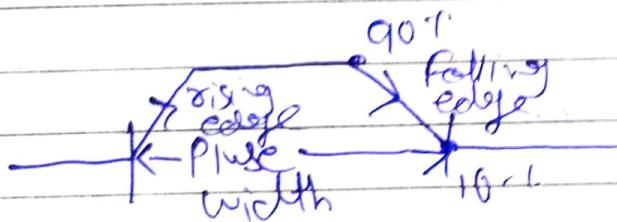
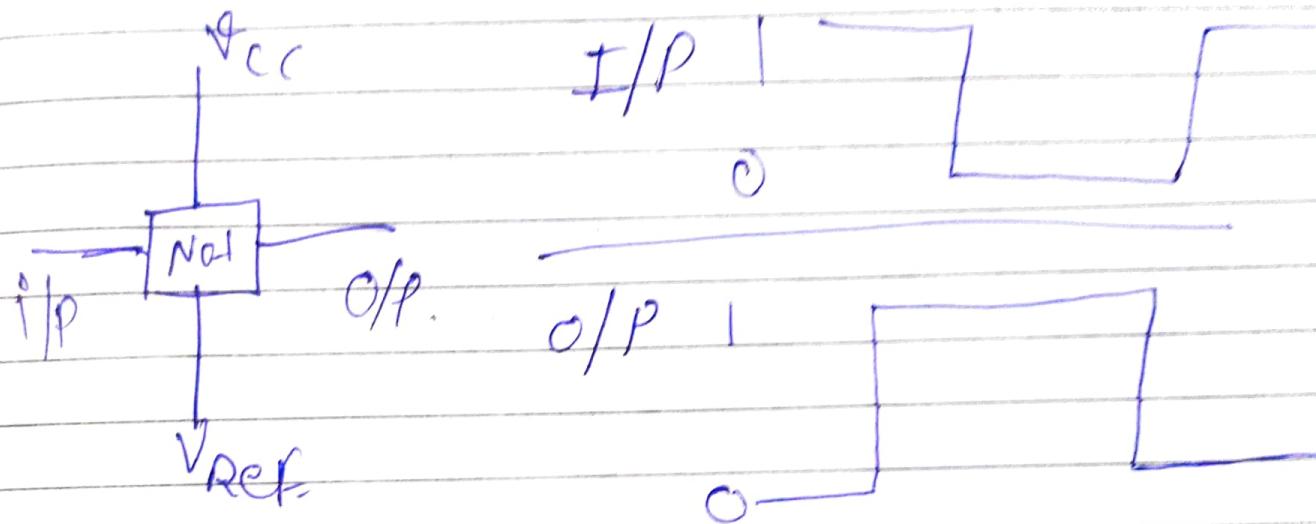
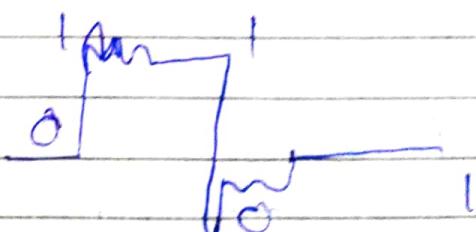
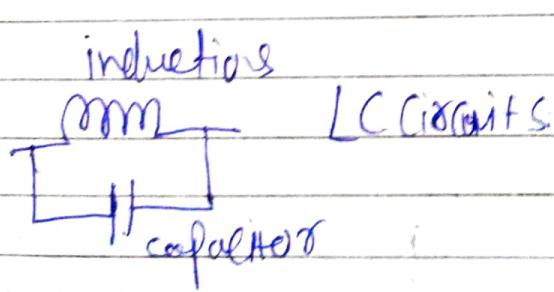
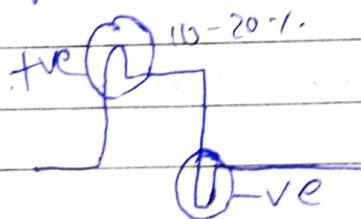


