


Number System

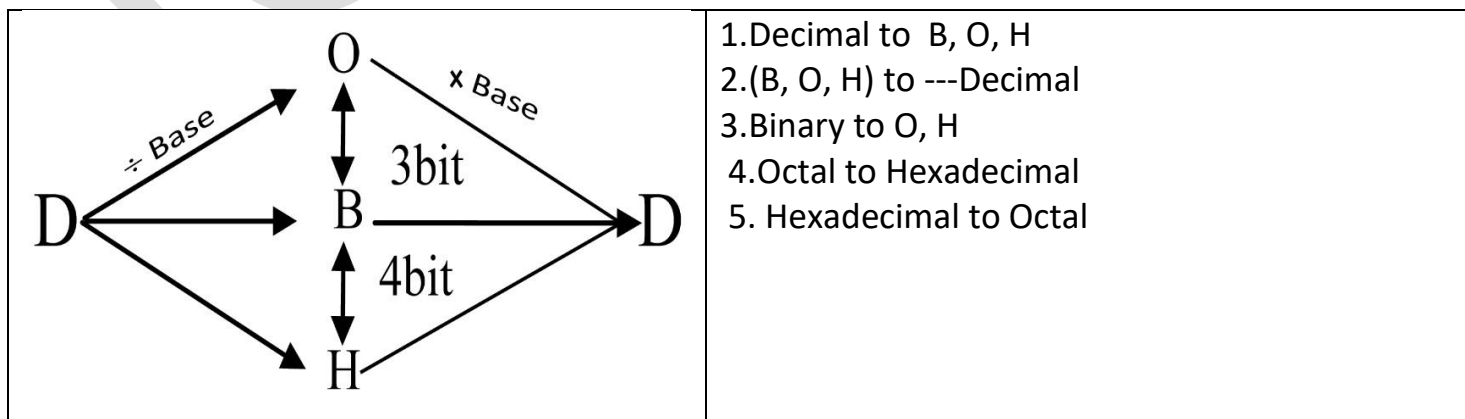
Two types of number system

Positional	Non-positional
391	

Positional Number System several types:-

Types	Base	Digit	Example												
Binary	2	0,1	$(1011)_2$												
Octal	8	0,1,2,3,4,5,6,7	$(675)_8$												
Decimal	10	0,1,2,3,4,5,6,7,8,9	$(9507)_{10}$												
Hexadecimal	16	0,1,2,3,4,5,6,7,8,9	$(19BF)_{16}$												
		<table><tr><td>10</td><td>11</td><td>12</td><td>13</td><td>14</td><td>15</td></tr><tr><td>A</td><td>B</td><td>C</td><td>D</td><td>E</td><td>F</td></tr></table>		10	11	12	13	14	15	A	B	C	D	E	F
		10		11	12	13	14	15							
A	B	C	D	E	F										

Number System Convert:



Decimal to Binary Convert:

$(9)_{10}$

Binary Base 2	9---Remained
Divided 2	4 1
2	2 0
	1 0
	0 1

$(99)_{10}$

2 99

2 49 ————— 1

2 24 ————— 1

2 12 ————— 0

2 6 ————— 0

2 3 ————— 0

2 1 ————— 1

.. 0 ————— 1

$\therefore (99)_{10} = (1100011)_2$

LSB- Least Significant Bit (সর্বনিম্ন গুরুত্বের অংক)

MSB- Most Significant Bit (সর্বোচ্চ গুরুত্বের অংক)

➤ কোন অংকের মান বেশি ? → 193

Decimal , Octal , Hexadecimal থেকে Binary তে রূপান্তরের নিয়ম:

	Bit Number
Decimal	...64 32 16 8 4 2 1
Octal	4 2 1
Hexadecimal	8 4 2 1



2's Complement (২ এর পরিপূরক)

- ❖ 2's Complement Binary Number system করতে হয়।
- ❖ Negative Number এর 2's Complement করতে হয়।
- ❖ Minimum 8 bit নিতে হয়।
- ❖ 1's Complement = 8bit Number এর 0<--থাকলে-->1 হয়।
- ❖ 2's Complement = 1's Complement + 1 (Binary Add)
- ❖ 8,16,32.... no. bit sign bit . --->
 - Sign bit 2 প্রকার।
 - 0 হলে Positive .
 - 1 হলে Negative.

