CH-4[A]

NUMBERING SYSTEM AND CODES

Introduction

WHAT IS A BINARY CODES ?

- A binary code **represents text, computer processor instructions, or any other data using a two-symbol system.**

- The two-symbol system used is often "0" and "1" .

BINARY CODE ALPHABET REFERENCE

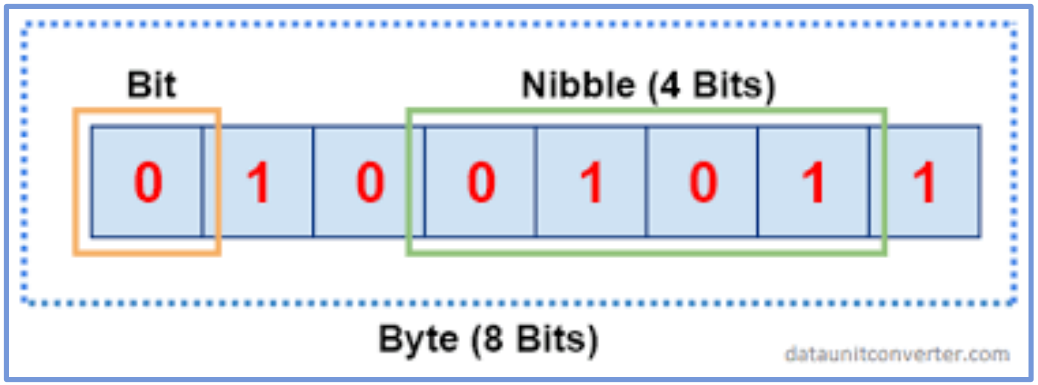
1	A	00001	14	N	01110
2	B	00010	15	O	01111
3	C	00011	16	P	10000
4	D	00100	17	Q	10001
5	E	00101	18	R	10010
6	F	00110	19	S	10011
7	G	00111	20	T	10100
8	H	01000	21	U	10101
9	I	01001	22	V	10110
10	J	01010	23	W	10111
11	K	01011	24	X	11000
12	L	01100	25	Y	11001
13	M	01101	26	Z	11010

ALPHABET IN BINARY CODE

A	01000001	J	01001010	S	01010011
B	01000010	K	01001011	T	01010100
C	01000011	L	01001100	U	01010101
D	01000100	M	01001101	V	01010110
E	01000101	N	01001110	W	01010111
F	01000110	O	01001111	X	01011000
G	01000111	P	01010000	Y	01011001
H	01001000	Q	01010001	Z	01011010
I	01001001	R	01010010		

WHAT IS A NIBBLE?

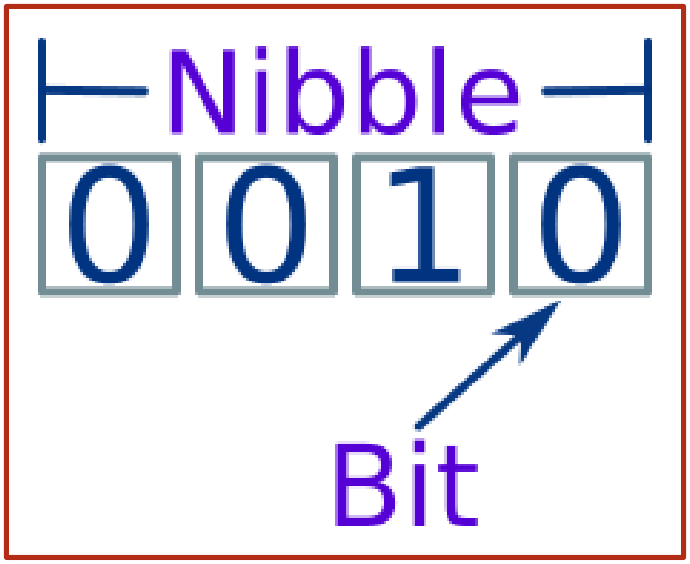
- Nibble is also a part of the computer storage system.
- Nibble is aggregation (combination) of 4 bits.
- 1 Nibble = 4 Bits and 1 nibble = 0.5 Bytes also.



WHAT IS A BIT?

