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Program BS(CS)

Exam Mid-Term Assignment

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Q:1 Convert each of the following:

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

(Step:1) 1st convert whole numbers:-

2	45
2	22 → 1
2	11 → 0
2	5 → 1
2	2 → 1
	1

$\boxed{45 = 11101}$

Step:2 Convert fraction :-

$0.25 \times 2 = .5 \rightarrow 0$
$0.5 \times 2 = .0 \rightarrow 1$

$0.25 = (.10)$.

$45.25_{10} = (11101.10)_2$. Ans

b) $10000000.1010_2 = (?)_{10}$

Given:

$10000000.1010_{(2)}$
Convert Binary number int decimal number system.
Sol:-

using weighted notation.

$(1 \times 2^7) + (1 \times 2^{-1}) + (1 \times 2^{-2})$

$\Rightarrow (1 \times 128) + (0.5) + (0.125)$

$\Rightarrow 128.625_{(10)}$ Ans.
$10000000.1010_{(2)} = 128.625_{(10)}$ Ans

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c) $4D7F_{16} = (?)_{10}$

Given:

$4D7F_{(16)}$

Required

convert Hex number into decimal number system.

Sol:- using weighted notation.

$(4\times16^3) + (13\times16^2) + (7\times16^1) + (15\times16^0)$

$\Rightarrow (4\times4096) + (13\times256) + (7\times16) + (15\times1)$

$\Rightarrow 16,384 + 3328 + 112 + 15$

$\Rightarrow (19839)_{10}$

$4D7F_{16} = (19839)_{10}$ Ans

d) $128_{(10)} = (?)_{16}$

Given:

$128_{(10)}$

convert Decimal into Hex

Sol:

using Repeated division by 16.

16	128
16	8 → 0

hence

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

e) $3A6F_{(16)} = (?)_2$

Given:

$3A6F_{(16)}$

convert Hex number into Binary number system.

Sol: using Hex-Binary table to convert $3A6F_{16}$ to Binary.

3	A	6	F
0011	1010	0110	1111

hence

$3A6F_{(16)} = (11101001101111)_2$ Ans

f) $1100001111100101_{(2)} = (?)_{16}$

Given:

$1100001111100101_{(2)}$ *

convert:

Sol:

using Groups of four.

1100	0011	1110	0101
C	3	E	5

hence

$1100001111100101_{(2)} = C3E5_{(16)}$ Ans

g) $6173_8 = (?)_{10}$

Given: $6173_{(8)}$

convert into Decimal number system.

Sol:

using weighted notation.

$(6\times 8^3) + (1\times 8^2) + (7\times 8^1) + (3\times 8^0)$

$\Rightarrow (6\times 512) + (1\times 64) + (7\times 8) + (3\times 1)$

$\Rightarrow 3072 + 64 + 56 + 3$

$\Rightarrow 3195_{(10)}$

hence

$6173_{(8)} = 3195_{(10)}$ Ans

h) $169_{(10)} = (?)_8$

Given:

$169_{(10)}$

Decimal to octal.

sol:-

using Repeated division by 8

$$\begin{array}{r|l}
8 & 169 \\
\hline
8 & 21 \rightarrow 1 \\
\hline
8 & 2 \rightarrow 5
\end{array}$$

hence

$169_{(10)} = (251)_8$. Ans

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i) $2A7D_{16} = (?)_8$

Given :-

$2A7D_{16}$

Hex- to octal number system.

Sol :-

First convert $2A7D_{(16)}$ Binary number

using groups of fours (Table)

2	A	7	D
0010	1010	0111	1101

Now : convert the obtained binary number into octal number

using groups of three.

000	010	101	001	111	101
0	2	5	1	7	5

hence :-

$2A7D_{(16)} = (25175)_{(8)}$

j) $1111111_2 = \pm (?)_{10}$

Given:-

$1111111_{(2)}$

Required:

Decimal value of the given signed number.

Sol:-

using weighted notation of the magnitude bits.

$\Rightarrow (1\times 2^6) + (1\times 2^5) + (1\times 2^4) + (1\times 2^3) + (1\times 2^2) + (1\times 2^1) + (1\times 2^0)$

$\Rightarrow 64 + 32 + 16 + 8 + 4 + 2 + 1$

$\Rightarrow 127_{(10)}$

Since the sign-bit is 1

hence

$1111111_{(2)} = -127_{(10)}$ Ans

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

Given:-

$-12_{(10)}$

Required:- Binary equivalent of $-12_{(10)}$

Sol:-

First find Binary equivalent of $12_{(10)}$ using Repeated division by 2.

2	12	
2	6	$\rightarrow 0$
2	3	$\rightarrow 0$
2	1	$\rightarrow 1$

$12_{(10)} = 1100_{(2)} \Rightarrow 00001100_{(2)}$

Now taking 2's complement of obtained number

$$
\begin{array}{rl}
00001100 & \\
11110011 & \text{1's complent} \\
1 & \text{2's complent} \\
\hline
11110100 &
\end{array}
$$

hence :- $-12_{(10)} = 1110100_{(2)}$ ANS

l) $198 = (?)\ BCD$

Given:

$198_{(10)}$

convert the given number system into BCD.

sol:

using Decimal-BCD Table.

1	9	8
0001	1001	1000

hence:-

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

Ans.

M) $100001110000\ BCD = (?)_{10}$

Given:-

100001110000_{BCD}

convert BCD into Decimal number system.

sol:-

using BCD - Decimal table.

