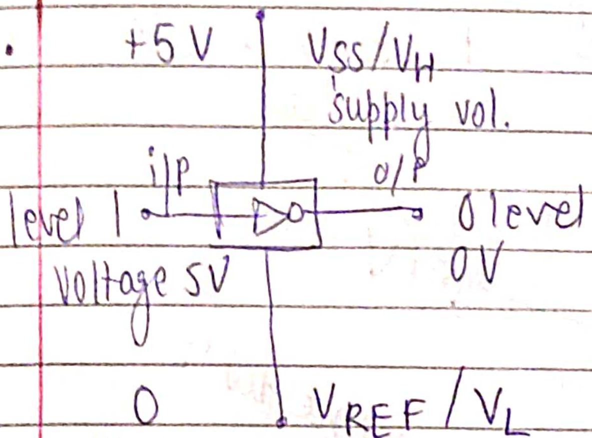
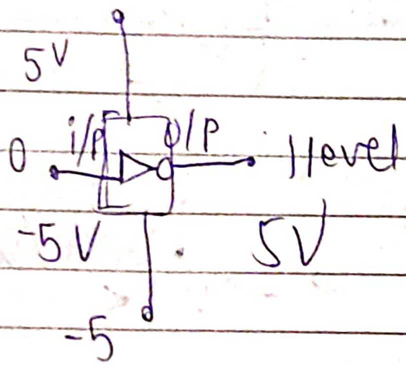
14/2/23

- 0 is low voltage & 1 is high voltage
  with reference to 1   with reference to 0.

