Date:_____

SAADAT

Name :- Muhammad Daniyal

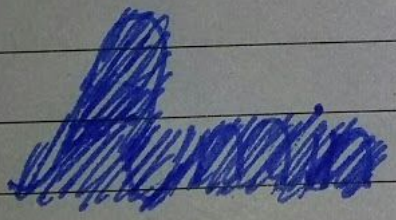
ID :- 17011

program :- BS(CS)

Subject :- Digital logic design

Mid Assignment

"INU"



Date:_____ 1

SAADAT

Q1: Convert each of the following.

a) $(45.25)_{10} = (?)_2$

Solution:

45

$= 2^5 + 2^3 + 2^2 + 2^0$

$= 1\times2 + 0\times2 + 1\times2 + 1\times2 + 0\times2 + 1\times2$

1 0 1 1 0 1

25

$= 2^4 + 2^3 + 2^0$

$= 1\times2 + 1\times2 + 0\times2 + 0\times2 + 1\times2$

1 1 0 0 1

$(45.25)_{10} = (10\,1101.11001)_2$

Answer

Date:_____

SAADAT

b) $(10000000 \cdot 1010)_2 = (?)_{10}$

Solution:-

$(10000000 \cdot 1010)_2 = (?)_{10}$

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

$= 128 + 0\times64 + 0\times32 + 0\times16 + 0\times8$
$+ 0\times4 + 0\times2 + 0\times1 + 1\times0.5 + 0\times0.25$
$+ 1\times0.125 + 0\times0.0625$

$128 + 0.625$

$(128.625)_{10}$

Answer.

Date:_____ 3

SAADAT

C:- $(4D7F)_{16} = (?)_{10}$

Solution:-

4D7F

$4 \times 16^3 + 13 \times 16^2 + 7 \times 16^1 + 15 \times 16^0$

$16384 + 3328 + 112 + 15$

$(19839)_{10}$

Answer

D:- $(128)_{10} = (?)_{16}$

Solution:-

$(128)_{10}$

$\frac{128}{16} = 8 \longrightarrow 0 \times 16 = 0$

$\frac{8}{16} = 0.5 \longrightarrow 0.5 \times 16 = 8$

So

$(128)_{10} = (80)_{16}$.

Ans.

Date:_____ 4 SAADAT

E:- $(3A6F)_{16} = (?)_2$

Solution:-

3A6F

Replace each hexadecimal symbol with the approximate four bits

3 A 6 F
↓ ↓ ↓ ↓
0011 1010 0110 1111

So the required answer from this is

$(3A6F)_{16} = (1110100110101111)_2$

Answer.

F:- $(1100001111100101)_2 = (?)_{16}$

Solution:-

$(1100001111100101)_2$

Convert the required binary code to appropriate four bits

1100 0011 1110 0101
↓ ↓ ↓ ↓
C 3 E F Ans

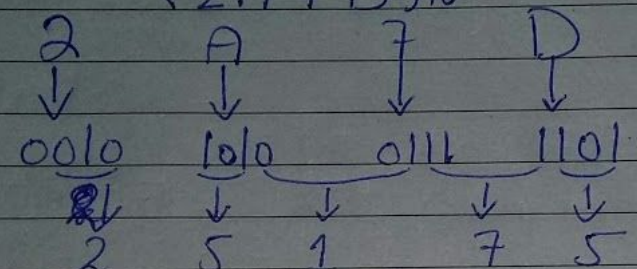
Date:_____ 6

SAADAT

I:- $(2A7D)_{16} = (?)_8$

Solution:-

$(2A7D)_{16}$



$(2A7D)_{16} = (27175)_8$ Answer.

j:- $(11111111)_2 = \pm(?)_{10}$

Solution:-

$(11111111)_2$

Take 2's Complement

11 1 1 1 1 1 1 1

0 0 0 0 0 0 0 0 2's Comp

+ 1

$(0\,0\,0\,0\,0\,0\,0\,1)_2$

$0\times2+0\times2+0\times2+0\times2+0\times2+0\times2+0\times2+1\times2$

$0+0+0+0+0+0+0+2$

SAADAT

$(11111111)_2 = \pm(2)_{10}$

Answer.

K:- $(-12)_{10} = (?)_2$

Solution:-

$(-12)_{10}$ = [redacted]

Take 2's Complement

```
 1111
-1000
-0111
 0001
 1000
```

Note:
2's Comp of (-12) is (-1000)

$(-12)_{10} = (1000)_2$

Answer.

