Date :
Page No. :

S.P Group of Institute

Computer Fundamental Notes

Unit 6: Number System - Basics

Computer mein data ko represent karne ke liye Number System ka use hota hai. Iske main types hain:

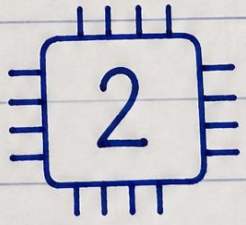
Base-10

0 1 2 3 4
5 6 7 8 9

1. Decimal Number System:

Iska base 10 hota hai aur isme digits 0 se 9 tak use hoti hain.

Base-2



0 1 0 1 1 0 1
1 0 1 0 0 1 0

2. Binary Number System:

Iska base 2 hota hai aur isme sirf do digits 0 aur 1 hoti hain. Computer internal data ko binary format mein hi process karta hai.

Date :
Page No. :

S.P Group of Institute

Computer Fundamental Notes

Unit 6: Number System – Dec-Bin Conversion

Conversions computer science mein bohot important hain:

1. Decimal to Binary Conversion:

Decimal number ko 2 se divide karte hain aur remainders ko bottom-to-top likhte hain.

Example:

13 (base 10) = 1101 (base 2)

2. Binary to Decimal Conversion:

Binary digits ko 2 ki powers se multiply karke add karte hain taaki decimal value mil sake.

Decimal to Binary Conversion

Division		Quotient	Remainder
2	13	6	1
2	6	3	0
2	3	1	1
2	1	0	1

LSB

Read Bottom to Top

MSB

Stop

13 (base 10) = 1101 (base 2)

Example: 1101 (base 2)

Position (Right to Left)	Binary Digit	Power of 2	Multiplication
3	1	$2^3 = 8$	$1 \times 8 = 8$
2	1	$2^2 = 4$	$1 \times 4 = 4$
1	0	$2^1 = 2$	$0 \times 2 = 0$
0	1	$2^0 = 1$	$1 \times 1 = 1$

Total = 8 + 4 + 0 + 1 = 13

1101 (base 2) = 13 (base 10)

Page No. _____
Date : / /

S.P Group of Institute

Computer Fundamental Notes

Unit 6: Number System - Octal Conversion

1. Decimal to Octal Conversion:

Decimal number ko 8 se divide kiya jata hai aur remainders ko reverse order mein likhte hain.

Example:
100 (base 10) = 144 (base 8).

Decimal to Octal Conversion (Base-8)

		Remainder
8	100	4 ↑
8	12	4 ↑
8	1	1 ↑
	0	-

Read remainders in reverse order → 144

2. Octal to Decimal Conversion:

Octal number ke har digit ko 8 ki powers (8^0, 8^1, 8^2...) se multiply karke sum nikalte hain.

Place Value Chart for Octal

Place (Power)	8^3	8^2	8^1	8^0
Value	512	64	8	1
Example $(257)_8$	2	5	7	

$$(257)_8 = 2\times8^2 + 5\times8^1 + 7\times8^0$$
$$= 2\times64 + 5\times8 + 7\times1$$
$$= 128 + 40 + 7$$
$$= 175_{(10)}$$

S.P Group of Institute

Date : 25/05/2024
Page No. : 1

Computer Fundamental Notes

Unit 6: Number System - Hex Conversion

1. Decimal to Hexadecimal Conversion:

- Decimal number ko 16 se divide karte hain; agar remainder 10-15 ho toh A-F use karte hain.

Example:

255 (base 10) = FF (base 16).

2. Hexadecimal to Decimal Conversion:

- Hex digits ko 16 ki powers se multiply karke decimal value calculate ki jati hai.

Hex to Decimal Reference (A-F)

Hex	Decimal
A	10
B	11
C	12
D	13
E	14
F	15

Decimal to Hexadecimal Example (255_{10})

		Remainder
16)	255	15 (F) ↑
16)	15	15 (F) ↑
16)	0	0 ↑

Read remainder from bottom to top

255 (base 10) = FF (base 16)

S.P Group of Institute

Computer Fundamental Notes

Unit 6: Number System - Binary Arithmetic

Binary numbers ke sath arithmetic operations:

1. Binary Addition:

Rules:

- 0 + 0 = 0
- 0 + 1 = 1
- 1 + 0 = 1
- 1 + 1 = 10 (0 with carry 1)

Example:

101 + 011 = 1000.

Binary Addition

Carry →	1	1	1
	1	0	1
+	0	1	1
	1	0	0	0

101 + 011 = 1000

2. Binary Subtraction:

Rules:

- 0 - 0 = 0
- 1 - 0 = 1
- 1 - 1 = 0
- 0 - 1 = 1 (with borrow 1)

Binary Subtraction

Borrow →	1	1	1
	1	0	1
-	0	1	1
	0	1	0

101 - 011 = 010

S.P Group of Institute

Computer Fundamental Notes

Unit 6 : Number System - Complements

1. 1s Complement :

Binary number ke sabhi 0s ko 1 aur 1s ko 0 mein convert karte hain.

Example :

1011 → 0100

2. 2s Complement :

1s complement mein 1 add karne par 2s complement milta hai. Yeh negative numbers represent karne ke liye use hota hai.

Example :

1011 → 0100(1s) + 1 = 0101(2s)

1s Complement (Inversion)

Rules: 0 → 1, 1 → 0

1 0 1 1
↓ ↓ ↓ ↓
0 1 0 0

1011 → 0100

2s Complement (Steps)

Step 1: 1s Complement lo.

1 0 1 1
↓ ↓ ↓ ↓
0 1 0 0 (1s Complement)

Step 2: Usme 1 add karo.

```
  0 1 0 0
+ 0 0 0 1
---------
  0 1 0 1   (2s Complement)
```

1011 → 0101

★ Use: 2s complement ka use computers mein subtraction aur negative numbers represent karne ke liye hota hai.