Number System

(1) Introduction
(2) Conversion
(3) Arithmetic operations
(4) Complement
(5) Various codes
(6) floating points

Introduction

(1) Binary – (0, 1) – 2
(2) Octal – (0, 7) – 8
(3) Decimal – (0-9) – 10
(4) Hexadecimal – (0-9 (A-F)) 16

Base, Radix

$()_n \rightarrow \underbrace{(0-(n-1)}_{\text{Range}}$

From Decimal to others

↳ Binary
↳ Octal
↳ Hexadecimal

(1) $(19.35)_{10} \rightarrow ()_2$

÷2 ↙ ↘ ×2

2	19	
2	9	1 – LSB
2	4	1
2	2	0
2	1	0
	0	

MSB

10011 . 0101

.35 × 2
.70 0
.70 × 2
1.40 × 2 1
.80 0
1.60 1

$(19.35)_{10} = ()_8$

÷8 ↙ ↘ ×8

23.26

8	19	
	2	3

.35 × 8
2.80 2
.80 × 8
6.40 6
.40 × 8

$(19.35)_{10} = ()_{16}$

÷16 ↙ ↘ ×16

13.59

16	19	
	1	3

From others to Decimal

↳ Binary
↳ Octal
↳ Hexadecimal

$(1101.01)_2$

2^0 ↙ ↘ 2^{-1}

$1\times2^3 + 1\times2^2 + 0\times2^1 + 1\times2^0 . 0\times2^{-1} + 1\times2^{-2}$
$= 8+4+0+1 . 0 + 1/4$
$= 13.25$

Conversion b/w Base (Power of 2)

$x = y$

Power of 2

Binary	Octal	Hexa
2^1	2^3	2^4

B ↔ O

O ↔ H

B ↔ H

⇒ Binary to Octal

$(11011.110)_2 = (33.6)_8$

⇒ Octal to hexa

$(237.61)_8 = (9F.C4)_{16}$

010011 111 . 11000100

0 9 F C 4

⇒ Binary to Hex

(1101010 . 0110 1)

6 A 6

6A.68