | 0 |
| 1 | 0 | 1 |

=101010101

The answer is $(101010101)_2$

### D). Hexadecimal to Binary

#### i). $(992)_{16} = (?)_2$

9 9 2

| 8 | 4 | 2 | 1 |
|---|---|---|---|
| 1 | 0 | 0 | 1 |
| 1 | 0 | 0 | 1 |
| 0 | 0 | 1 | 0 |

$2^3$  $2^2$  $2^1$  $2^0$

=100110010010

The answer is $(100110010010)_2$

**ii). $(12F2)_{16} = (?)_2$**

**12F2**

**= 1 2 15 2**

| 8 | 4 | 2 | 1 |
|---|---|---|---|
| 0 | 0 | 0 | 1 |
| 0 | 0 | 1 | 0 |
| 1 | 1 | 1 | 1 |
| 0 | 0 | 1 | 0 |

=~~000~~1001011110010

=1001011110010

**The answer is $(1001011110010)_2$**

X=X=X=X=X====THE END====X=X=X=X=X