# CS & IT ENGINEERING


## Basics of Computer System

## Binary and Power of 2s

Lecture No.- 05


By- Vishvadeep Gothi sir

# Recap of Previous Lecture

Topic Number System

Topic Radix or Base

Topic Binary

Topic Hexadecimal

# Topics to be Covered

- Topic: Binary Numbers
- Topic: Conversion to Decimal
- Topic: Decimal To Binary
- Topic: Power of 2

# Topic : Binary Number

base = 2 ⇒ digits → 0, 1

| | | |
|---|---|---|
| 0 | 00 | 000 |
| 1 | 01 | 001 |
| | 10 | 010 |
| | 11 | 011 |
| | | 100 |
| | | 101 |
| | | 110 |
| | | 111 |

decimal number

562

$10^2$ $10^1$ $10^0 = 1$

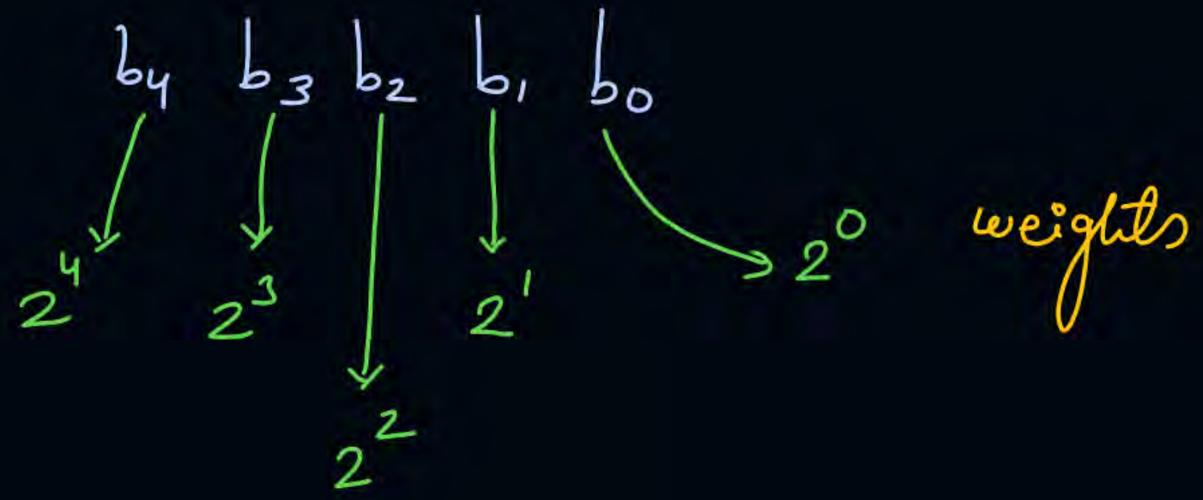
$10^2 \Rightarrow 5$
$10^1 \Rightarrow 6$
$10^0 \Rightarrow 2$

number $(5*10^2)+(6*10^1)+(2*10^0)$

500 + 60 + 2

562

Binary number :- 5 bits



# Binary to Decimal

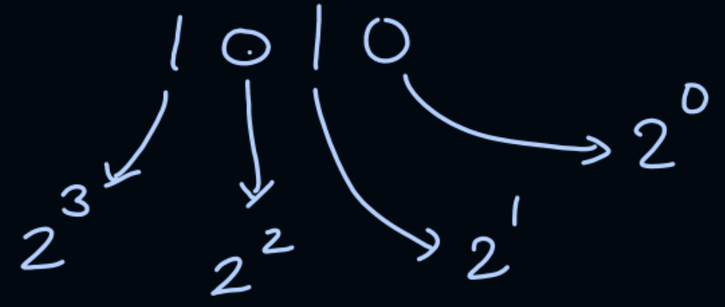
Steps: multiple each bit by it's weight
then add all multiplication results.