Date:_____

SAADAT

L: (198) = (?)BCD

Solution:-

(198)

1 9 8
↓ ↓ ↓
0001 1001 1000

$(198)_{10}$ = (000110011000)BCD

Answer:

m:- (100001110000)BCD = $(?)_{10}$

Solution:-

(100001110000)BCD

1000011110000
↓ ↓ ↓
8 7 0

So

(100001110000)BCD = (870)BCD

Answer:

Date:_____ 9

SAADAT

N:- $(1001010)_2 = (?)_{Gray}$

Solution:-

Now

$(1001010)_2$

Convertion to Gray code.

1 + 0 + 0 + 1 + 0 + 1 + 0

↓

1 1 0 1 + 1 + 1 + 1

So

$(1001010)_2 = (1101111)_{Gray}$

Answer.

O:- $(10101111)_{Gray} = (?)_2$

Solution:-

$(10101111)_{Gray}$

Convert to binary number.

1 0 1 0 1 1 1 1

1 1 0 0 1 0 1 0

So $(10101111)_{Gray} = (11001010)_2$

Date:_____

SAADAT

P:- 01000001 = (?) ASCII

Solution:-

(01000001)$_2$

The ASCII Code for the number is

(065)$_{ASCII}$

So

(01000001)$_2$ = (065)$_{ASCII}$

Answer.

Q:- 111000 = (?111000) Evenparity

Solution:-

111000

The even parity of this number is

(1111000) evenparity.

So

(111000) = (1111000) even parity

Answer.

Date:_____

SAADAT

Q3. Calculate each of the following.

a) $01111111_2 - 00000111_2$

Solution:

$01111111_2 - 00000111_2$

Take 2's Complement of

00000111_2

11111000

$+1$

11111001 ⇒

Now

Add both equations.

$$\begin{array}{r} 11111001 \\ 01111111 \\ \hline (1)11111000 \end{array}$$

drop

So

$(11111000)_2$ is the required answer.

Date:_____ 12

b) $(01101010)_2 \times (11110001)_2$

Solution:-

$(01101010)_2 \times (11110001)_2$

Multiply these two numbers.

```
  01101010
x 11110001
  01101010
 0000000x
00000000xx
000000oxxx
01101o1oxxxx
011o1o1oxxxxx
01101o1oxxxxxx
011o1o1oxxxxxxx
11000111001010
```

So the required answer is

$(11000111001010)_2$

Answer.

Date:_____

SAADAT

C:- $(10001000)_2 \div (00100010)_2$

Solution:-

Dividsion:

Step 1:- Quotient is zero

Step 2:- Take Complement of divisers.

```
 1 1 1 1 1 1 1 1
 0 0 1 0 0 0 1 0
 1 1 0 1 1 1 0 1
```

```
          | 1 0 0 0 | 0 0 0
        + | 1 1 0 1 | 1 1 0
      ----|---------|------
        1 | 0 1 1 0 | 0 1 0
      ----|---------|------
Add 1     | 0 0 0 0 | 0 0 0 1
      ----|---------|------
          | 0 1 1 0 | 0 1 1 0
```

Step 3:-

```
          | 0 1 1 0 | 0 1 1 0
        + | 1 1 0 1 | 1 1 0
      ----|---------|------
        1 | 1 1 0 0 | 0 1 1
      ----|---------|------
Add 1 ↳   | 0 0 0 0 | 0 0 0 1
      ----|---------|------
          | 1 1 0 0 | 0 1 0 0
```

Date:_____

SAADAT

Step 4:-

	11 0001 00
+	11 0111 01
1	10 1000 01
Add ↳	00 0000 01
	10 1000 10

Step 5:-

	10 1000 10
+	11 0111 01
	01 1111 11
Add ↳	00 0000 01
1	00 0000 00
Add ↳	00 0000 01
	00 0000 01

Answer.

Date:_____

SAADAT

d:- $(6D)_{16} - (3F)_{16}$

Solution:-

$(6D)_{16} - (3F)_{16}$

(16) → Borrow

$$\begin{array}{r} 6D \\ -\ 3F \\ \hline (2E)_{16} \end{array}$$

So

The required answer from multiplication is

$(2E)_{16}$

Answer.

Date:_____ 16

Q3:- Apply CRC data bits 11010011_2 using the generator code 1010_2 to produce the transmitted CRC code?