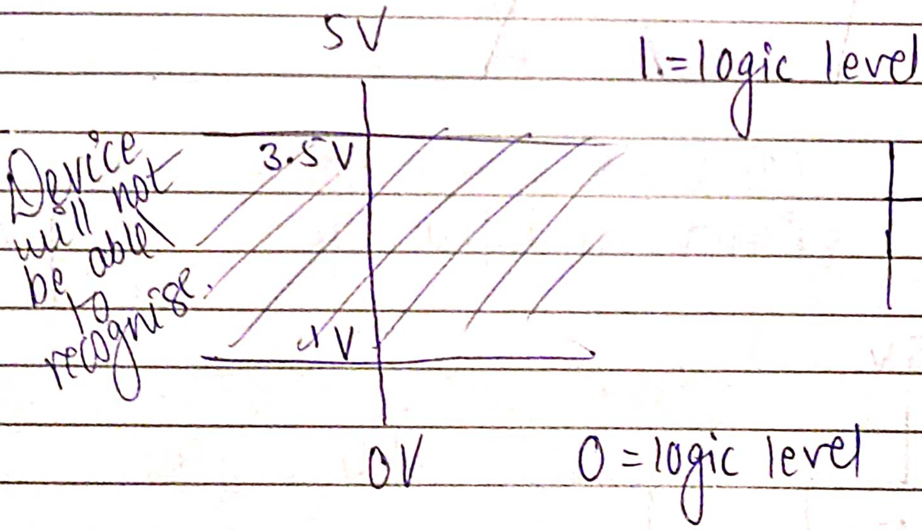
- 

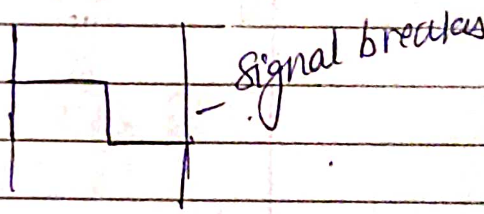


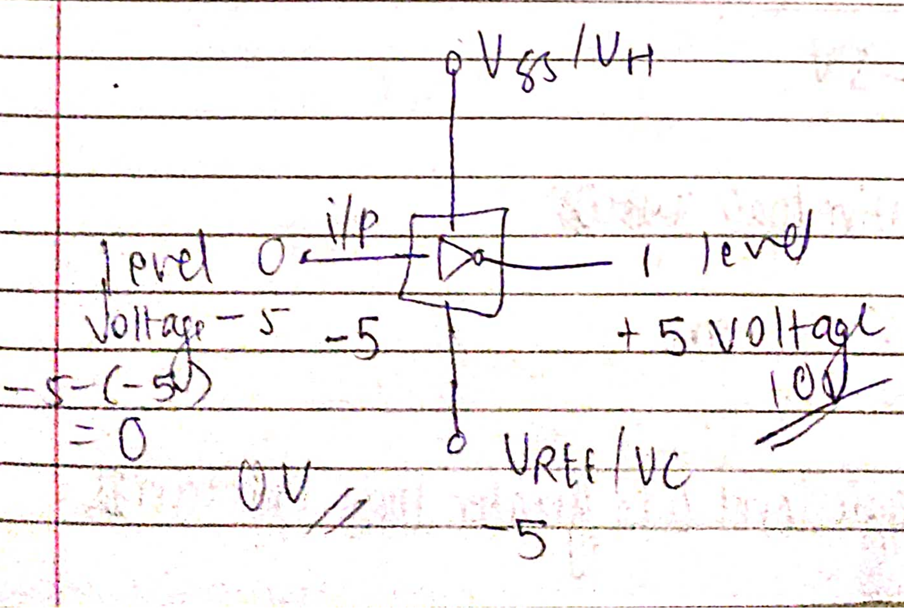
We are taking ~~wst~~ with ref to V_{ref} i.e. we get 5V if it is with ref. to level 0 then 10V.

