Digital Assignment-1 #dld Winter Semester 2019-20

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Q1. List out the characteristics of Digital Logic Family.

Ans:

The main characteristics of digital logic families include :-

- speed
- Fan-in
- Fan-out
- Noise Immunity
- Power dissipation

(a) Speed : Speed of a logic circuit is determined by the time between the application of input and change in the output of the circuit.

(b) Fan-in : It determines the number of inputs the logic gate can handle.

(c) Fan-out : It determines the number of circuits that a gate can drive.

(d) Noise Immunity : Maximum noise that a circuit can withstand without affecting the output.

(e) Power : When a circuit switches from one state to the other, power dissipates.

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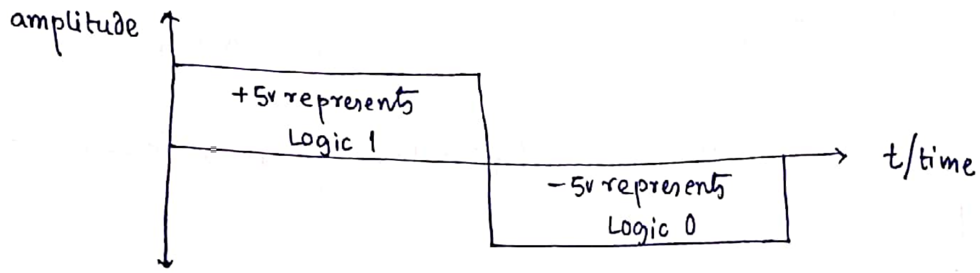
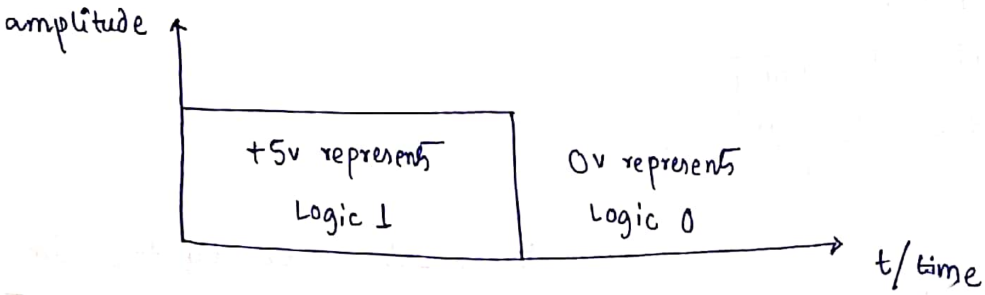
Q2. Difference between Positive Logic and Negative Logic.

Ans:

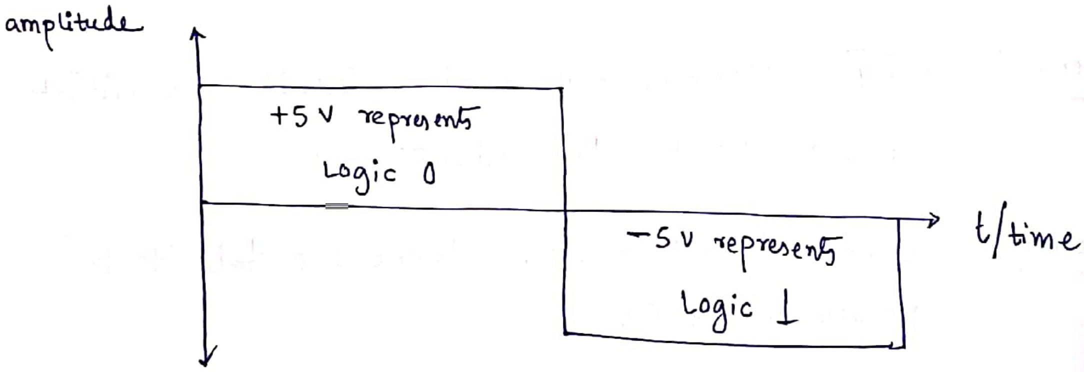
- There are 2 types of representations used in digital systems: the positive logic & the negative logic representations.
- In positive logic representation, Bit 1 represents Logic high and Bit 0 represent a Logic Low, as shown.

