UNIT-3

Data Representation

☆ Number System:-

i) Decimal number System:-

⇒ It consists of digits 0 to 9. Its base or, radix is 10. It is most Popular and widly used number System. It is the by default number System used in Common Practise.

Exa- 5074 + 7219 = 12293 Addition

7025 - 3098 = 3927 Subtraction

125 × 5 = 625 Multiplication

$$5\overline{)1275}\,(255$$
10
27
25
25
25
xx division

1265 in Decimal number System = $1\times10^3 + 2\times10^2 + 6\times10^1 + 5\times10^0$

$= 1000 + 200 + 60 + 5$

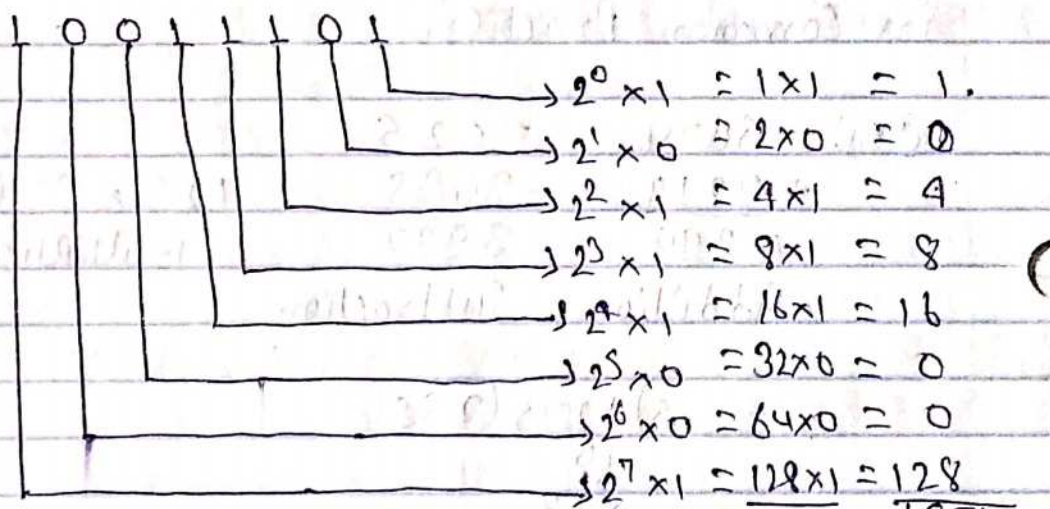
ii) Binary number System:-

⇒ Binary number System is the number System of Computers. It is widly used in Computer Operations. Those Computers which work on Binary number Systems are Known as digital Computer.

A Binary number System consist of only two digits namely - 0, 1. Its base or radix is 2.
For exa:- $(100)_2$ → Binary number.
2 → base or, radix.

$(100)_2$ → Binary number System
$(9)_{10}$ → Decimal number System

Exa:-



✡ Addition of Binary Numbers:-
⇒ Rule for Addition

A	B	A+B
0	0	0
0	1	1
1	0	1
1	1	10

→ Carry forward 0

Exa:-

```
  1 1 1 0 1
  1 0 1 0 1
-------------
1 1 0 0 1 0
```

✡ Multiplication of Binary numbers:-

⇒ Rule for Multiplication

A	B	A*B
0	0	0
0	1	0
1	0	0
1	1	1

Exa:-

```
  1 1 0 0 1
      1 0 1
-------------
  1 1 0 0 1
0 0 0 0 0 x
1 1 0 0 1 x x
-------------
1 1 1 1 1 0 1
```

✡ Subtraction of Binary numbers:-

⇒ Rule for Subtraction

A	B	A-B	
0	0	0	
0	1	1	→ with a borrow form next column
1	0	1	
1	1	0	

exa:-

$$\begin{array}{r} 1\ 1\ 0\ 1 \\ 0\ 1\ 1\ 1 \\ \hline 0\ 1\ 1\ 0 \end{array}$$

✡ Division of Binary numbers:-

⇒ Rule for Division

A	B	A÷B	
0	0	∝	→ (error/undefined)
0	1	0	
1	0	∝	→ (error/undefined)
1	1	1	

✡ One's Complement:-

⇒ The One's Complement of Binary number System is obtained by simply changing 1's into 0's and vice-versa.

exa:- 1010

1's complement = 0101

✡ Two's Complement:-

⇒ Step1:- Find the one's complement of the given number.

Step2:- Add '1' to the Right most bit.

exa:- 1010

1's complement = 0101

2's " " " = 0101 + 1

0110

$$\begin{array}{r} 0\ 1\ 0\ 1 \\ \quad\quad 1 \\ \hline 0\ 1\ 1\ 0 \end{array}$$

✡ Octal number System:-

⇒ The base of an octal number system is 8. It uses digits 0 to 7.

Base: 8

Set of numbers: 0, 1, 2, 3, 4, 5, 6, 7

- Conversion of octal to decimal.