if -5 if +5   P.D = 5-5 = 0V

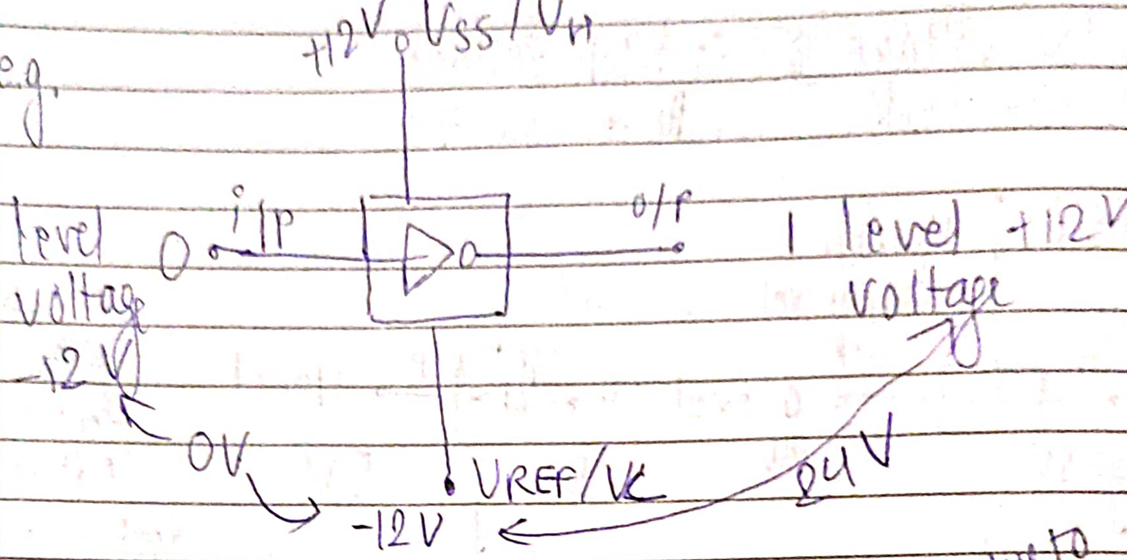
P.D = 5-(-5) = 10V

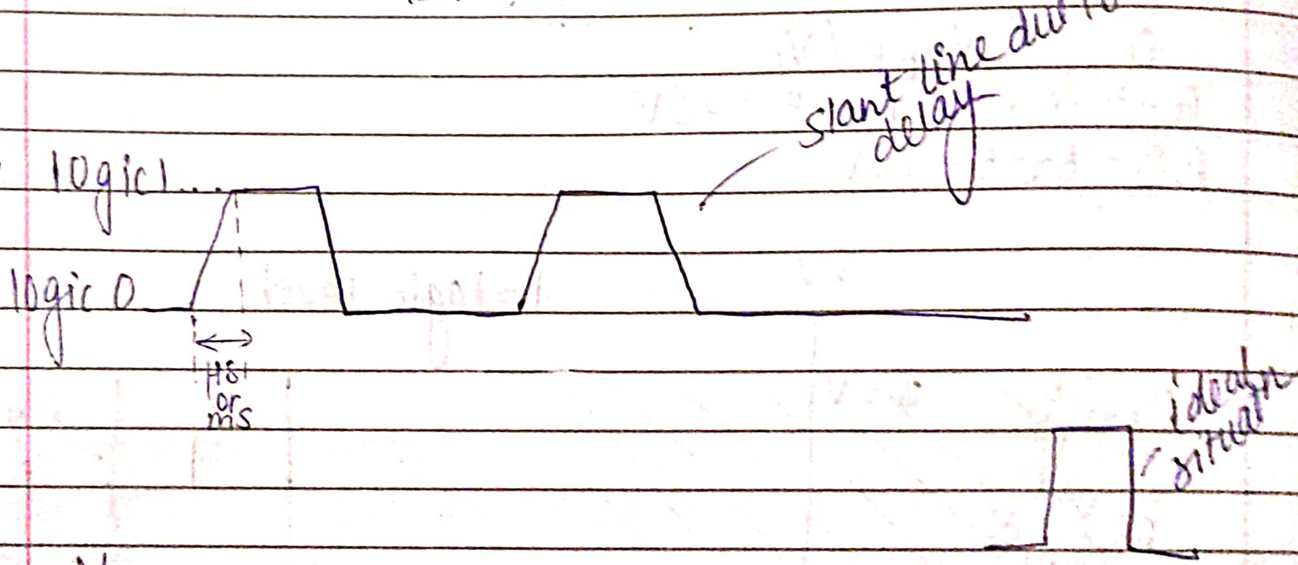




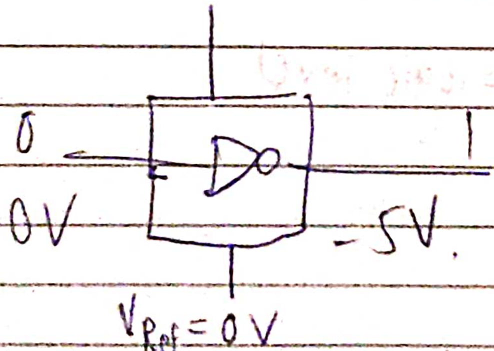
- 

• e.g.



• 

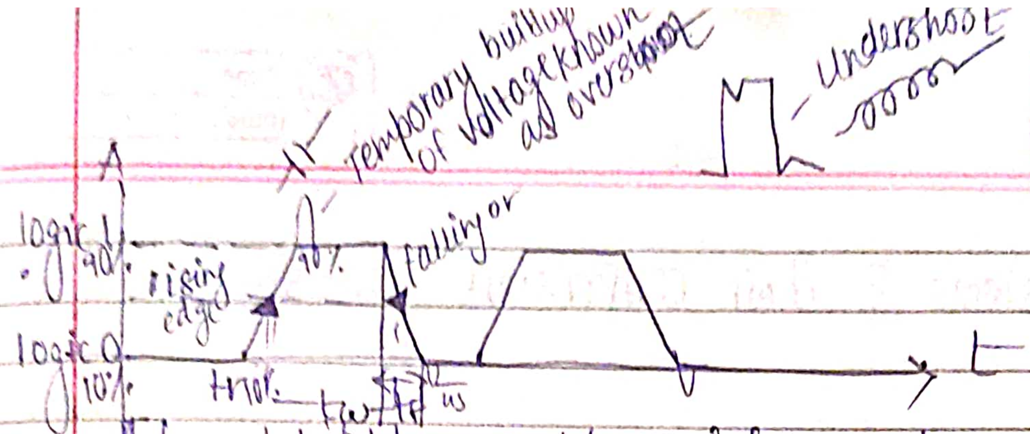
• $V_{SS} = -5V$



Known as negative logic system.

• For negative logic system
$V_{SS} < V_{Ref}$

• Potential of logic level 0 is greater than logic level 1.



rise & fall is pulse
~~anything which repeats~~ is signal.

- Edge which resembles rising of logic level 0 to 1 is known as rising edge or starting edge.
- Edge which resembles falling of ~~edges~~ logic level 1 to 0 is known as falling or trailing edge.
- Time taken to rise logic level from 10% to 90% amplitude is known as rise time (tr)
- Time taken to fall logic level from 90% to 10% amplitude is known as fall time (tf).
- Pulse width – Time wherein signal is 1
  50% amplitude during rising & falling
- Logic level 1 for 1s & logic level 0 for 4s.