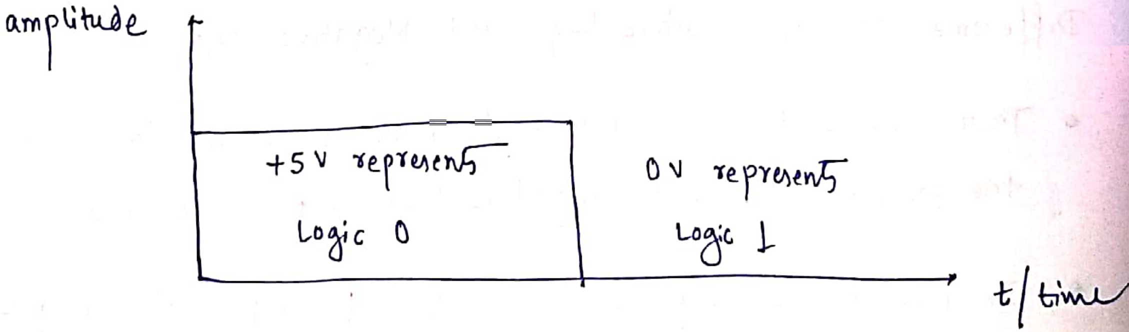
High is represented by +5 volts and Low is represented by −5 volts or 0 volts.





- In Negative Logic representation, Bit 1 represents logic Low and Bit 0 represents Logic High as shown below.
  In terms of voltage level, Bit 1 can be represented as +5 V and Bit 0 can be represented as 0 V or −5 V.





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Q3. Represent the decimal number 6957 in: (a) BCD, (b) Excess 3 code, (c) 2421 code, and (d) 6311 code.

Ans. decimal number = 6957

(a) BCD = 0110100101010111

(b) Excess 3 code = 1001110010001010 [6957 + (3) = (9 12 8 10)]

(c) 2421 code = 1100111101010111

(d) 6311 code = 1000110001111010

Q4. Find the 9's complement and 10's complement of the following decimal numbers :

(a) 2523 ; (b) 1234

Ans. (a) 2523 :

9999 − 2523 = 7476 (BCD → 0111010001110110)

[9's complement]

7476 + 1 = 7477 (BCD → 0111010001110111)

[10's complement]

(b) 1234 :

9999 − 1234 = 8765 (BCD → ~~0111010000111011~~ 1000011101100101)