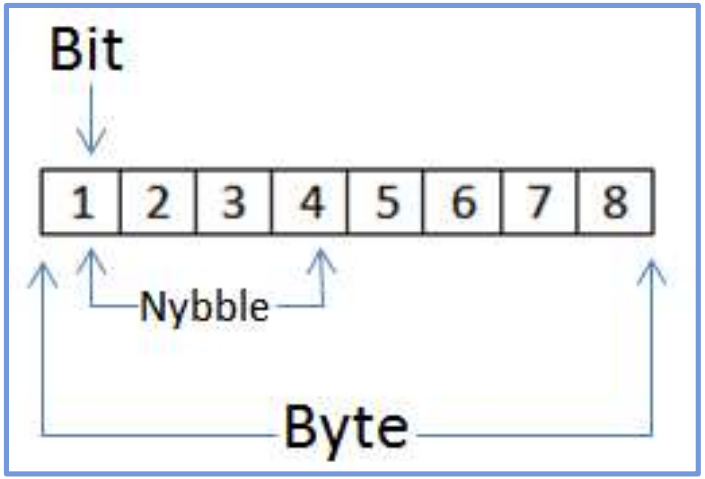
- A bit (binary digit) is the smallest unit of data that a computer can process and store.

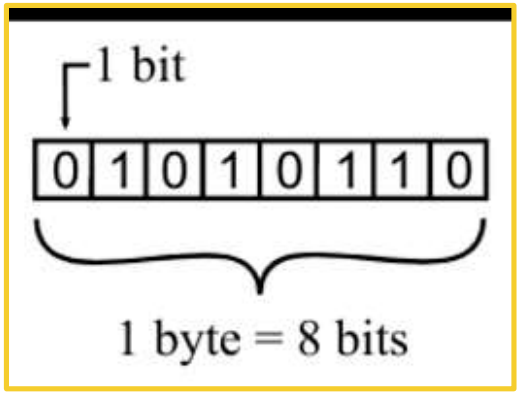
- A bit (short for binary digit) is the smallest unit of data in a computer. A bit has a single binary value, either 0 or 1.



WHAT IS A BYTE?

- A byte is a unit of data that is eight binary digits long.
- 1 byte = 8 bits.



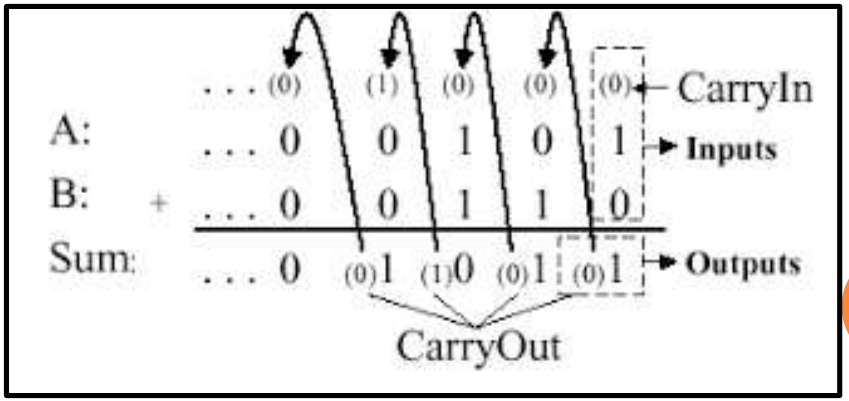


WHAT IS A CARRY BIT?

- The carry bit from the most significant bit of an arithmetic operation.

Don't forget to carry the 1 because 5+9=14

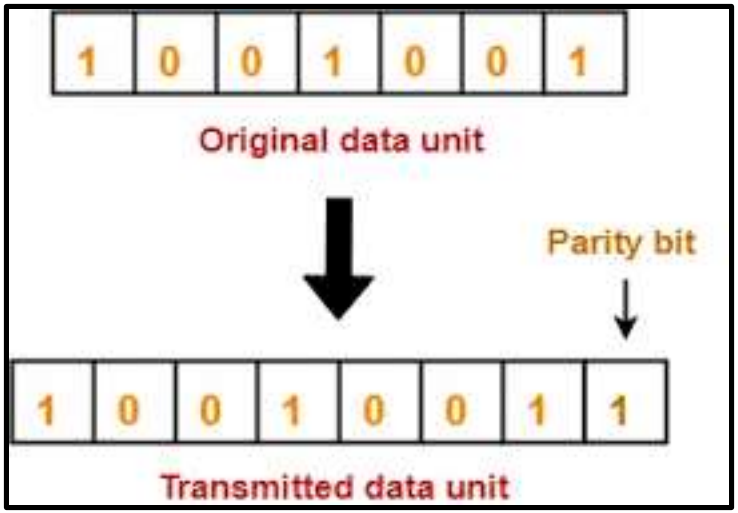
```
  1
 15
+29
----
 44
```



WHAT IS A PARITY BIT?