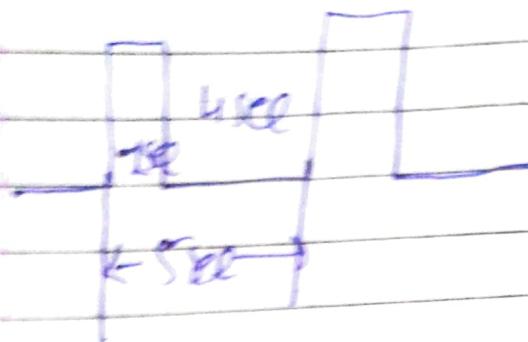
(C) Page 9/2/2023

- 0 & 1 characteristics
- Characteristics of Digital Signal
- Number Systems
- Characteristics



Capacitor → Edge stores the charge.





$$\text{duty cycle} = \frac{T_{on}}{T} \times 100\%$$

$$= \frac{1}{5} \times 100\% \\ = 20\%$$

Binary = 0 to 1

Octal = 0 to 7

Hexa = 0 to 9 A to F

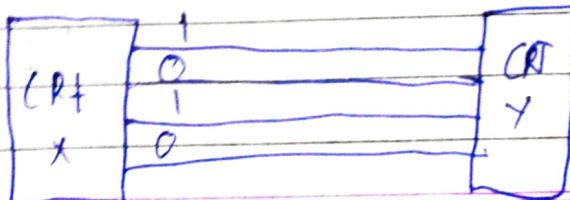
Nibble = Four bytes

10/02/2023

Friday

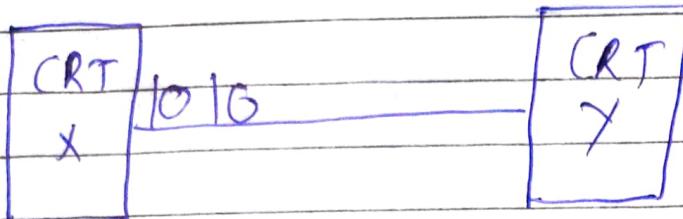
- Devices with/wo memory (RAM, ROM - Ch 4)
- Series & parallel communication
- Number systems
- Conversion

① Series & Parallel Communication

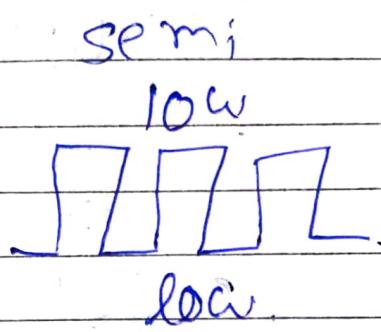
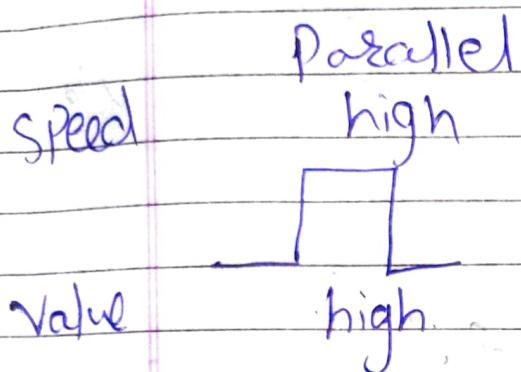


Parallel
communication

② Speed fast



Semi
communication



④ Decimal

→ 10 digits = base₁₀
 $(x \cdot x \cdot x \cdot x)_{10}$

→ highest = base - 1

→ 0 to 9

1 2 3 4 5 6 7 8 9

⑤ Binary

→ base = 2 $(xx \cdot xx)_2$

0 & 1

$(1010.0010)_2$ ✓

$(1010.1101)_2$ ✓

⑥ Octal

base = 8

Digit = 0 to 7.