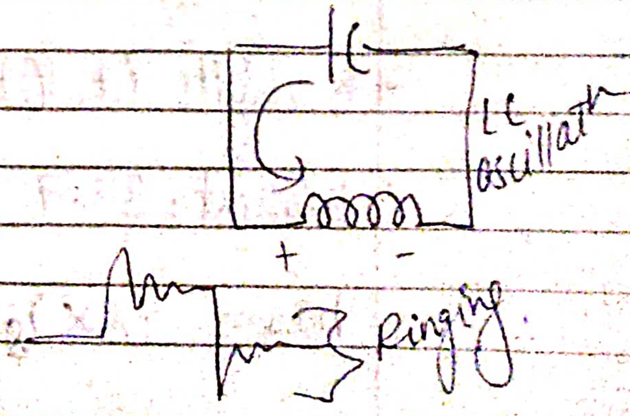
  duty cycle $= \frac{T_{ON}}{T}$

  $T_{ON} + T_{OFF}$ $= \frac{1}{5} \times 100\%$

  $= 20\%$

- Green-1, Red-0

- Increase duty cycle $T_{OFF} \uparrow$
  Decrease " " $T_{ON} \downarrow$



16/2/23

- Number Systems & their conversion

- Binary
  - 0 & 1
  - base = 2
    $(xx)_2$
  - Highest digit would be base-1.
  - Known as machine language or low-level language.

- Decimal
  - 10 digits i.e. 0 to 9
  - highest = 10-1 = 9
  - base = 10
    $(xx)_{10}$.

- Octal
  - 8 digits i.e. 0 to 7
  - highest = 8-1 = 7
  - base = 8 $(xx)_8$

0	000
1	001
2	010
3	011
4	100
5	101
6	110
7	111

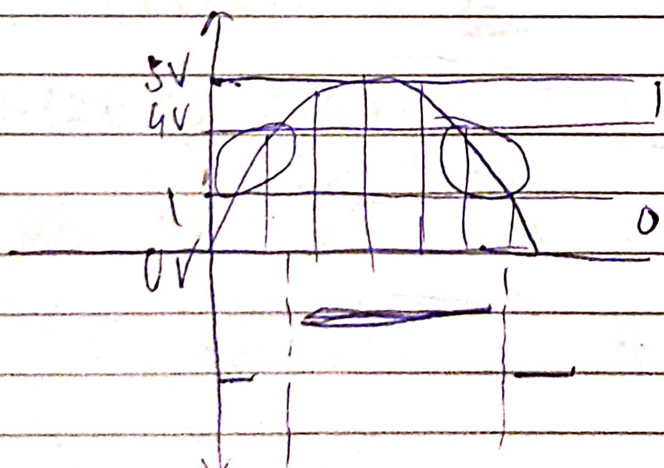
- Hexadecimal

- 16 digits
  0 to 9 & A to F
- base = 16
- highest = F
- $(XX)_{16}$.

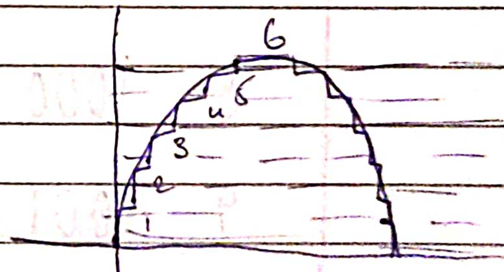
- Purpose

- Reducing error or short & simple commands

-



Limitation of binary System.



Continuity is more

Signal is properly converted

- For hexadecimal

0	0000	A	1010
1	0001	B	1011
2	0010	C	1100
3	0011	D	1101
4	0100	E	1110
5	0101	F	1111
6	0110		
7	0111		
8	1000		
9	1001		

- Conversion

• (Decimal to Binary)

• e.g. $(567.625)_{10}$

2	567	
2	283	1
2	141	1
2	70	1
2	35	0
2	17	1
2	8	1
2	4	0
2	2	0
2	1	0
	0	1

Bottom to top.

$(1000110111)_2$.