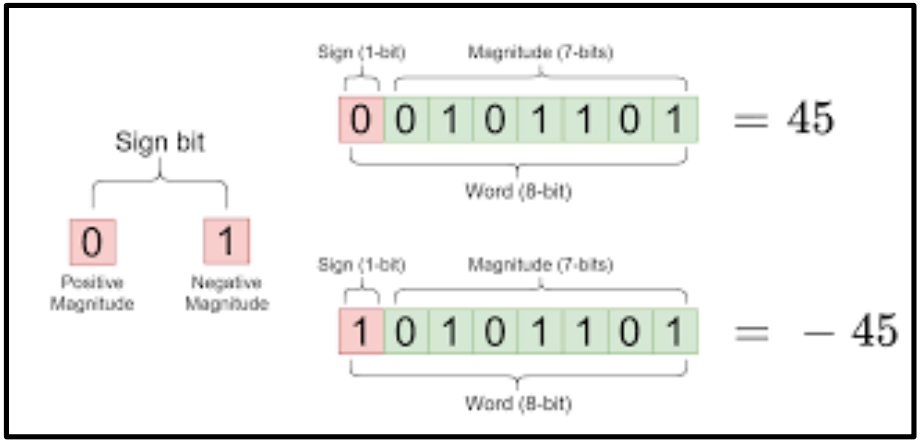
- A parity bit is a check bit, which is added to a block of data for error detection purposes.

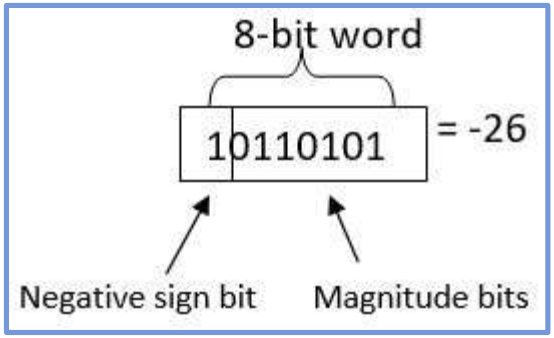
- It is used to validate the integrity of the data.



