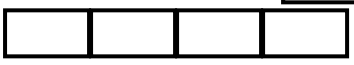
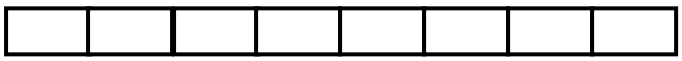
Computer Fundamental

DATA REPRESENTATION

Q. What is Number System ?

- Number systems are the technique to represent numbers in the computer system architecture, every value that you are saving (देना) or obtain (लेना) into/from computer memory has a defined/Convert number system.
- All digital computers store numbers, letters, and other characters in coded form.
- Every character is represented by a string of "0s" and "1s" – the only digits found in the binary numbering system.

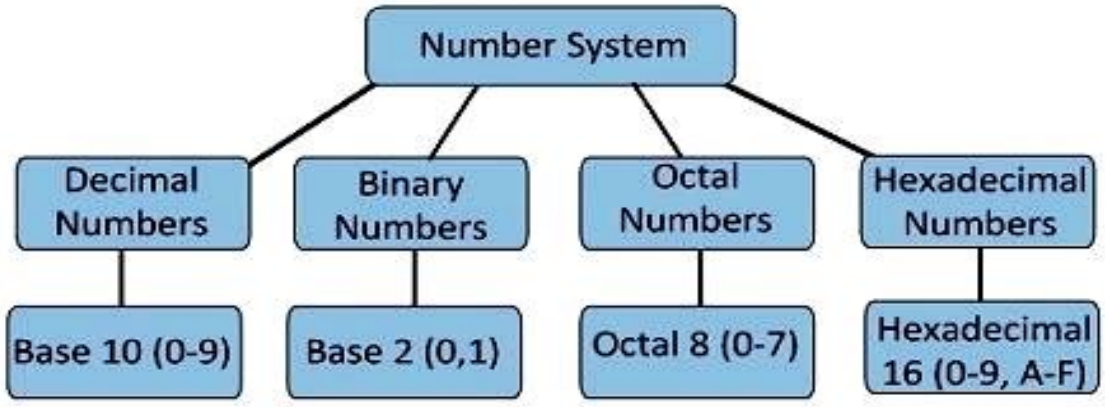
❖ Storage/Memory Unit of Computer

- ✓ "0" or "1" = 1 bit (Binary Digit) 
- ✓ 4 bits = 1 Nibble 
- ✓ 8 bits = 1 Byte 
- ✓ 1024 Bytes = 1 KB (Kilo Bytes)
- ✓ 1024 KB = 1 MB (Mega Byte)
- ✓ 1024 MB = 1 GB (Giga Byte)
- ✓ 1024 GB= 1 TB (Terra Byte)
- ✓ 1024 TB = 1PB(Peta Byte)
- ✓ 1024 PB = 1 EB (Exa Byte)
- ✓ 1024 EB = 1 ZB (Zetta byte) {theoretical}
- ✓ 1024 ZB = 1 YB (Yotta byte) {theoretical} [Till Exam/interview]
- ✓ 1024 YB = 1 BB (Bronto byte) {theoretical / future}
- ✓ 1024 BB = 1 GB (Geop byte) {theoretical}

- When data is typed into a computer, the key board converts each key stroke into a binary character code. This code is then transmitted/transfer to the computer.
- When the computer transmits the data to the any device, each individual character is communicated in binary code. It is then converted back to the specific character while displaying or printing the data.

❖ Computer architecture supports following number systems.

1. **Binary number system**
2. **Octal number system**
3. **Decimal number system**
4. **Hexadecimal (hex) number system**



1. BINARY NUMBER SYSTEM

- A Binary number system has only two digits that are 0 and 1. Every number (value) represents with 0 and 1 in this number system.
- The base of binary number system is 2, because it has only two digits.
- 1 binary = 1 bit / digit

2. OCTAL NUMBER SYSTEM

- Octal number system has only eight (8) digits from 0 to 7. Every number (value) represents with 0,1,2,3,4,5,6 and 7 in this number system.

- The base of octal number system is 8, because it has only 8 digits.
- 1 octal digit = 3 bit/digit

3. DECIMAL NUMBER SYSTEM

- Decimal number system has only ten (10) digits from 0 to 9. Every number (value) represents with 0,1,2,3,4,5,6, 7,8 and 9 in this number system.
- The base of decimal number system is 10, because it has only 10 digits.
- 1 decimal digit = 4 bit/digit (approx)

4. HEXADECIMAL NUMBER SYSTEM

- A Hexadecimal number system has sixteen (16) alphanumeric values from 0 to 9 and A to F. Every number (value) represents with 0,1,2,3,4,5,6, 7,8,9,A,B,C,D,E and F in this number system.
- The base of hexadecimal number system is 16, because it has 16 alphanumeric values. Here A is 10, B is 11, C is 12, D is 13, E is 14 and F is 15.
- 1 hexdecimal digit = 4 bit / digit

Number system	Base(Radix)	Used digits	Example
Binary	2	0,1	$(11110000)_2$
Octal	8	0,1,2,3,4,5,6,7	$(360)_8$
Decimal	10	0,1,2,3,4,5,6,7,8,9	$(240)_{10}$
Hexadecimal	16	0,1,2,3,4,5,6,7,8,9, A,B,C,D,E,F	$(F0)_{16}$

Q. Why computer use Binary Numbers ?

→ A computer uses binary because it is built using electronic circuits that have only two states: ON and OFF. These states are represented by 1 and 0. Binary is simple, reliable, and easy for hardware to process.