$0.625 \times 2 = 1.250$ 1

$0.25 \times 2 = 0.5$ 0

$0.5 \times 2 = 1.0$ 1

Top to bottom

0

$\therefore \boxed{(1000110111.101)_2}$.

2. $(286.33)_{10}$

2	286	
2	143	1
2	71	1
2	35	0
2	17	1
2	8	0
2	4	0
2	2	0
2	1	0
	0	1

$0.33 \times 2 = 0.66 - 0$

$0.66 \times 2 = 1.32 \quad 1$

$0.32 \times 2 = 0.64 \quad 0$

$0.64 \times 2 = 1.28 \quad 1$

$(100001011.0101)_2$

20/2/23

- Decimal to Octal

$(589.75)_{10} \rightarrow (1115.6)_8$

$\Rightarrow$

8	589	
8	73	5
8	9	1
8	1	1
	0	1

$0.75 \times 8 = 6$ 6

0.

$\Rightarrow$

16	589	
16	36	13
16	2	4
	0	2

$0.75 \times 16 = 12.00$ C.

$(24D.C)_{16}$

$\Rightarrow$ $(110101.11101)_2$

Decimal

110101 . 11101

2^5 2^4 2^3 2^2 2^1 2^0 . 2^{-1} 2^{-2} 2^{-3} 2^{-4} 2^{-5}

$= (1\times2^5)+(1\times2^4)+(0\times2^3)+(1\times2^2)+(0\times2)+(1\times2^0)+1\times2^{-1}$
$+1\times2^{-2}+1\times2^{-3}+0\times2^{-4}+1\times2^{-5}$

$= 53.90625$

0.5
0.25
0.125
0.031

- Octal

Divide digits on LHS & RHS into group of 3.

$\underbrace{110}\,\underbrace{101}.\underbrace{111}\,\underbrace{010}$

$(65.72)_8$

- Hexa

Divide digits on LHS & RHS into group of 4

$\underbrace{0011}\,\underbrace{0101}.\underbrace{1110}\,\underbrace{1000}$

35.E8

$\Longrightarrow (111010111.1110101)_2$

Decimal

111010111.1110101

$2^8\ 2^7\ 2^6\ 2^5\ 2^4\ 2^3\ 2^2\ 2^1\ 2^0.\ 2^{-1}\ 2^{-2}\ 2^{-3}\ 2^{-4}\ 2^{-5}\ 2^{-6}\ 2^{-7}$

$= (1\times2^8)+(1\times2^7)+(1\times2^6)+(1\times2^5)+(1\times2^4)+(1\times2^3)+(1\times2^2)$
$+(1\times2^1)+(1\times2^0)+(1\times2^{-1})+(1\times2^{-2})+(1\times2^{-3})+(1\times2^{-4})$
$+(1\times2^{-5})+(1\times2^{-6})+(1\times2^{-7})$

0.5
0.25
0.125
0.03125
0.015625
0.0078125
0.390

= 51~~2~~3

Octal

$\underbrace{111}\,\underbrace{010}\,\underbrace{111}\,.\,\underbrace{111}\,\underbrace{010}\,\underbrace{100}$

$(727.724)_8$

Hexa

$\underbrace{0001}\,\underbrace{1101}\,\underbrace{0111}\,.\,\underbrace{1110}\,\underbrace{1010}\,0$

$(1D7.EA)_{16}$.

21/2/23

- Conversion of Octal to Rest three

421
$2^2\ 2^1\ 2^0$

octal (0-7) ~~(895.023)~~$_8$ $(765.23)_8$

8421
$2^3\ 2^2\ 2^1\ 2^0$

Decimal ⇒ 7 6 5 . 2 3

$8^2\ 8^1\ 8^0\ 8^{-1}\ 8^{-2}$

$7\times8^2+6\times8^1+5\times8^0+2\times\frac{1}{8}+3\times\frac{1}{64}$

~~4ΘΘ~~ $501+0.2968$

0.25
0.046

$=(501.2968)_{10}$

Binary – 7 6 5 . 2 3

111 110 101 010 011

$(111110101.010011)_2$

Hexadecimal – 765.23
Octal – Hexa
Hexa – Octal

Convert Octal to Decimal to Hexa
Octal to Binary to Hexa

$$\begin{array}{ccccc} 7 & 6 & 5 & . & 2 \quad 3 \end{array}$$

$$\underbrace{000}\underbrace{111}\underbrace{0101}.\underbrace{0100}\underbrace{1100}$$

$(1F5.4C)_{16}$

Start from decimal point always on left & right.