Solution:-

Now the bits we called

$D = 11010011_2$

And the generator code we called as

$G = 1010_2$

Now the generator code has four bits so add four to the data byte which we call data (D')

$D' = 11010011\,0000$

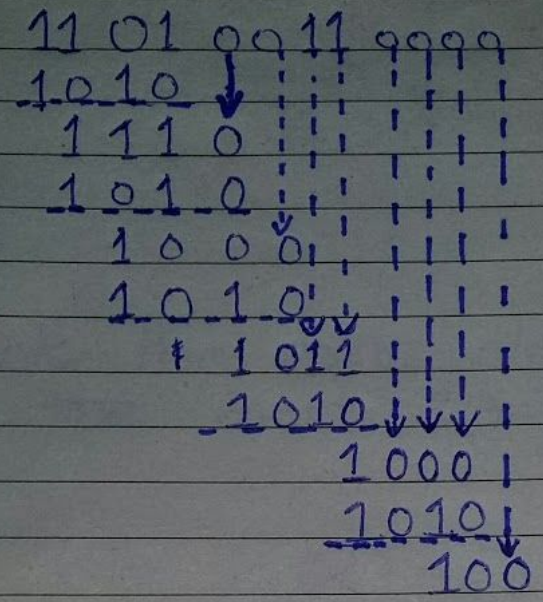
Divide the data code by generator code using modulo-2 operation.

$$\frac{D'}{G} = \frac{11010011\,0000}{1010}$$

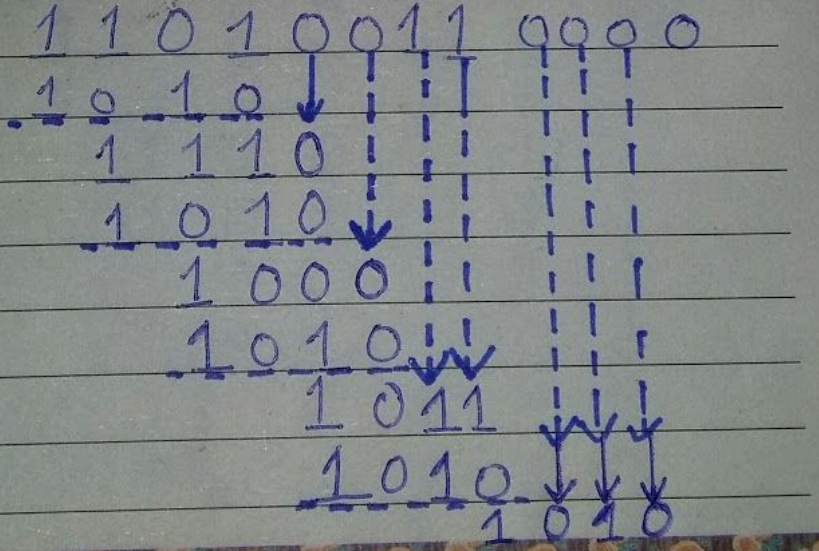
$$\begin{array}{r} 11010011\,0000 \\ \underline{1010} \end{array}$$

Date:_____

SAADAT



Remaider = 0100 the remaider is not zero. So apperde the data until the remaider is zero.



Date:_____

SAADAT

```
1010 |
1010 ↓
 000
```

Remainder = 0

Answer.

Q4:- Check the error detection from the most significant bit.