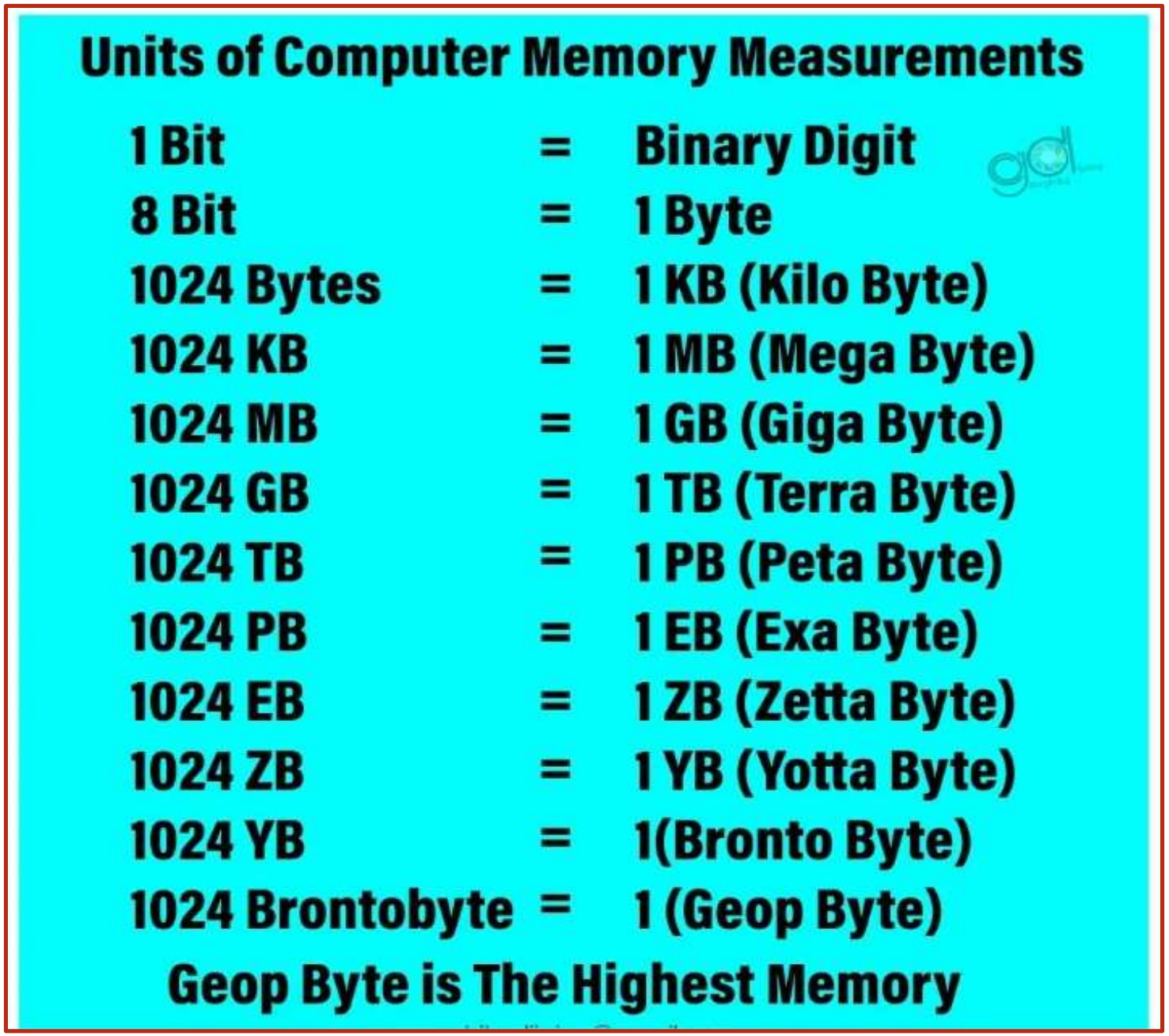
WHAT IS A SIGN BIT?

- The sign bit is a bit in a signed number representation that indicates the sign of a number.





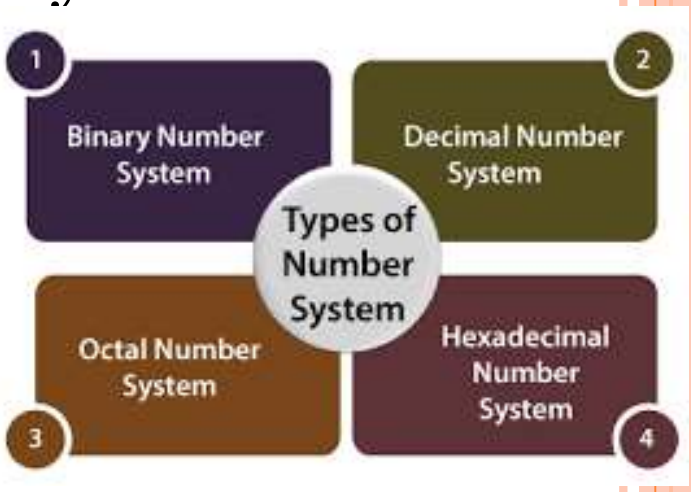
Memory measure



Types of Numbering System

Types of Numbering System

- **The four most common number system types are:**



1. **Binary** number system (Base- 2)
2. **Octal** number system (Base-8)
3. **Decimal** number system (Base- 10)
4. **Hexadecimal** number system (Base- 16)

BINARY NUMBER SYSTEM (BASE- 2)

- A binary number is a number expressed in the base-2 numeral system or binary numeral system, a method of mathematical expression.

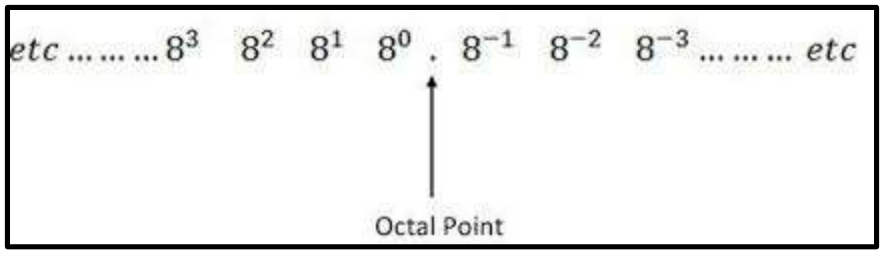
- uses only two symbols: "0" and "1".