4. $(2567.732)_8$

Decimal → 2 5 6 7 . 7 3 2

$8^3 \; 8^2 \; 8^1 \; 8^0 \quad 8^{-1} \; 8^{-2} \; 8^{-3}$

$2\times8^3+5\times8^2+6\times8^1+7\times8^0+7\times\frac{1}{8}+3\times\frac{1}{64}+2\times\frac{1}{512}$

$1024+320+48+7+0.875+0.046+$

$(1399.925)_{10}$

Binary - 2 5 6 7 . 7 3 2

$(010 \;\; 101 \;\; 110 \;\; 111 \; . \; 111 \;\; 011 \;\; 010)_2$

Hexadecimal - 2 5 6 7 . 7 3 2

$$\underbrace{0101}\underbrace{0111}\underbrace{0111}.\underbrace{1110}\underbrace{1101}\underbrace{0000}$$

577.ED

21

- Hexadecimal to rest three

$(1FE.C8)_{16}$

Decimal - 1 F E . C 8

16^2 16^1 16^0 16^{-1} 16^{-2}

$1\times16^2+15\times16^1+14\times16^0+12\times16^{-1}+8\times16^{-2}$

$510+0.78125$

$(510.78125)_{10}$

Binary → 1 F E . C 8

$(0001\ 1111\ 1110.1100\ 1000)_2$

Octal → 1 F E . C 8

$\underbrace{000}\underbrace{111}\underbrace{111}\underbrace{110}.\underbrace{110}\underbrace{010}\underbrace{000}$

$(776.620)_8$

Q. $(3FEB7.CD)_{16}$

3 F E B 7 . C D

16^4 16^3 16^2 16^1 16^0 16^{-1} 16^{-2}

$3\times16^4 + 15\times16^3 + 14\times16^2 + 11\times16^1 + 7\times16^0 + 12\times16^{-1} + 13\times16^{-2}$

$= \cancel{65536 + 61440 + 3584 + 176 + 7}$

$= \cancel{130743}$

$= 196608 + 61440 + 3584 + 176 + 7$

$= (261815.8008)_{10}$

Binary 3 F E B 7 . C D

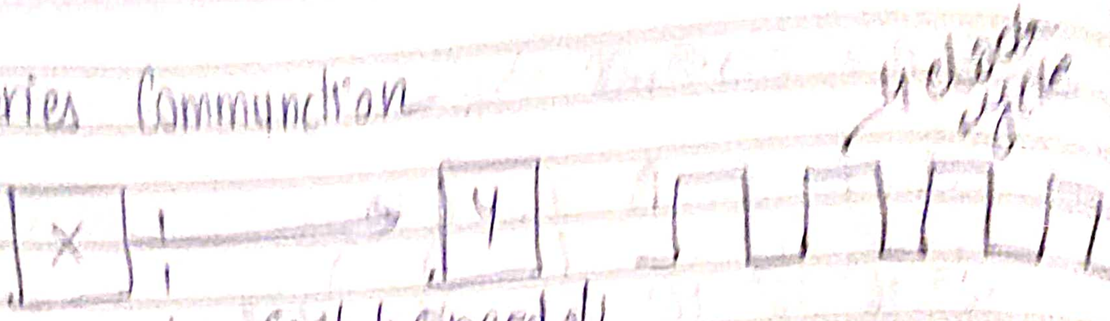
$(0011\ 1111\ 1110\ 1011\ 0111 . 1100\ 1101)_2$