➤ Negative হলে পুনরায় 2's Complement করতে হয়।

❖ 9,17,33.... no. bit carry bit (carry bit বাদ দিতে হয়।)

Encoder and Decoder

Encoder	Decoder
	
$2^n \text{ to } n$	$n \text{ to } 2^n$
4 to 2	2 to 4
8 to 3	3 to 8
16 to 4	4 to 16

Decoder:

Input		Output			
A	B	D_0	D_1	D_2	D_3
0	0	1			
0	1		1		
1	0			1	
1	1				1

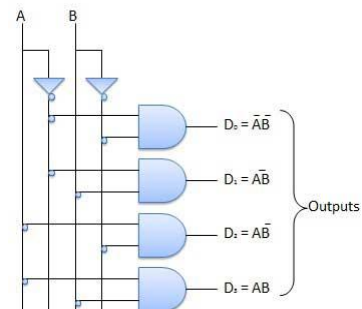
Equation from Output:

$$D_0 = \bar{A}\bar{B}$$

$$D_1 = \bar{A}B$$

$$D_2 =$$

$$D_3 =$$



Input			Output							
A	B	C	D_0	D_1	D_2	D_3	D_4	D_5	D_6	D_7
0	0	0	1							
0	0	1		1						
0	1	0			1					
0	1	1				1				
1	0	0					1			
1	0	1						1		
1	1	0							1	
1	1	1								1

Equation from Output:

$$D_0 = \bar{A}\bar{B}\bar{C}$$

$$D_1 =$$

$$D_2 =$$

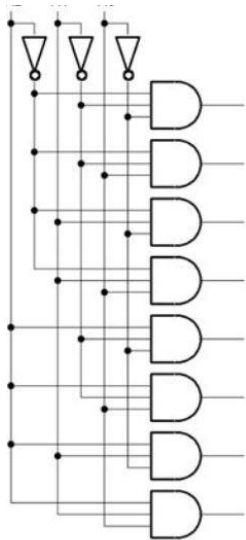
$$D_3 =$$

$$D_4 =$$

$$D_5 =$$

$$D_6 =$$

$$D_7 = ABC$$



Encoder:

Input				Output	
D_0	D_1	D_2	D_3	A	B
1	0	0	0	0	0
0	1	0	0	0	1
0	0	1		1	0
0	0	0	1	1	1

Equation from Output:

$$A = D_2 + D_3$$

$$B = D_1 + D_3$$

Input								Output		
E_0	E_1	E_2	E_3	E_4	E_5	E_6	E_7	A	B	C
1								0	0	0
	1							0	0	1
		1						0	1	0
			1					0	1	1
				1				1	0	0
					1			1	0	1
						1		1	1	0
							1	1	1	1

Equation from Output:

$$A = E_4 + E_5 + E_6 + E_7$$

$$B = E_2 + E_3 + E_6 + E_7$$

$$C = E_1 + E_3 + E_5 + E_7$$

Adder যে ইলেকট্রনিকস সার্কিট 2/3 ইনপুট গ্রহন করে 2টি আউটপুট sum এবং carry পাওয়া উৎপন্ন করে তাকে বলে।

Adder দুই প্রকার । Half Adder এবং Full Adder

Logic Gate

Logic Gate:

Logic gate দুই প্রকার।

1. মৌলিক gate..

মৌলিক gate তিন প্রকার।

- i. AND gate ii. OR gate iii. NOT gate
2. যৌগিক gate..

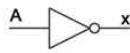

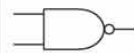


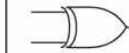
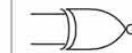
যৌগিক gate চার প্রকার।