if n bit binary binary number $\Rightarrow b_{n-1} \cdots b_2 b_1 b_0$

$$decimal = \sum_{i=0}^{n-1} b_i * 2^i$$

example:-

$$(1010)_2 = (\quad 10 \quad)_{10}$$




$$= (0 * 2^0) + (1 * 2^1) + (0 * 2^2) + (1 * 2^3)$$

$$= 0 + 2 + 0 + 8$$

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

ex:- $(1101)_2 = (13)_{10}$

$= (1 * 2^0) + (0 * 2^1) + (1 * 2^2) + (1 * 2^3)$

$= 1 + 0 + 4 + 8$

$= (13)_{10}$

# Binary to Decimal

1. $(10110)_2 = (\underline{22})_{10}$ $\Rightarrow (0*2^0)+(1*2^1)+(1*2^2)+(0*2^3)+(1*2^4)=22$
2. $(1101110)_2 = (\underline{110})_{10}$ $\Rightarrow$ $64+32+8+4+2 = 110$
3. $(10101)_2 = (\underline{21})_{10}$ $\Rightarrow (1*2^0)+(0*2^1)+(1*2^2)+(0*2^3)+(1*2^4)=21$
4. $(1100)_2 = (\underline{12})_{10}$ $\Rightarrow (0*2^0)+(0*2^1)+(1*2^2)+(1*2^3)=0+0+4+8=12$
5. $(101)_2 = (\underline{5})_{10}$ $\Rightarrow (1*2^0)+(0*2^1)+(1*2^2)=1+0+4=5$
6. $(11001)_2 = (\underline{25})_{10}$ $\Rightarrow (1*2^0)+(0*2^1)+(0*2^2)+(1*2^3)+(1*2^4)=25$

# Decimal to Binary

for binary

given decimal number

Steps:

| | | Remainder |
|---|---|---|
| 2 | 6 | |
| 2 | 3 | 0 |
| 2 | 1 | 1 |
| | 0 | 1 |

stop here

$(110)_2$

$(6)_{10} = (110)_2$

$2)\overline{6}\,(3 \quad 6 \quad 0$

$2)\overline{3}\,(1 \quad 2 \quad 1$

$2)\overline{1}\,(0 \quad 0 \quad 1$

$(13)_{10} = (1101)_2$

| | | |
|---|---|---|
| 2 | 13 | |
| 2 | 6 | 1 |
| 2 | 3 | 0 |
| 2 | 1 | 1 |
| | 0 | 1 |

# Decimal to Binary

1. $(27)_{10} = (\underline{\quad 11011 \quad})_2$
2. $(19)_{10} = (\underline{\quad 10011 \quad})_2$
3. $(33)_{10} = (\underline{\quad 100001 \quad})_2$
4. $(50)_{10} = (\underline{\quad 110010 \quad})_2$

| 2 | 27 | |
|---|---|---|
| 2 | 13 | 1 |
| 2 | 6 | 1 |
| 2 | 3 | 0 |
| 2 | 1 | 1 |
| | 0 | 1 |

| 2 | 19 | |
|---|---|---|
| 2 | 9 | 1 |
| 2 | 4 | 1 |
| 2 | 2 | 0 |
| 2 | 1 | 0 |
| | 0 | 1 |

| 2 | 33 | |
|---|---|---|
| 2 | 16 | 1 |
| 2 | 8 | 0 |
| 2 | 4 | 0 |
| 2 | 2 | 0 |
| 2 | 1 | 0 |
| | 0 | 1 |

| 2 | 50 | |
|---|---|---|
| 2 | 25 | 0 |
| 2 | 12 | 1 |
| 2 | 6 | 0 |
| 2 | 3 | 0 |
| 2 | 1 | 1 |
| | 0 | 1 |

# Power of 2

$2^0 = 1$

$2^1 = 2$

$2^2 = 4$

$2^3 = 8$

$2^4 = 16$

$2^5 = 32$

$2^6 = 64$

$2^7 = 128$

$2^8 = 256$

$2^9 = 512$

$2^{10} = 1024$

$2^{11} = 2048$

$2^{12} = 4096$

$2^{13} = 8192$

$2^{14} =$

$2^{15} =$

$2^{16} =$

# Power of 2

| Unit | Power of 2 |
| --- | --- |
| **K** (Kilo) | $2^{10}$ |
| **M** (Mega) | $2^{20}$ |
| **G** (Giga) | $2^{30}$ |
| **T** (Tera) | $2^{40}$ |

$10^3$

$10^6$

$10^9$

$10^{12}$

# 2 mins Summary

**Topic** Binary Numbers

**Topic** Conversion to Decimal

**Topic** Decimal To Binary

**Topic** Power of 2

# Happy Learning

# THANK - YOU