$(717)_8$

Hex.

$$\text{base} = 16$$

Otg

A to F

$$(12425)_{10} \rightarrow (\quad)_2 \quad (\quad)_8 \quad (\quad)_{16}$$

	Q	R
2	124	
2	62	0 ↑ TOP
2	31	0
2	15	1
2	7	1
2	3	1
2	1	1
	0	1 ↓ bottom

$$\begin{aligned}
 0.25 \times 2 &= 0.5 \rightarrow 0 \\
 0.5 \times 2 &= 1.0 \rightarrow 1 \\
 0 \times 2 &= 0
 \end{aligned}$$

(1111100.010)

$(34,625)_{10}$

2	34	
2	17	0
2	8	1
2	4	0
2	2	0
2	1	0
	0	1

$$\begin{aligned}
 0.625 \times 2 &= 1.250 & 1 \\
 0.250 \times 2 &= 0.500 & 0 \\
 0.5 \times 2 &= 1 & 1
 \end{aligned}$$

(100010.101)

15th Feb. 2023

① Decimal to Octal

$$(256.25)_{10} \rightarrow (400.20)_8$$

-8	256		
8	32	0	(400.20) ₈
8	4	0	
8	0	4	

$$\begin{array}{r} 25 \times 8 = 200 \quad 2 \\ 0 \times 8 = 0 \quad 0 \end{array}$$

② Decimal to Hexa.

$$(256.25)_{10}$$

$$25 \times 16 = 4$$

16	256		(100)
16	16	0	
16	1	0	(100.4) ₁₆
0		1	

③ Decimal to Octal

$$(5893.6)_{10} \rightarrow$$

8	5893	
8	736	5
8	92	0
8	11	4
8	1	3
0		1

$$\begin{array}{l} 2.6 \times 8 = 4.8 \quad 4 \\ 0.8 \times 8 = 6.4 \quad 6 \\ 0.4 \times 8 = 3.2 \quad 3 \\ 0.2 \times 8 = 1.6 \quad 1 \end{array}$$

$$(13405.6631)_8$$

16	5893	
	5888	
16	368	5
16	25	0
16	1	7
	0	1

$$0.6 \times 16 = 9.6$$

$$0.6 \times 16 = 9.6$$

$$0.6 \times 14 = 9.6$$

(17059999)₁₆

④ Binary to Decimal

(1010.00101)₂

$$= 1 \times 2^3 + 1 \times 2^2 + 1 \times 2^1 + 1 \times 2^0 + 0 \times 2^{-1} + 0 \times 2^{-2} + 1 \times 2^{-3} + 0 \times 2^{-4} + 1 \times 2^{-5}$$

$$= 8 + 2 + \frac{1}{8} + \frac{1}{32}$$

$$= 10 + 0.125 + 0.03125$$

$$= 10.15625$$

⑤ For Octal

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

Put into three of pair

001, 010, 100 | 010, 101

1 2 1 2

Q) For hexa

0	0000
1	0001
2	0010
3	0011
4	0100
5	0101
6	0110
7	0111

8	8	1000
A	9	1001
B	A	1010
C	B	1011
D	C	1100
E	D	1101
F	E	1110
	F	1111

(1010.00101)₂

Put into four of pair

1010. 0010 [1000]
A(A · 28)₁₆

(11100101.101011101)₂

$$2^7 + 2^6 + 2^5 + 0 + 0 + 2^2 + 0 + 1 + \frac{1}{8} + \frac{1}{32} + \frac{1}{64} + \frac{1}{128} + \frac{1}{256} + \frac{1}{512}$$

(345.~~58~~ 5364)₈

(E5.AF4)₁₆

11100101.10101110100

E S. A F 6

* Octal to decimal

$(243.26)_8 \rightarrow$

$$2 \ 4 \ 3. \ 2 \ 6$$

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

$$2 \times 8^2 + 4 \times 8^1 + 3 \times 8^0 + 2 \times \frac{1}{8} + 8 \times \frac{1}{64}$$

$$128 + 32 + \frac{0.25}{64} + 0.09375$$

$(60.34375)_{10}$

(243.26)

$(010 \ 100 \ 011. \ 010 \ 110)_2$

$(243.26)_8 \rightarrow ()_{16}$

1010 10011. 0101 1000

A3.58

40

$$(737.765)_8 \rightarrow (479.9785)_{10}$$

$$(11101111.11110111)_2$$

$$(1DFFA8)_{16}$$

$$(737.765)_{16} \rightarrow ()_{10}$$

$$7 \times 16^8 + 3 \times 16^1 + 7 \times 16^0 + 7 \times 16^{-1} + 6 \times 16^{-2} + 5 \times 16^{-3}$$