Solution:-

Code = 11010011₂

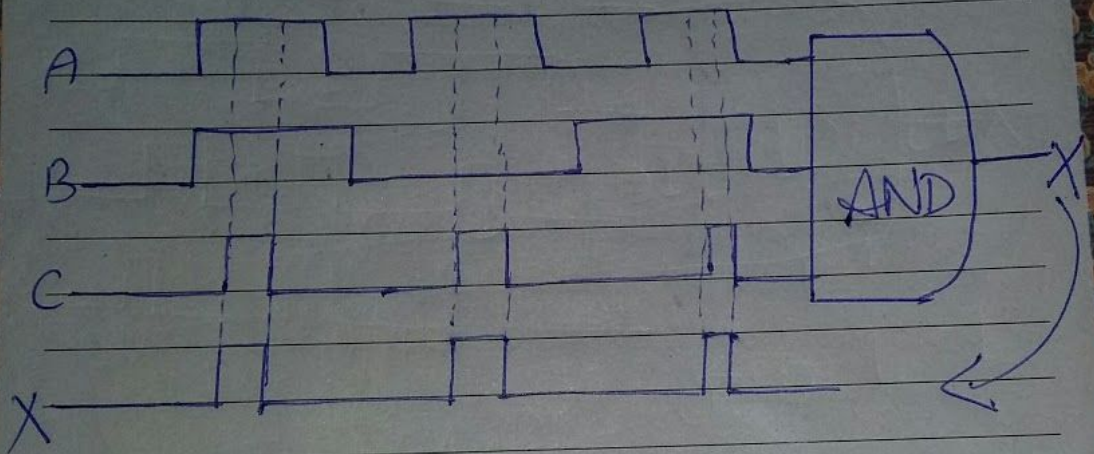
Generator Code = 1010₂

Now the code in which we have error is

Date: 13/4/20

SAADAT

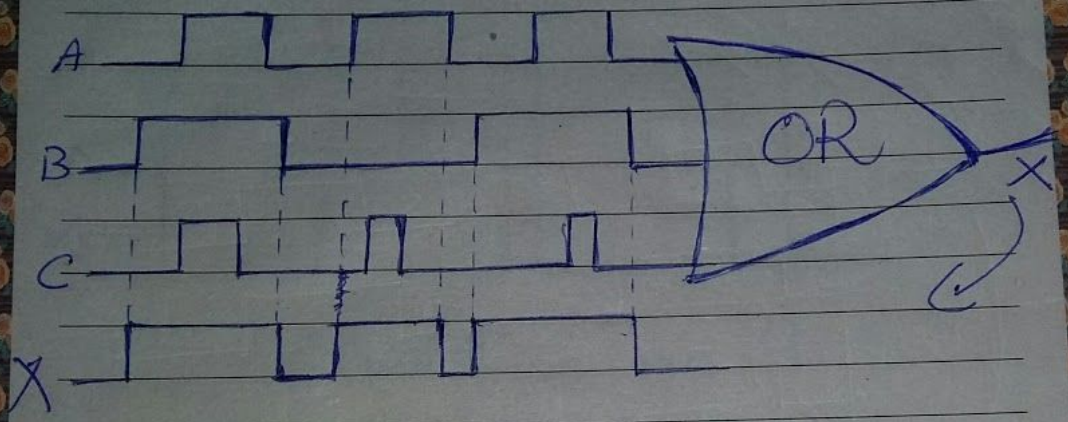
Q5 The input waveforms in figure 3-~~[illegible]~~ are applied to a input AND gate Show the output wave form with Timing diagram.



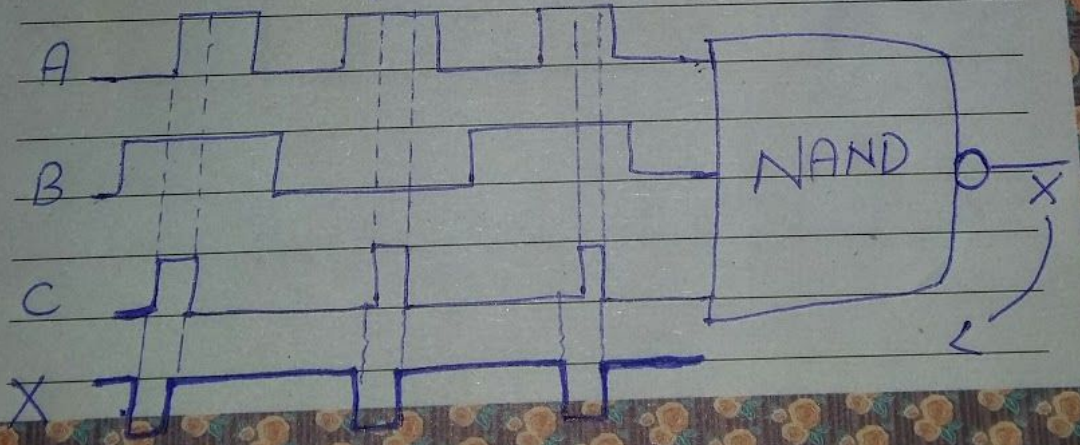
Date:_____ 20

SAADAT

Q6:- The input wave forms in figure are applied to a 3-input OR Gate Show the output wave form with timing diagram.