- i. NAND gate ii. NOR gate iii. X-OR gate iv. X-NOR

3. Universal gate(সার্বজনীন) দুই প্রকার।








- i. NAND gate ii. NOR gate

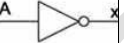






Logic Gates

Name	NOT	AND	NAND	OR	NOR	XOR	XNOR																																																																																																
Alg. Expr.	\overline{A}	AB	\overline{AB}	$A+B$	$\overline{A+B}$	$A\oplus B$	$\overline{A\oplus B}$																																																																																																
Symbol																																																																																																							
Truth Table	<table><tr><th>A</th><th>X</th></tr><tr><td>0</td><td>1</td></tr><tr><td>1</td><td>0</td></tr></table>	A	X	0	1	1	0	<table><tr><th>B</th><th>A</th><th>X</th></tr><tr><td>0</td><td>0</td><td>0</td></tr><tr><td>0</td><td>1</td><td>0</td></tr><tr><td>1</td><td>0</td><td>0</td></tr><tr><td>1</td><td>1</td><td>1</td></tr></table>	B	A	X	0	0	0	0	1	0	1	0	0	1	1	1	<table><tr><th>B</th><th>A</th><th>X</th></tr><tr><td>0</td><td>0</td><td>1</td></tr><tr><td>0</td><td>1</td><td>1</td></tr><tr><td>1</td><td>0</td><td>1</td></tr><tr><td>1</td><td>1</td><td>0</td></tr></table>	B	A	X	0	0	1	0	1	1	1	0	1	1	1	0	<table><tr><th>B</th><th>A</th><th>X</th></tr><tr><td>0</td><td>0</td><td>0</td></tr><tr><td>0</td><td>1</td><td>1</td></tr><tr><td>1</td><td>0</td><td>1</td></tr><tr><td>1</td><td>1</td><td>1</td></tr></table>	B	A	X	0	0	0	0	1	1	1	0	1	1	1	1	<table><tr><th>B</th><th>A</th><th>X</th></tr><tr><td>0</td><td>0</td><td>1</td></tr><tr><td>0</td><td>1</td><td>0</td></tr><tr><td>1</td><td>0</td><td>0</td></tr><tr><td>1</td><td>1</td><td>0</td></tr></table>	B	A	X	0	0	1	0	1	0	1	0	0	1	1	0	<table><tr><th>B</th><th>A</th><th>X</th></tr><tr><td>0</td><td>0</td><td>0</td></tr><tr><td>0</td><td>1</td><td>1</td></tr><tr><td>1</td><td>0</td><td>1</td></tr><tr><td>1</td><td>1</td><td>0</td></tr></table>	B	A	X	0	0	0	0	1	1	1	0	1	1	1	0	<table><tr><th>B</th><th>A</th><th>X</th></tr><tr><td>0</td><td>0</td><td>1</td></tr><tr><td>0</td><td>1</td><td>0</td></tr><tr><td>1</td><td>0</td><td>0</td></tr><tr><td>1</td><td>1</td><td>1</td></tr></table>	B	A	X	0	0	1	0	1	0	1	0	0	1	1	1
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		NOT	AND	NAND	OR	NOR	XOR	XNOR
2	1							
A	B		AB		A+B			
0	0							
0	1							
1	0							
1	1							

Logic gate Operation

Input		Output		
একটি মাত্র 0 1		1 0	A	\bar{A}
যেকোন একটি 0		0	AB	ABC
যেকোন একটি 0		1	\overline{AB}	\overline{ABC}
যেকোন একটি 1		1	A+B	A+B+C
যেকোন একটি 1		0	$\overline{A+B}$	$\overline{A+B+C}$
বিজোড় সংখ্যক 1		1	$A \oplus B$	$A \oplus B \oplus C$
বিজোড় সংখ্যক 1		0	$\overline{A \oplus B}$	$\overline{A \oplus B \oplus C}$

			NOT	AND	NAND	OR	NOR	XOR	XNOR
4	2	1							
A	B	C							
0	0	0							
0	0	1							
0	1	0							
0	1	1							
1	0	0							
1	0	1							
1	1	0							
1	1	1							

Boolean Theorems:

বুলিয়ান স্বত্বঃসিদ্ধ (Boolean Postulates) -

A	B	Logical OR Operation	Logical AND Operation
0	0	0	0
0	1	1	0
1	0	1	0
1	1	1	1

Logical OR Operation		Logical AND Operation
$A + A = A$	$AB + AB + AB = AB$ $\overline{ABC} + \overline{ABC} = \overline{ABC}$	$A.A =$
$0 + 0 =$ $1 + 1 =$		$0.0 =$ $1.1 =$
$A + \bar{A} = 1$ $0 + 1 = 1$ $1 + 0 = 1$		$A.\bar{A} = 0$
$0 + 0 =$ $1 + 1 =$		$0.1 = 0$ $1.0 = 0$
$A + 1 = 1$		$A.1 =$
$0 + 1 = 1$ $1 + 1 = 1$		$0.1 = 0$ $1.1 = 1$
$A + 0 = A$		$A.0 = 0$
$0 + 0 = 0$ $1 + 1 = 1$		$0.0 =$ $1.1 =$
$A + \bar{A}B = A + B$		$\bar{C}B + C = B + C$

Morgan's Law

$$\overline{AB} = \bar{A} + \bar{B}$$

$$\overline{A + B} = \bar{A}.\bar{B}$$

Truth Table

A	B	\bar{A}	\bar{B}	A+B	$\overline{A+B}$	$\bar{A} \cdot \bar{B}$
0	0	1	1	0	1	1
0	1	1	0	1	0	0
1	0	0	1	1	0	0
1	1	0	0	1	0	0