CONVERSIONS (रूपांतरण)

❖ Decimal to Binary

Example:

- The decimal number is 65

2	65	1
2	32	0
2	16	0
2	8	0
2	4	0
2	2	0
	1	

- The binary number of 65 is 1000001

$(14.625)_{10}$

2	14	0
2	7	1
2	3	1
	1	

$14 \Rightarrow 1110$

$.625 \times 2 = 1.250$
$.250 \times 2 = 0.500$
$.500 \times 2 = 1.000$

$.625 = 101$

$\Rightarrow (1110.101)_2$ Ans

❖ Binary to Decimal

Converting Binary To Decimal

The decimal number of 1000001 is

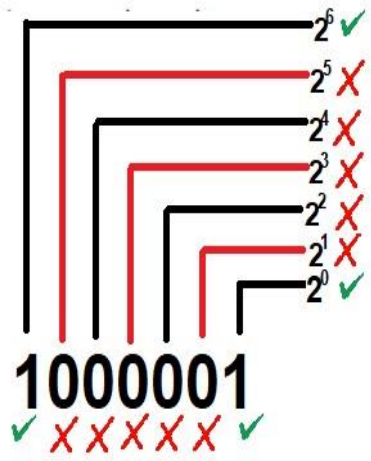
$= (1*2^6)+(0*2^5)+(0*2^4)+(0*2^3)+(0*2^2)+(0*2^1)+(1*2^0)$

$= (1*64) + (0*32) + (0*16) + (0*8) + (0*4) + (0*2) + (1 * 1)$

$= 64 + 0 + 0 + 0 + 0 + 0 + 1$

$= 65$

- The decimal number of 1000001 is 65



● 0 1 0 1

2^{-1} 2^{-2} 2^{-3} 2^{-4}

Add the remaining

$= 2^{-2} + 2^{-4}$

$= \frac{1}{4} + \frac{1}{16}$

$= 0.25 + 0.0625$

$= 0.3125$

Circuit Globe

Q. Convert Decimal to Binary ($)_{10} = ($ $)_2$

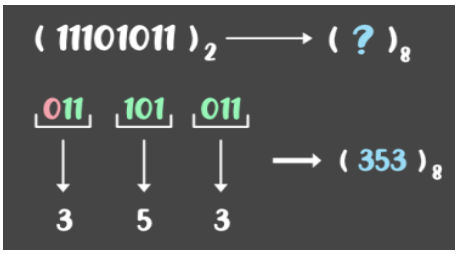
Si.no	Decimal	Binary
1	213	11010101
2	9	1001
3	67	1000011
4	99	1100011
5	23	10111
6	143	10001111
7	6	110
8	1	1
9	197	11000101
10	252	11111100
11	14.625	1110.101
12	25.375	11001.011
13	129	10000001
14	72.25	1001000.01
15	1024	10000000000

Q. Convert Binary to decimal ($)_2 = ($ $)_{10}$

Si no	Binary	decimal
1	11001011	203
2	00110101	53
3	10000011	131
4	10001111	143
5	11100011	227
6	00000100	4
7	00010010	18
8	00111111	63
9	10101010	170
10	01010101	85
11	11011.01	27.25
12	1001001110	590
13	11100.001	28.125
14	110011.10011	51.59375

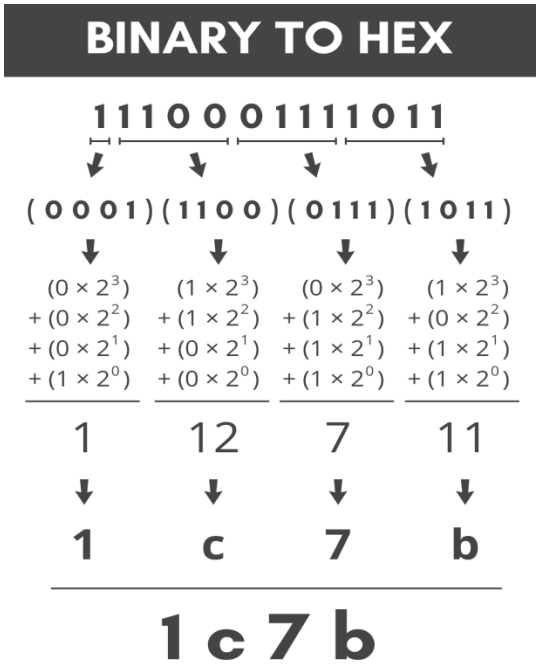
15	101010101010.1	2730.25

Q. Convert Binary to Octal ($)_2$ = ($)_8$



Si no	Binary	Octal
1	11001010	312
2	00110101	65
3	10000011	203
4	10001111	217
5	11100011	343
6	00000100	4
7	00010010	22
8	00111111	77
9	10101010	252
10	01010101	51
11	11011.01	33.2
12	1001001110	446
13	11100.001	34.1
14	110011.10011	63.46
15	101010101010.1	5252.4

Q. Convert Binary to Hexadecimal ($)_2$ = ($)_{16}$



Decimal	Binary	Hexadecimal
0	0000	0
1	0001	1
2	0010	2
3	0011	3
4	0100	4
5	0101	5
6	0110	6
7	0111	7
8	1000	8
9	1001	9
10	1010	A
11	1011	B
12	1100	C
13	1101	D
14	1110	E
15	1111	F

Si no	Binary	Hexa
1	11001011	CB
2	00110101	35
3	10000011	83
4	10001111	8F
5	11100011	E3
6	00000100	4
7	00010010	12
8	00111111	3F
9	10101010	AA
10	01010101	55
11	11011.01	1B.4
12	1001001110	24E
13	11100.001	1C.2
14	110011.10011	33.98
15	101010101010.1	AAA.8

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