Q7:- Repeat Q5 for NAND Gate:

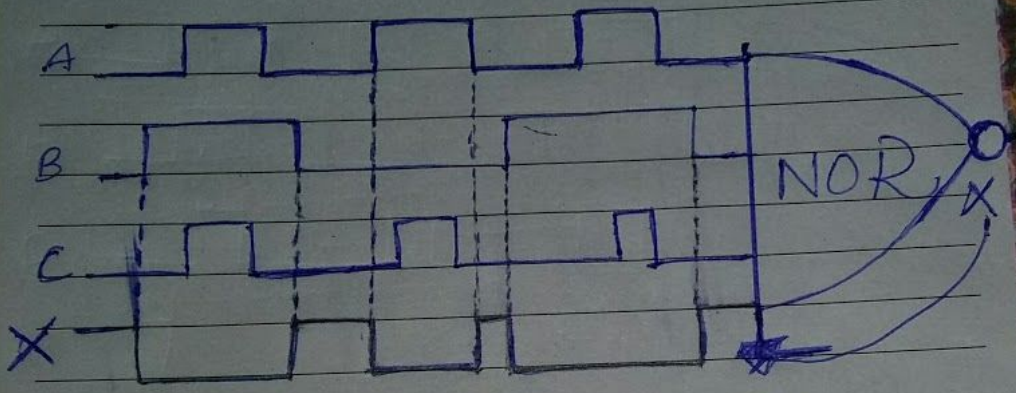


Date:_____ 22

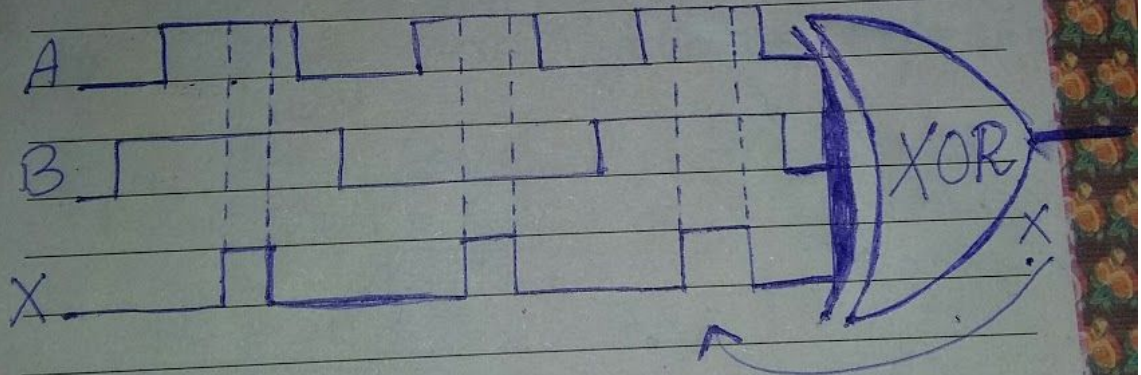
SAADAT

Q8:- Repeat Q5: for NOR Gate:

Solution:-



"Question no 9"

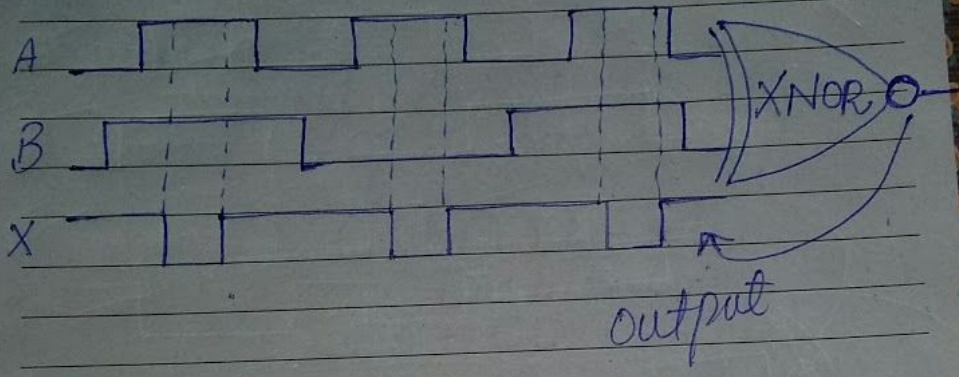


X is the output

Date:_____ 22 SAADAT

Q10:- Repeat Q9 for XNOR Gate:-

Solution:-



Q11:- Using boolean algebra techniques to simplify the following expression

Sol:- Using boolean Algebra rules:

$A\bar{B} + A\bar{B}C + A\bar{B}C.D + A\bar{B}CDE$

$(\overline{A + AB} = \overline{A})$

$A\bar{B} + A\bar{B}C.D + A\bar{B}C.D.$

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

$A\bar{B} + A\bar{B}CDE$

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

$A\bar{B}$ = Answer

R.W

$A\bar{B} + A\bar{B}C$

$A\bar{B}(1+C)$

$\overline{A+1} = 1$

$A\bar{B}(1)$

$(A\bar{B})$

Date:_____ 23 SAADAT

Q2:- Convert the following expression into standard SOP form.