- Ex.
  - 0
  - 1

2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0	
0	0	0	0	0	0	0	0	0
128	64	32	16	8	4	2	1	1

OCTAL NUMBER SYSTEM (BASE- 8)

- The octal numeral system is the base-8 number system, and uses the digits 0 to 7.
- That means there are only 8 symbols or digits (0, 1, 2, 3, 4, 5, 6, 7) used to form other numbers.
- Ex.
  - 0
  - 1
  - 2
  - 3
  - 4
  - 5
  - 6
  - 7



DECIMAL NUMBER SYSTEM (BASE- 10)

- The **Decimal** numeral system is the base-10 number system, and uses the digits 0 to 9.

- That means there are only 10 symbols or digits (0, 1, 2, 3, 4, 5, 6, 7,8,9) used to form other numbers.

- Ex.
  - 0
  - 1
  - 2
  - 3
  - 4
  - 5
  - 6
  - 7
  - 8
  - 9

One	1	10^0
Ten	10	10^1
Hundred	100	10^2
Thousand	1,000	10^3
Ten Thousand	10,000	10^4
Hundred Thousand	100,000	10^5
Million	1,000,000	10^6
Ten Million	10,000,000	10^7
Hundred Million	100,000,000	10^8

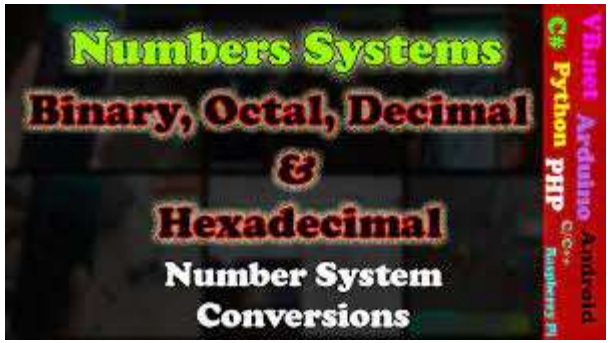
HEXADECIMAL NUMBER SYSTEM (BASE- 16)