$$7 \times 256 + 48 + 7 + \frac{7}{16} + \frac{6}{256} + \frac{5}{4096}$$

$$17926352 + 48 + 7 + 0.4375 + 0.0234 + 0.00012$$

$$= 1847.4621$$

$$(737.765)_{16} \rightarrow ()_2$$

$$(0111, 0011, 0111, 0111, 0110, 0101)_2$$

$$\xrightarrow{\quad} ()_8$$

$$(011, 100, 110, 111, 011, 101, 100, 101)_8$$

$$(3467.3545)_8$$

$(3A0F.BDE7)_{16} \rightarrow ($

Binary	Decimal	Octal	Hexa decimal
$\boxed{1111}$	$\boxed{1111}$	$\boxed{777}$	\boxed{FFF}
2^3	16^3	8^3	16^3
8	1000	512	4096

22nd Feb 2023

① ASCII (American Standard Code for info interchange)

② BCD → Binary code decimal

③ Gray code

④ Excess - 3 (xs-3)

⑤ EBCDIC → Extended binary code decimal interchange code

⑥ ASCII (Full Form)

→ 7 bit codes

→ contains 1101010 (Binary codes)

ASCII Tables

- ① Alphabets
- ② Numbers
- ③ Special Characters
- ④ Commands

A → 65 a → 97
 ; ;
 z → 90 z → 122
 (72 69 76 71) ASCII Code
 decimal

* BCD :- First even code to be
 ↳ Binary code Decimal

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

Q:- $(963.25)_{BCD} \rightarrow ()_2$

100101100011, 0010, 0101,

$$(12)_{BCD} \rightarrow (0001\ 0010)_2$$

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

2	12	0
2	6	0
2	3	0
2	2	1
1	0	

Date _____
 Page _____

Ques: Diff. between Excess-3 & BCD Codes

* Excess-3 :-

	8	4	2	1	43 i.e	
0	0	0	0	0	0000	0
1	0	0	0	1	0100	1
2	0	0	1	0	0101	2
3	0	0	1	1	0110	3
4	0	1	0	0	0111	4
5	0	1	0	1	1000	5
6	0	1	1	0	1001	6
7	0	1	1	1	1010	7
8	1	0	0	0	1011	8
9	1	0	0	1	1100	9

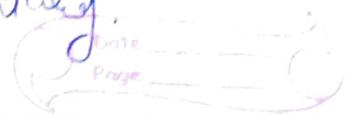
$$(783, 33)_{\text{Excess-3}} \rightarrow ()_2$$

$$(1010\ 1011\ 0110,\ 0110\ 0110)_2$$

grey Codes

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

~~XS-3 codes are self complementary.~~



23rd Feb 2023

BCD

Binary

equivalent

weighted codes

Excess-3 X 5 3

8 4 2 1

0

0 0 0 0

0 0 1 1

1

0 0 0 1

0 1 0 0

2

0 0 1 0

0 1 0 1

3

0 0 1 1

0 1 1 0

4

0 1 0 0

0 1 1 1

5

0 1 0 1

1 0 0 0

6

0 1 1 0

1 0 0 1

7

0 1 1 1

1 0 1 0

8

1 0 0 0

1 0 1 1

9

1 0 0 1

1 1 0 0

5 XS-3 \rightarrow (1000)₂ \rightarrow ()₁₆

8 XS-3 \rightarrow (1011)₂ \rightarrow ()₁₆

EBCDIC \rightarrow Extended ~~BCD~~ Binary code called
interchange code.

8 bits

$$= 2^8 = 256$$

16 zones

• 10 digits.
 $B_7 \ B_6 \ B_5 \ B_4 \ B_3 \ B_2 \ B_1 \ B_0$

new 0 0 0 0 0 0 0 0

0 1 1 1 1 1 1 1 = 10 digits.

1 0 1 0 0 1 1 0

1 1 1 1 1 1 1 1

→ ASCII code new version is Unicode.

* Gray Codes:-

	gray	Binary
0	0000	0000
1	0001	0001
2	0011	0010
3	0010	0011
4	0110	0100
5	0111	0101
6	0101	0110
7	0100	0111
8	1100	1000
9	1101	1001
10	1111	1010
11	1110	1011

② Binary to gray codes.