Octal → 3 F E B 7 . C D

$\underbrace{0\ 011\ 111\ 111\ 110\ 1011\ 0111 . 110\ 011\ 010}$

$(7\ 7\ 7\ 2\ 6\ 7 . 632)_8$

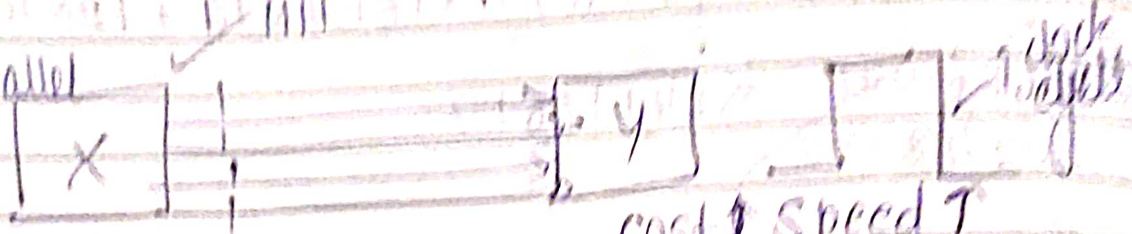
- Series Communcion



Cost ↓ speed ↓

1111

- Parallel



cost ↑ Speed ↑

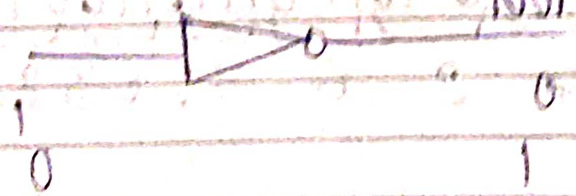
MSB 1111 - LSB

- Least significant bit

  Most significant bit

- One wire so cost saved.

- Non-memory device



- 

inspite of no i/p we get some o/p i.e. either 1 or 0

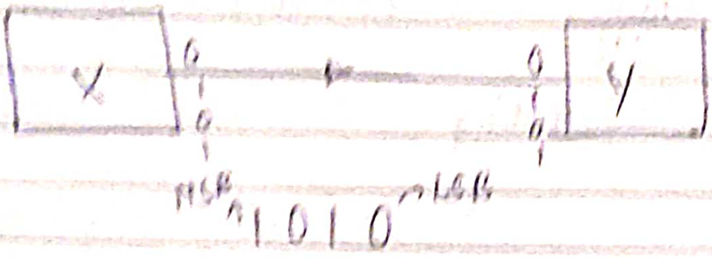
Memory device

eg. lach,
flip flops

23/2/23

1 nibble data to be transfered
4 bits

Series:

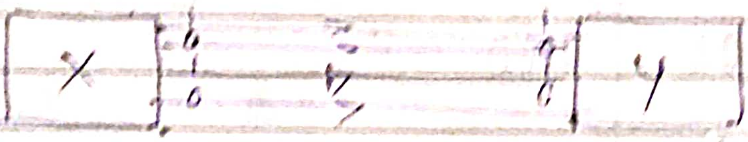


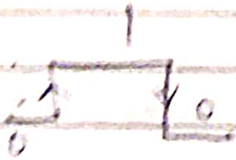
- 4 clock cycles.

clock high device conducts.

4 X T - time required.

Parallel:





1 X T - time required.

- 1 byte requires 8T in series & 2 T in parallel
- Parallel is faster than series.
- If length ↑ much speed is not req. than serial communication is preffered as cost is also less.
- Cost, Time, Speed are characteristics on which communication depending upon application or use.

- Codes

- data → code → code → data

Encoded 1010 # # 1010 Decoding

- BCD
Binary Coded Decimals

		+3 0011 Excess 3
0	0000	0011
1	0001	0100
2	0010	0101
3	0011	0110
4	0100	0111
5	0101	1000
6	0110	1001
7	0111	1010
8	1000	1011
9	1001	1100

16 8 4 2 1 e.g.

421 • $9_{BCD} \rightarrow (\ )_2 = 1001$

• e.g. $(12)_{BCD} \rightarrow (0001\,0010)_2$

$(12)_{10} \rightarrow (1100)_2$

• e.g. $(15)_{10} \rightarrow (1111)_2$

$(15)_{BCD} \rightarrow (00010101)_2$

• BCD also known as 8421 codes.

• BCD also known as weighted codes.

as 8 4 2 1

$\underbrace{\text{MSB} \qquad \text{LSB}}_{\text{have weight}}$.

• e.g. $9_{XS-3} \rightarrow (1100)_2$

$5_{XS-3} \rightarrow (1000)_2$

• Self-complimented codes were made for excess-3 codes.

• Zone BCD

Zone	BCD
00	0000
01	1001
10	
11	

30

B_5	B_4	B_3			B_0
0	0	0	0	0	0
0	0	1	0	0	1
0	1	0	0	0	0
0	1	1	0	0	1

00 1001

01 1001