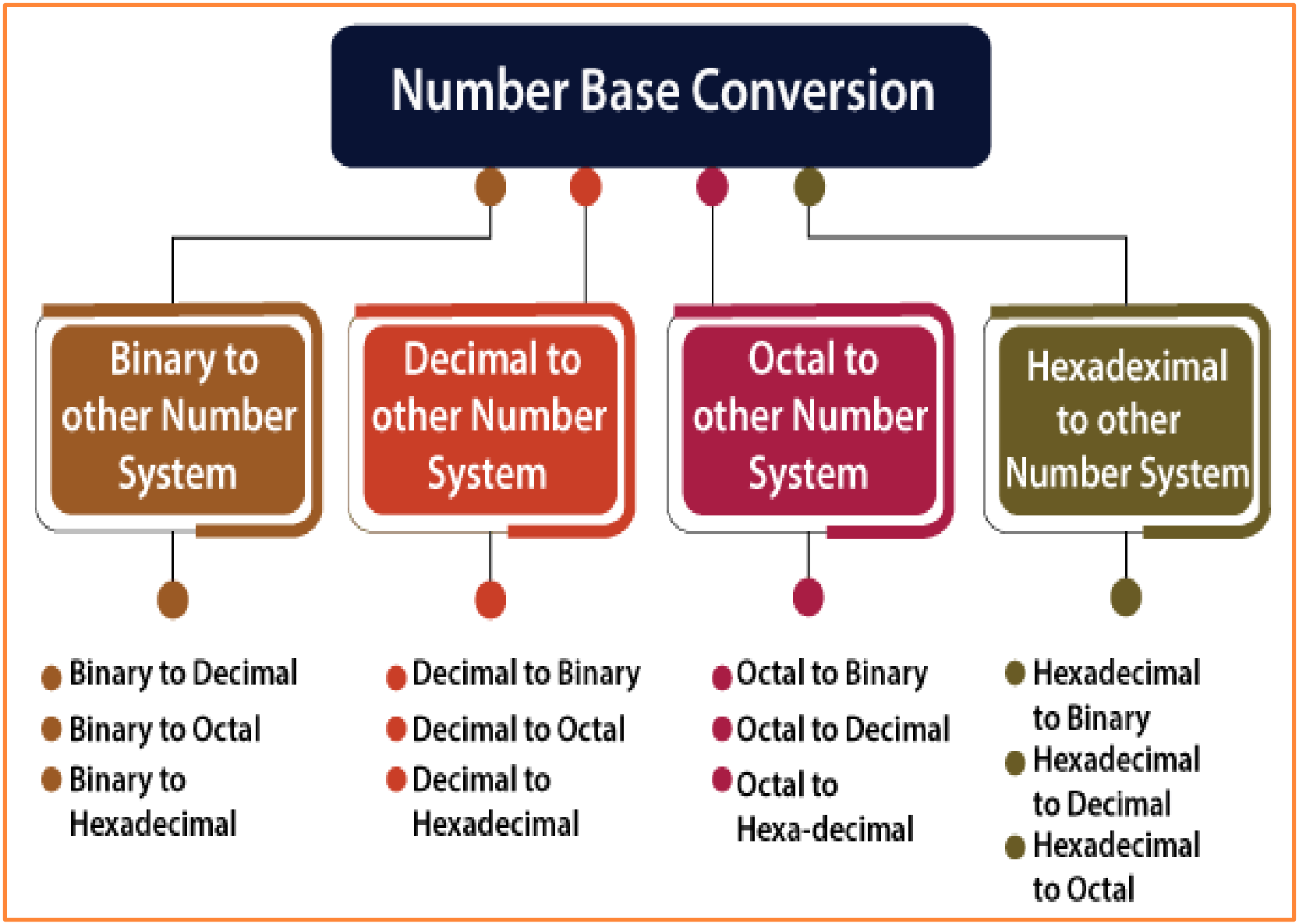
- The hexadecimal system contains 16 sequential numbers as base units, including 0.
- The first nine numbers (0 to 9) are the same ones commonly used in the decimal system.
- The next six two-digit numbers (10 to 15) are represented by the letters A through F.

- Ex.
  - 0 A
  - 1 B
  - 2 C
  - 3 D
  - 4 E
  - 5 F
  - 6
  - 7
  - 8
  - 9

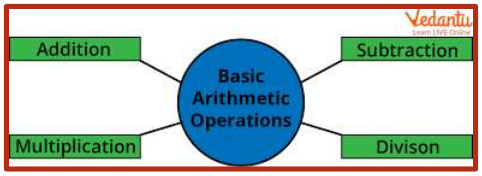
Number Systems		
System	Base	Digits
Binary	2	0 1
Octal	8	0 1 2 3 4 5 6 7
Decimal	10	0 1 2 3 4 5 6 7 8 9
Hexadecimal	16	0 1 2 3 4 5 6 7 8 9 A B C D E F

Numbering System
Conversion




Number Base Conversion
Binary to other Number System
Decimal to other Number System
Octal to other Number System
Hexadeximal to other Number System
Binary to Decimal
Binary to Octal
Binary to Hexadecimal
Decimal to Binary
Decimal to Octal
Decimal to Hexadecimal
Octal to Binary
Octal to Decimal
Octal to Hexa-decimal
Hexadecimal to Binary
Hexadecimal to Decimal
Hexadecimal to Octal

Binary Arithmetic Type



- **Binary Arithmetic Type**

1) Binary Addition
2) Binary Subtraction
    1) 1st Compliment method
    2) 2nd Compliment method
3) Binary Division
4) Binary Multiplication

Types of codes

What is a codes?

- Most computer do not represent character as pure binary numbers. They use a codes version of true binary to represent letters and special as well as decimal numbers.

- Four types in codes
  1. BCD
  2. ASCII
  3. EBCDIC
  4. Unicode

BCD CODES

- **BCD (Binary-Coded Decimal) code :**
- Four-bit code that represents one of the ten decimal digits from 0 to 9.
- Thus BCD code requires more bits than straight binary code.
- Still it is suitable for input and output operations in digital systems.
- Note: 1010, 1011, 1100, 1101, 1110, and 1111 are INVALID CODE in BCD code.