$B_3 \ B_2 \ B_1 \ B_0$

0 1 0 1

$G_3 \ G_2 \ G_1 \ G_0$

0 1 1 1

1 0 1 0

$$G_3 = B_3$$

$$G_2 = B_3 \oplus B_2 \quad \xrightarrow{\text{XOR}}$$

$$G_1 = B_2 \oplus B_1 \quad \xrightarrow{\text{XOR}}$$

$$G_0 = B_1 \oplus B_0$$

X OR

$$Y = A \oplus B$$

0 0 0

0 1 1

1 0 1

1 1 0

X \bar{Y} + \bar{X} Y

$$B_3 \bar{B}_2 + B_2 \bar{B}_3 = B_3 \oplus B_2$$

$$(101010111)_2 \rightarrow (1111100)_\text{gray}$$

① gray code \rightarrow Binary code

$$\begin{array}{cccc} G_3 & G_2 & G_1 & G_0 \\ | & | & | & | \\ 1 & 1 & 1 & 1 \end{array}
 \quad
 \begin{array}{cccc} B_3 & B_2 & B_1 & B_0 \\ | & | & | & | \\ 1 & 0 & 1 & 0 \\ & & B & \end{array}$$

$$\begin{aligned} B_3 &= G_3 \\ B_2 &= B_3 \oplus G_2 \\ B_1 &= B_2 \oplus G_1 \\ B_0 &= B_1 \oplus G_0 \end{aligned}$$

$$(111010111)_\text{gray} \rightarrow (101100101)_\text{binary}$$

② Binary Arithmetic

Addition

Subtraction

Multiplication

Division

24th Feb-2023

* Binary Addition

$$0 + 0 = 0$$

$$0 + 1 = 1$$

$$\textcircled{2} 1 + 0 = 1$$

$$1 + 1 = \textcircled{2} 0$$

explain = 1

$$(1)_2 \rightarrow (1)_{10}$$

$$\begin{array}{r} & 1 \\ & + 1 \\ \hline (2)_{10} \rightarrow (10) \end{array}$$

explain = 2

$$\begin{array}{r} (1)_{10} \\ + (1)_{10} \\ \hline (2)_{10} \end{array} \quad \begin{array}{r} (0001)_2 \\ + (0001)_2 \\ \hline 00\textcircled{1}0 \end{array}$$

$$1+1+1 = 0011
= 21.$$

Example -

$$\begin{array}{r} 11 \\ 101 \\ 111 \\ \hline 1100 \end{array} \quad \begin{array}{r} 5 \\ 7 \\ \hline 12 \end{array}$$

Example:-

$$\begin{array}{r} (77)_8 \\ + (56)_8 \\ \hline \end{array}$$

$$\begin{array}{r} 11101.1110101 \\ 1101.1110101 \\ \hline 101011.1101101 \end{array}$$

A	B	Sum	Carry
0	0	0	0
0	1	1	0
1	0	1	0
1	1	0	1
1	1	1	1

* Binary Subtraction:-

DIFF Borrow.

$$\begin{array}{r} 0 - 0 = 0 \\ | - 0 = 0 \end{array}$$

$$\begin{array}{r} 1 - 1 = 0 \\ | - 1 = 0 \end{array}$$

$$\begin{array}{r} [0 - 1 =] \\ 10 - 1 = 1 \end{array}$$

$$\begin{array}{r} 15 \\ 25 \\ 19 \\ \hline 6 \end{array}$$

$$\begin{array}{r} 0 4 10 \\ \times 0 5 \\ \hline 9 5 \end{array}$$

$$\begin{array}{r} 10^{10} \\ 11101 \\ 1110 \\ \hline 1110 \end{array}$$

$$\begin{array}{r}
 01110110 \\
 1001001111 \\
 \hline
 101010000
 \end{array}$$

$$A = 110101$$

$$B = 111111$$

$$C = 10010011$$

$$C = (A+B)$$

$$A+B = D$$

$$\begin{array}{r}
 110101 \\
 111111 \\
 \hline
 1010100
 \end{array}$$

$$C - D.$$

$$\begin{array}{r}
 0101 \\
 10010011 \\
 1010100 \\
 \hline
 01101111
 \end{array}$$