Solution:-

First Convert the given SOP form

$(C+D)(\bar{A}+D)$

Distributing

$\Rightarrow C\bar{A} + CD + D\bar{A} + DD$

$\Rightarrow CA + CD + C\bar{A} + DD$

Domain of this is Sop is "ACD"

Term CA is missing "D"

$\Rightarrow C\bar{A} = CA(D+\bar{D}) = CAD + C\bar{A}\bar{D}$

Term CD is missing "A"

$\Rightarrow CD = CD(A+\bar{A}) = CDA + CD\bar{A}$

Term $D\bar{A}$ is missing C

Date:_____ 24

SAADAT

$\Rightarrow D\bar{A} = D\bar{A}(C+\bar{C}) = D\bar{A}C + D\bar{A}\bar{C}$

Term DD is missing "A" and "C"

$\Rightarrow DD = DD(A+\bar{A}) = DDA + DD\bar{A}$

Term "DDA" and "DDĀ" is mising "C"

$\Rightarrow DDA = DDA(C+\bar{C}) = DDAC + DDA\bar{C}$

$\Rightarrow DD\bar{A} = DD\bar{A}(C+\bar{C}) = DD\bar{A}C + DD\bar{A}\bar{C}$

Hence the final Sop form is

$(C\bar{A}D + C\bar{A}\bar{D} + CDA + CD\bar{A} + D\bar{A}C + D\bar{A}\bar{C} + DDAC + DDA\bar{C} + DD\bar{A}C + DD\bar{A}\bar{C})$

Answer.

Date:_____ 25

Q13:- write Standart POS expression using Standard Sop expression form

Solutions:-

$(C\bar{A}D + C\bar{A}D + DA\bar{C} + ACD)$

Evalulate the "POS" eq/

$(101) + (100) + (110) + (111)$

Since there are three variables in the domain of this expression There are $2^3 = 8$ possible combinatio. Four of which are contained by this expression the rest are.

000, 010, 011, 001

Hence the eqvalent "POS" equation is

$(A+B+C)(A+\bar{B}+C)(A+\bar{B}+\bar{C})(A+B+\bar{C})$

Answer.

Date:_____

SAADAT

Q14:- Draw a Single truth table for both the Standard SOp and POS form.

Solution:-

A	C	D	Sop	POS
0	0	0		
0	0	1	$A\bar{D}$	
0	1	0	$\bar{A}C$	$(\bar{A}+C)$
0	1	1	CD	$(C+D)$
1	0	0		
1	0	1		
1	1	0		
1	1	1		

Date:_____ 27

SAADAT

Q1S:- Use a Karnaugh map to Simplify the following expression to a minimum Sop form.

$\bar{A}\bar{B}\bar{C} + \bar{A}BC + A\bar{B}C + AB\bar{C}$

Solution:-

Using Karnaugh map

	$\bar{C}$	C
$\bar{A}\bar{B}$	1	
$\bar{A}B$		1
$A\bar{B}$	1	
AB		1

$\Rightarrow \bar{A}\bar{B}\bar{C} + \bar{A}BC + AB\bar{C} + A\bar{B}C$

Hence proved the minimum Sop form.

Date:_____ 28

SAADAT

Q16:- Obtain the minimum POS expression from the Karnaugh map used in Q:15.

$\bar{A}\bar{B}\bar{C} + \bar{A}BC + A\bar{B}C + AB\bar{C}$

Solution:-

Using Karnaugh map

	$\bar{C}$	C
$\bar{A}\bar{B}$	0	
$\bar{A}B$		0
AB	0	
$A\bar{B}$		0

Therefore:

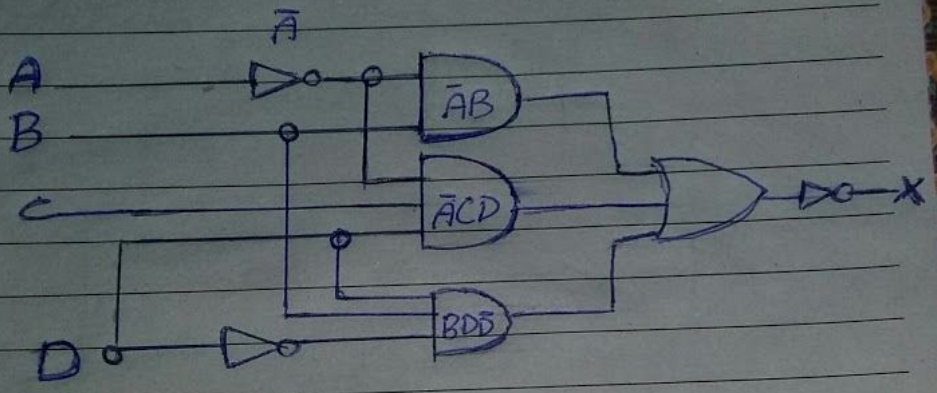
$(\bar{A}+\bar{B}+\bar{C})\ (\bar{A}+B+C)\ (A+B+\bar{C})$
$(A+\bar{B}+C$

Hence the POS form proved.

SAADAT

Q17:- write the output expression for the circuit in figure.

Solution:-

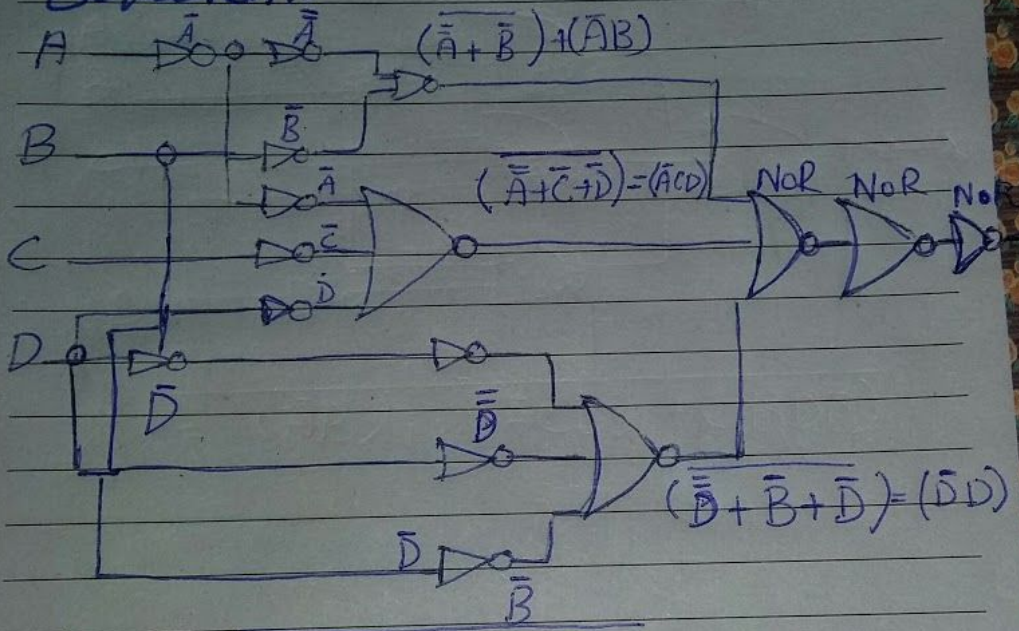


$$X = \overline{(\bar{A}B) + (\bar{A}CD) + (BD\bar{D})}$$

Date:_____ 30 SAADAT

Q# 18:- Implement the logic Circuit using only NOR Gate.

Solution:-



$$X = (\bar{\bar{A}}+B)(\overline{\bar{\bar{A}}+\bar{C}+\bar{D}})(\bar{\bar{D}}+\bar{B}\bar{D}) =$$

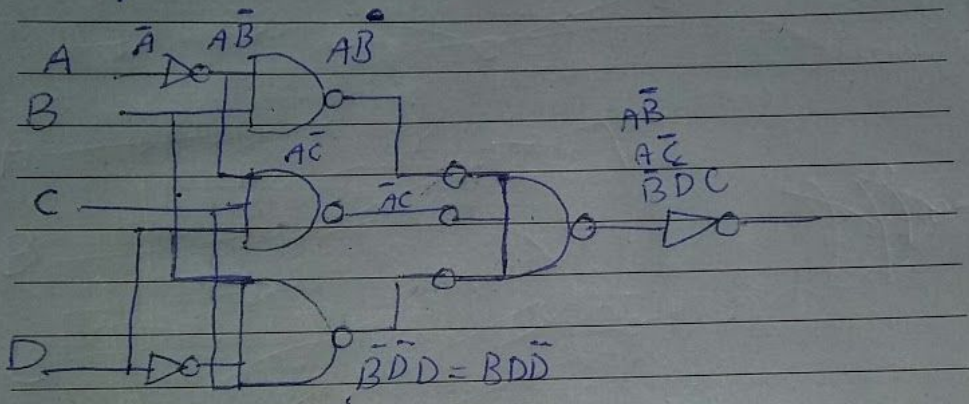
$$(\bar{A}B)+(\bar{A}CD)+(\bar{D}BD)$$

Ans.