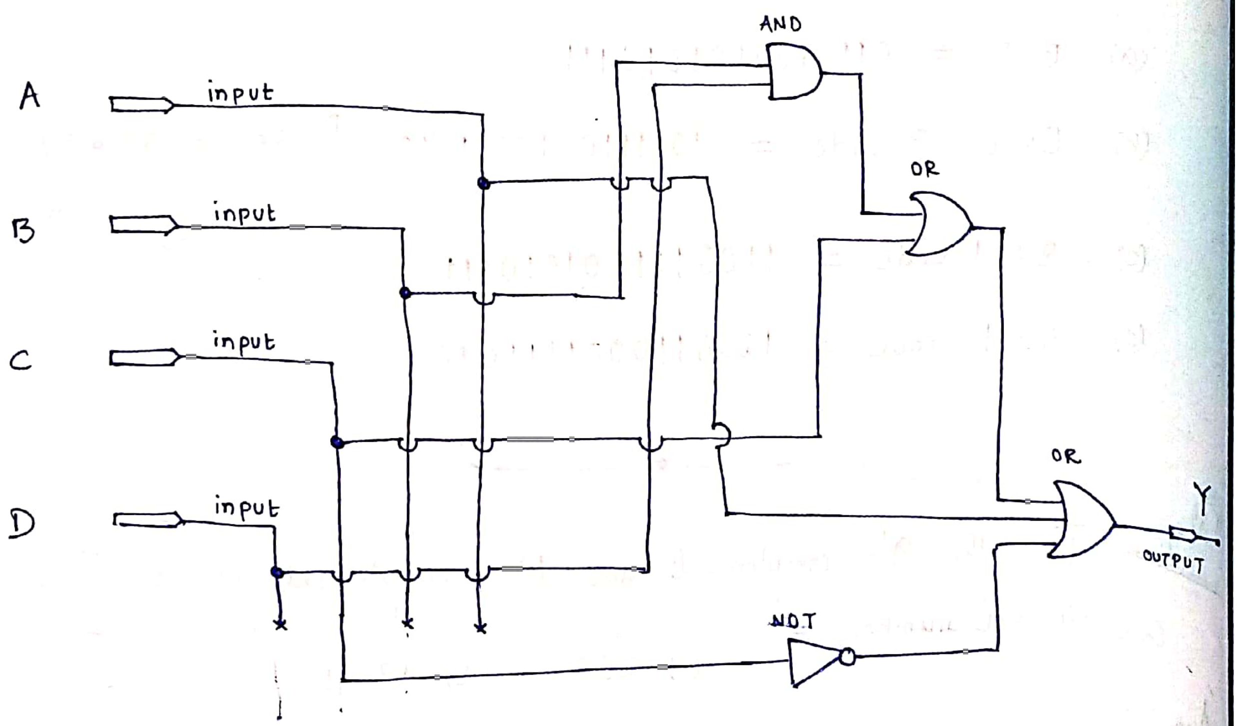
[9's complement]

7476 + 1 = 8766 (BCD → 1000011101100110)

[10's complement]

Q5. Draw the Logic diagram to implement the following Boolean expressions : $Y = A + (C + BD) + C'$

Ans.



$\therefore Y = A + (C + BD) + C'$

Q6. Express the following functions as sum of minterms and as a product of maxterms :

$$F(A,B,C,D) = B'D + A'D + BD$$

Ans.

- Sum of minterms :

$= B'D(A+A')(C+C') + A'D(C+C')(B+B') + BD(A+A')(C+C')$

$= (B'DA + B'DA')(C+C') + (A'DC + A'DC')(B+B')$
$+ (BDA + BDA')(C+C')$

$= B'DAC + B'DAC' + B'DA'C + B'DA'C' + A'DCB$
$+ A'DCB' + A'DC'B + A'DC'B' + BDAC$

$+ BDAC' + BDA'C + BDA'C'$

$= B'DAC + B'DAC' + B'DA'C + B'DA'C' + A'DCB + A'DC'B + BDAC + BDAC'$

$= m(1, 3, 5, 7, 9, 11, 13, 15)$

- product of maxterms :

As the sum of minterms is deduced to be $m(1, 3, 5, 7, 9, 11, 13, 15)$, then similarly, product of maxterms will be $= \Pi(0, 2, 4, 6, 8, 10, 12, 14)$, which is equal to :

$(A+B+C+D)(A+B+C'+D)(A+B'+C+D)(A+B'+C'+D) \cdot (A'+B+C+D)(A'+B+C'+D)(A'+B'+C+D)(A'+B'+C'+D)$.

Q7. What is the base 4 equivalent of the Hex number 3A7 ?

Ans.

$3 \rightarrow 0011$ (BCD) $\rightarrow 03$ (base 4)

$A \rightarrow 1010$ (BCD) $\rightarrow 22$ (base 4)

$7 \rightarrow 0111$ (BCD) $\rightarrow 13$ (base 4)

$\therefore (3A7)_{16} = (32213)_4$

Q8. Convert the following decimal number : 250.5 to base 3, base 4, base 7, base 8, and base 16.