Decimal	0	1	2	3	4	5	6	7	8	9
BCD	0000	0001	0010	0011	0100	0101	0110	0111	1000	1001

ASCII

- **ASCII (American Standard Code Information Interchange) code :**
- It is 7-bit or 8-bit alphanumeric code.
- 7-bit code is standard ASCII supports 127 characters.
- 8-bit code is extended ASCII supports 256 symbols where special graphics and math's symbols are added.

ASCII Table

Dec	Hex	Oct	Char	Dec	Hex	Oct	Char	Dec	Hex	Oct	Char	Dec	Hex	Oct	Char
0	0	0		32	20	40	[space]	64	40	100	@	96	60	140	`
1	1	1		33	21	41	!	65	41	101	A	97	61	141	a
2	2	2		34	22	42	"	66	42	102	B	98	62	142	b
3	3	3		35	23	43	#	67	43	103	C	99	63	143	c
4	4	4		36	24	44	$	68	44	104	D	100	64	144	d
5	5	5		37	25	45	%	69	45	105	E	101	65	145	e
6	6	6		38	26	46	&	70	46	106	F	102	66	146	f
7	7	7		39	27	47	'	71	47	107	G	103	67	147	g
8	8	10		40	28	50	(	72	48	110	H	104	68	150	h
9	9	11		41	29	51	)	73	49	111	I	105	69	151	i
10	A	12		42	2A	52	*	74	4A	112	J	106	6A	152	j
11	B	13		43	2B	53	+	75	4B	113	K	107	6B	153	k
12	C	14		44	2C	54	,	76	4C	114	L	108	6C	154	l
13	D	15		45	2D	55	-	77	4D	115	M	109	6D	155	m
14	E	16		46	2E	56	.	78	4E	116	N	110	6E	156	n
15	F	17		47	2F	57	/	79	4F	117	O	111	6F	157	o
16	10	20		48	30	60	0	80	50	120	P	112	70	160	p
17	11	21		49	31	61	1	81	51	121	Q	113	71	161	q
18	12	22		50	32	62	2	82	52	122	R	114	72	162	r
19	13	23		51	33	63	3	83	53	123	S	115	73	163	s
20	14	24		52	34	64	4	84	54	124	T	116	74	164	t
21	15	25		53	35	65	5	85	55	125	U	117	75	165	u
22	16	26		54	36	66	6	86	56	126	V	118	76	166	v
23	17	27		55	37	67	7	87	57	127	W	119	77	167	w
24	18	30		56	38	70	8	88	58	130	X	120	78	170	x
25	19	31		57	39	71	9	89	59	131	Y	121	79	171	y
26	1A	32		58	3A	72	:	90	5A	132	Z	122	7A	172	z
27	1B	33		59	3B	73	;	91	5B	133	[	123	7B	173	{
28	1C	34		60	3C	74	<	92	5C	134	\	124	7C	174	|
29	1D	35		61	3D	75	=	93	5D	135	]	125	7D	175	}
30	1E	36		62	3E	76	>	94	5E	136	^	126	7E	176	~
31	1F	37		63	3F	77	?	95	5F	137	_	127	7F	177	

EBCDIC

- **EBCDIC (Extended Binary Coded Decimal Interchange Code) code**
- 8-bit alphanumeric code developed by IBM, supports 256 symbols.
- It was mainly used in IBM mainframe computers.