Date:_____ 31 SAADAT

Q19 Implement the logic Circuits in figure 3 using only NAND gates.

Solution:-



$$X = \bar{A}\bar{B}\bar{C}\bar{D} = (\bar{A}B) + (\bar{A}C) + (\bar{B}D\bar{D})$$

Date:_____

SAADAT

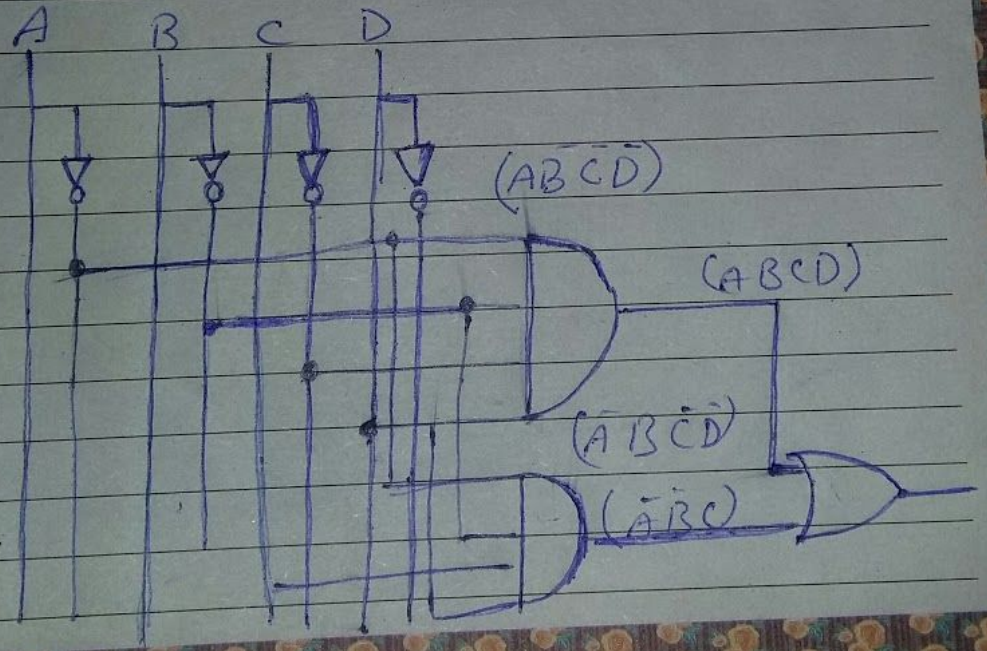
Q20: Implement a logic Circuit for the truth table 1

Answer:-

we obtain the following expression from the truth Table:

$(\bar{A}\bar{B}C\bar{D})+(\bar{A}\bar{B}CD)+(\bar{A}B\bar{C}\bar{D})+(A\bar{B}\bar{C}\bar{D})+$
$(\bar{A}B\bar{C}D)+(A\bar{B}C\bar{D})+(A\bar{B}CD)(ABCD)$

Using boolean expression and law we get $(\bar{A}\bar{B}\bar{C}.\bar{D})+(\bar{A}B\bar{C}\bar{D})+(\bar{A}\bar{B}C)$



Date:_____

SAADAT

Q2 Calculate the following "Part e"

$00010110_{BCD} + 00010101 = (?)_{10}$

Solution:-

00010110 + 00010101

we know that the q/uolient at the beginig is 00010101 and the second one is 00010101 add both of these (BCD) Codes.

$$\begin{array}{r} 0001\ \ 0110 \\ +0001\ \ 0101 \\ \hline 0010\ \ 1011 \\ \underline{\ 3\ \ \ \ \ \ \ 1\ } \end{array} \qquad \begin{array}{r} 16 \\ +15 \\ \hline 31 \end{array}$$

$(00010110)_{BCD} + (00010101)_{BCD} = (31)$

Ans