Ans.

- <u>conversion to base 3</u> :

( )$_3$ ⟶

3 | 250
3 | 83 – 1
3 | 27 – 2
3 | 9 – 0
3 | 3 – 0
  1 – 0

$0.5 \times 3 = 1.5 \rightarrow 1$
$0.5 \times 3 = 1.5 \rightarrow 1$

⇓

$(100021)_3$

$\therefore (250.5)_{10} = (100021.11\ldots\ldots)_3$

- <u>conversion to base 4</u> :

( )$_4$ ⟶

4 | 250
4 | 62 – 2
4 | 15 – 2
  3 – 3

$0.5 \times 4 = 2.0 \rightarrow 2$

$\therefore (250.5)_{10} = (3322.2)_4$

- <u>conversion to base 7</u> :

( )$_7$ ⟶

7 | 250
7 | 35 – 5
  5 – 0

$0.5 \times 7 = 3.5$
↓
3

$\therefore (250.5)_{10} = (505.3\ldots\ldots)_7$

- <u>conversion to base 8 :</u>

$(\ )_8 \longrightarrow$

$$\begin{array}{r|l} 8 & 250 \\ \hline 8 & 31 - 2 \\ \hline & 3 - 7 \end{array}$$

$0.5 \times 8 = 4.0 \longrightarrow 4$

$\therefore (250.5)_{10} = (372.4)_8$

- <u>conversion to base 16 :</u>

$(\ )_{16} \longrightarrow$

$$\begin{array}{r|l} 16 & 250 \\ \hline & 15 - 10(A) \\ & (F) \end{array}$$

$0.5 \times 16 \longrightarrow 8.0 \rightarrow 8$

$\therefore (250.5)_{10} = (FA.8)_{16}$

Q9. Determine the value of base x if : (a) $(193)_x = (623)_8$

(b) $(225)_x = (341)_8$.

Ans. (a) $(193)_x = (623)_8$

$\Rightarrow x^0 \times 3 + x^1 \times 9 + x^2 \times 1 = 8^0 \times 3 + 8^1 \times 2 + 8^2 \times 6$

$\Rightarrow 3 + 9x + x^2 = 3 + 16 + 384$

$\Rightarrow x^2 + 9x + 3 = 403$

$\Rightarrow x^2 + 9x - 400 = 0$

$\Rightarrow x^2 + 25x - 16x - 400 = 0$

$\Rightarrow x(x+25) - 16(x+25) = 0$

$\Rightarrow (x+25)(x-16) = 0$

$\therefore x = 16$ ($\because$ it can't be negative)

$\therefore$ value of base $x = 16$

(b) $(225)_x = (341)_8$

$\Rightarrow x^0 \times 5 + x^1 \times 2 + x^2 \times 2 = 8^0 \times 1 + 8^1 \times 4 + 8^2 \times 3$

$\Rightarrow 5 + 2x + 2x^2 = 1 + 32 + 192$

$\Rightarrow 2x^2 + 2x + 5 = 225$

$\Rightarrow 2x^2 + 2x - 220 = 0$

$\Rightarrow x^2 + x - 110 = 0$

$\Rightarrow x^2 + 11x - 10x - 110 = 0$

$\Rightarrow x(x+11) - 10(x+11) = 0$

$\Rightarrow (x+11)\cdot(x-10) = 0$

$\therefore x = 10$ ($\because$ it can't be negative)

$\therefore$ value of base $x = 10$

Q10. Convert the following binary numbers to Gray code :

(a) 101011110001

(b) 100011110101

Ans:

(a)

1 0 1 0 1 1 1 0 0 0 1 → Binary code

\+ + + + + + + + + +

(11111001001) ⟹ Gray code

(b) 1 0 0 0 1 1 1 0 1 0 1 → Binary code

\+ + + + + + + + + +

(11001001111) ⇒ Gray code

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