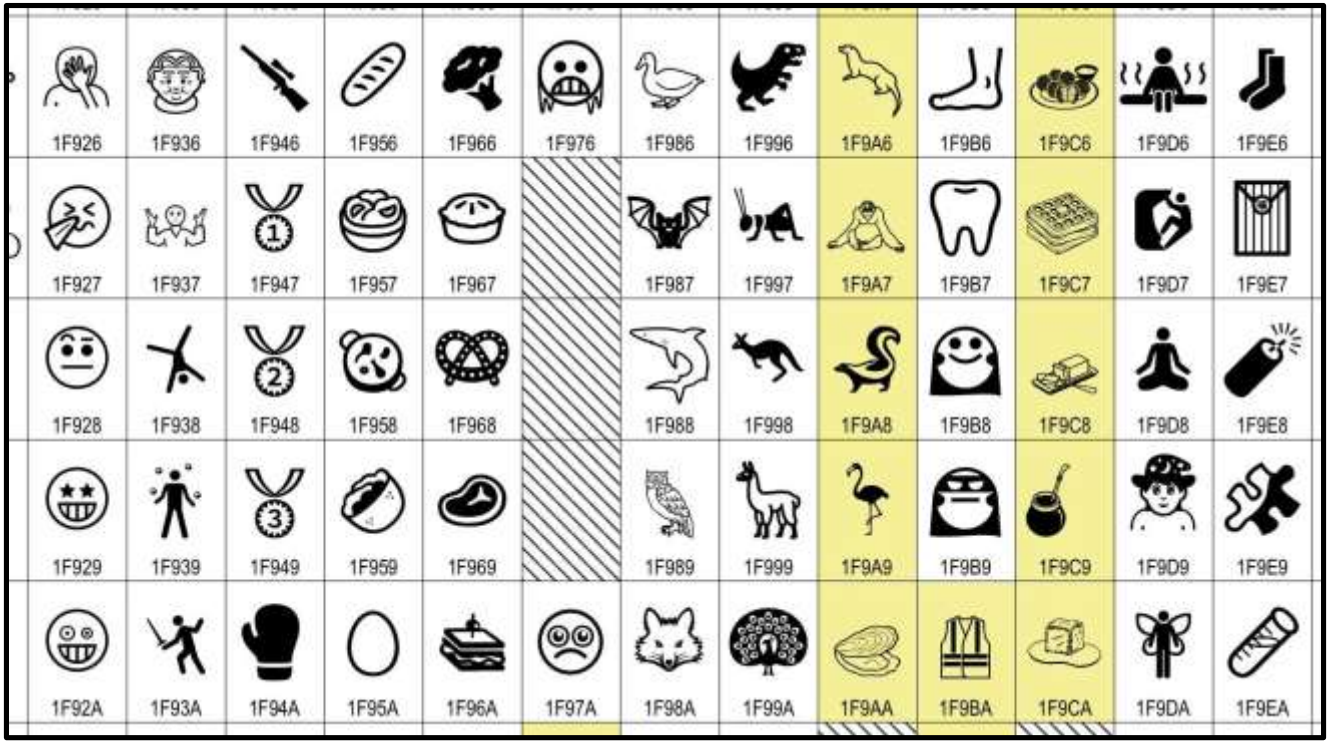
Special characters	EBCDIC
<	01001011
(	01001100
+	01001101
/	01001110
&	01010000
:	01111011
#	01111011
@	01111100
‘	01111101
=	01111110
“	01111111
,	01101011
%	01101100
-	01101101
>	01101110

Contd..

Alphabetic	EBCDIC
A	11000001
B	11000010
C	11000011
D	11000100
E	11000101
F	11000110
G	11000111
H	11001000
I	11001001
J	11010001
K	11010010
L	11010011
M	11010100
N	11010101
O	11010110
P	11010111

Unicode

- Unicode is a provides a unique number for every character.
- No matter what the platform
- No matter what the program
- No matter what the language

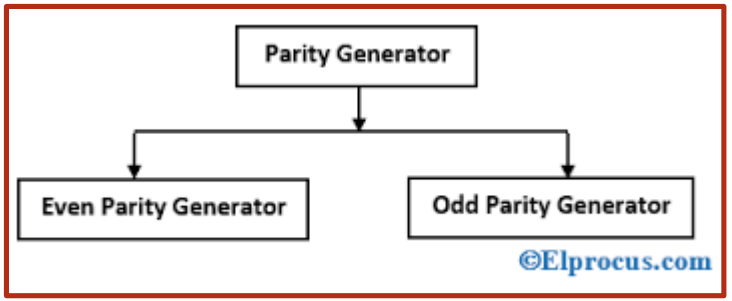


Parity Check

What is a parity bit ?

- A **parity bit**, also known as a **check bit**, is a single **bit** that can be appended to a binary string.
- It is set to either 1 or 0 to make the total number of 1-bits either even ("even **parity**") or odd ("odd **parity**"). ... **Parity checks** can help detect some of these errors.

- They are two types:
  - 1. Event Parity System
  - 2. Odd Parity System



Original Data	Even Parity	Odd Parity
0 0 0 0 0 0 0 0	0	1
0 1 0 1 1 0 1 1	1	0
0 1 0 1 0 1 0 1	0	1
1 1 1 1 1 1 1 1	0	1
1 0 0 0 0 0 0 0	1	0
0 1 0 0 1 0 0 1	1	0

The end
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