Q) $(56)_8 = (?)_{10}$

⇒

$5\ 6$

$6 \times 8^0 = 6$

$5 \times 8^1 = 40$

46

$\therefore (56)_8 = (46)_{10}$

- Conversion of decimal to octal:-

Q) $(46)_{10} = (?)_8$

⇒

8	46	6
	5	

$\therefore (46)_{10} = (56)_8$

- Conversion of Binary to octal:-

Q) $(101110)_2 = (?)_8$

⇒

$4\ 2\ 1\ \ 4\ 2\ 1$

$1\ 0\ 1\ \ 1\ 1\ 0$

$5 \quad 6$

$= (56)_8$

- Conversion of Octal to Binary:-

Q) $(56)_8 = (?)_2$

⇒

2	6	0
2	3	1
	1	

$6 = (110)_2$

2	5	1
2	2	0
	1	

$5 = (101)_2$

$\therefore (56)_8 = (101110)_2$

✡ Hexa Decimal number System :-

⇒ The Hexa Decimal number System consist of digits 0 to 9 and A-10, B-11, C-12, D-13, E-14, F-15. Its base or radix is 16. Hexadecimal no. System consist of numbers 0 to 9 and alphabets A to F. Therefor, It is also known as alpha (x) numeric number System.

- Conversion of Hexadecimal no. into Decimal number.

Q) $(2B6D)_{16} = (?)_{10}$

⇒

2 B 6 D

$16^0 \times 13 = 1 \times 13 = 13$

$16^1 \times 6 = 16 \times 6 = 96$

$16^2 \times 11 = 256 \times 11 = 2816$

$16^3 \times 2 = 4096 \times 2 = 8192$

(11117)

$\therefore (2B6D)_{16} = (11117)_{10}$ Ans

- Conversion of Decimal no. to Hexa decimal.

Q) $(36549)_{10} = (?)_{16}$

⇒

16	36549	5
16	2284	12 = C
16	142	14 = E
	8	

$\therefore (36549)_{10} = (8EC5)_{16}$ Ans

- Conversion of Hexdecimal to Binary.

Q) $(7CF2)_{16} = (?)_2$

⇒ 7 C F 2
(0111)(1100)(1111)(0010)

$\therefore (7CF2)_{16} = (0111110011110010)_2$ Ans

- Conversion of Binary no. to Hexadecimal no.

Q) $(1000111011111100)_2 = (?)_{16}$

⇒ 1000 1110 1111 1100
8 14=E 15=F 12=C

$\therefore (1000111011111100)_2 = (8EFC)_{16}$ Ans

✡ BCD Code:-

⇒ It Stands for Binary Code decimal number System. It is Similar to Binary number System. It used two digits 0 & 1 to represent any number. BCD codes are used where the decimal information is directly transfered into or outof a digital System. Electronic Calculators, digital voltmeters, frequency counters, electronic counters, digital clock etc work with 'BCD' Code. 'BCD' Code has also been used in early Computer Systems. However modern Computer don't use 'BCD' code because they have to transfer numeric as well as non-numeric data.

- Conversion of decimal to BCD:

Q) $(56)_{10} = (?)_2$

⇒ 5 → 0101, 6 → 0110 ⇒ $(01010110)_2$ or, $(01010110)_{BCD}$

- Conversion of BCD to decimal:-

Q) $(1101011001)_2 = (?)_{10}$

⇒ 0011 0101 1001 = 3 5 9 $= (359)_{10}$ Ans

✡ Bit / Byte :-

Units of Data Representation:-

⇒ 101011

Binary digits

Bit(s) = Bit / Bits

1 = Bit

0 = Bits

010110 = Bits

4 Bits = 1 Nibble

8 " " = 1 Byte

1024 " " ≈ 1 Kilo Byte

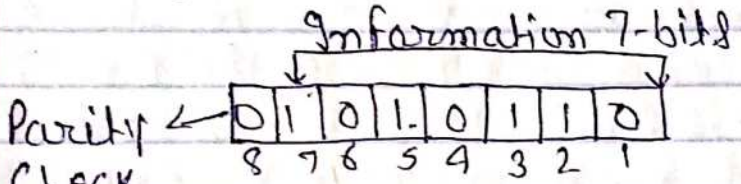
1024 KB = 1 MB (Mega Byte)

1024 MB = 1 GB (Giga Byte)

1024 GB = 1 TB (Tera Byte)

✡ ASCII Code:-

⇒ It Stands for American Standard Code for information Interchange (ASCII). It is a 7-bit code. ASCII Codes are extensively used in Small Computers, Pheripherals Instruments and Communication devices. It has replaced many of the special codes that were Previously used by the manufacturer Micro Computers using 8-bit word length. 7-bits use to represent basic code. The 8-bit is used for Pariety Check.



(To Identify error)

This is the Standard no. System used in Computers for Communication.