1000	0111	0000
8	7	0

hence:- $100001110000_{BCD} = (870)_{10}$

n) $1001010_2 = (?)$ Gray.

Given:-

1001010_2

Sol:-

$1 \rightarrow +0 \rightarrow +0 \rightarrow +1 \rightarrow +0 \rightarrow +1 \rightarrow +0$

$\downarrow \quad \downarrow \quad \downarrow \quad \downarrow \quad \downarrow \quad \downarrow \quad \downarrow$

1 1 0 1 1 1 1

hence

$1001010_2 = 1101111$ Gray.

o) 10101111 Gray $= (?)_2$.

Given:-

10101111 Gray.

Sol:-

1 0 1 0 1 1 1 1

1 1 0 0 1 0 1 0

hence:-

10101111 Gray = 11001010(2).

Ans

~~Q) 01000010~~

Q) 01000001 = (?) ASCII

Given

01000001$_{(2)}$

Sol:-

using ASCII table.

$(1\times 2^6) + (1\times 2^0)$

$\Rightarrow (1\times 64) + (1\times 1)$

$\Rightarrow 64 + 1$

$\Rightarrow 65_{(10)}$

$\Rightarrow 65_{(10)}$ = (A) ASCII character.

ANS

Q) 111000 = (?111000) Even parity.

Given:-

111000$_{(2)}$.

Sol.

We add 1 to the left of given number.

1111000 $\Rightarrow$ (1111000) Even parity.

ANS

Q2) Calculate each of the following.

a) $01111111_{(2)} - 00000111_{(2)}$

Sol:

Taking 2's complement

$$\begin{array}{r} 00000111 \\ \hline 11111000 \\ + \quad 1 \\ \hline 11111001 \end{array}$$

1's complement

2's complement

Now:

$$\begin{array}{r} 01111111 \\ +\ 11111001 \\ \hline 101111000 \end{array}$$

Discarded bit

hence:

$\Rightarrow 01111000_{(2)}$

b) $01101010_2 \times 11110001_2$

sol:

using 2's complement

$$\begin{array}{r} 11110001 \\ \hline 00001110 \quad \text{1's complement} \\ + \qquad\qquad 1 \quad \text{2's complement} \\ \hline 00001111 \end{array}$$

Now.

$$\begin{array}{r} 00001111 \\ 01101010 \\ \hline 00000000 \\ 000001111\text{x} \\ 0000000000\text{xx} \\ 000011111\text{xxx} \\ 00000000\text{xxxx} \\ 00001111\text{xxxxx} \\ 00001111\text{xxxxxx} \\ 000000000\text{xxxxxxx} \\ \hline 000011000110110 \end{array}$$

hence:

$1100011010110_{(2)}$ Ans

d) $6D_{16} - 3F_{16}$

Sol:-

First converting both in Binary number system.

6 D	3 F
0110 1001	0011 1111
	2's complement 3F
$6D_{(16)} = 01101001_{(2)}$	00111111 1's comp
	11000000
	+ 1 2's comp
	11000001
6D + C1 = 12E	1100 0001
	C 1

hence 12E

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

$$\begin{array}{rr} 0001 & 0110 \\ +0001 & 0101 \\ \hline 0010 & 1010 \end{array}$$

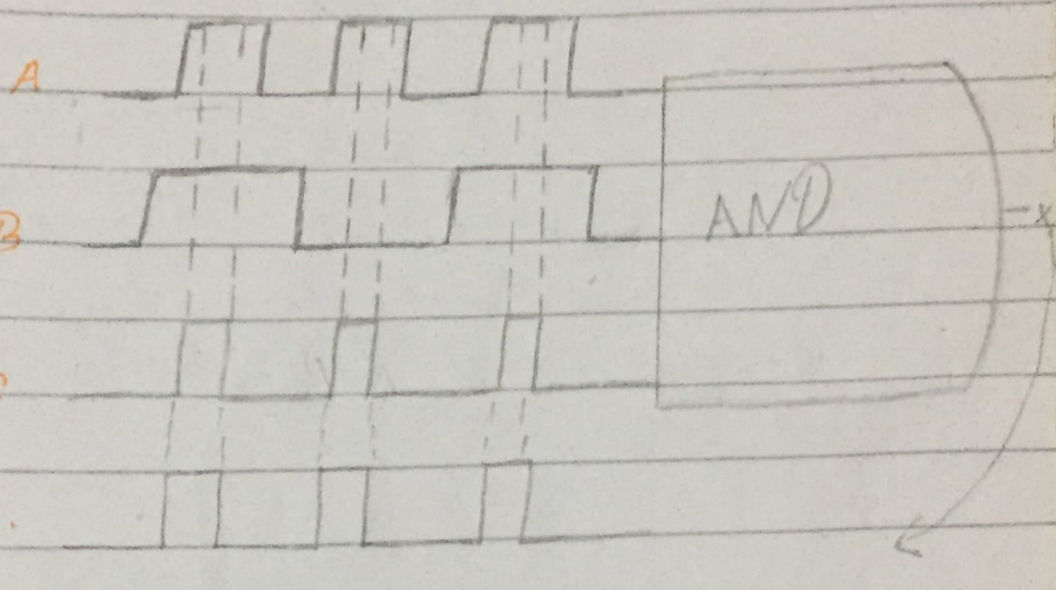
invalid due to (>9)

Add 6 to invalid code.

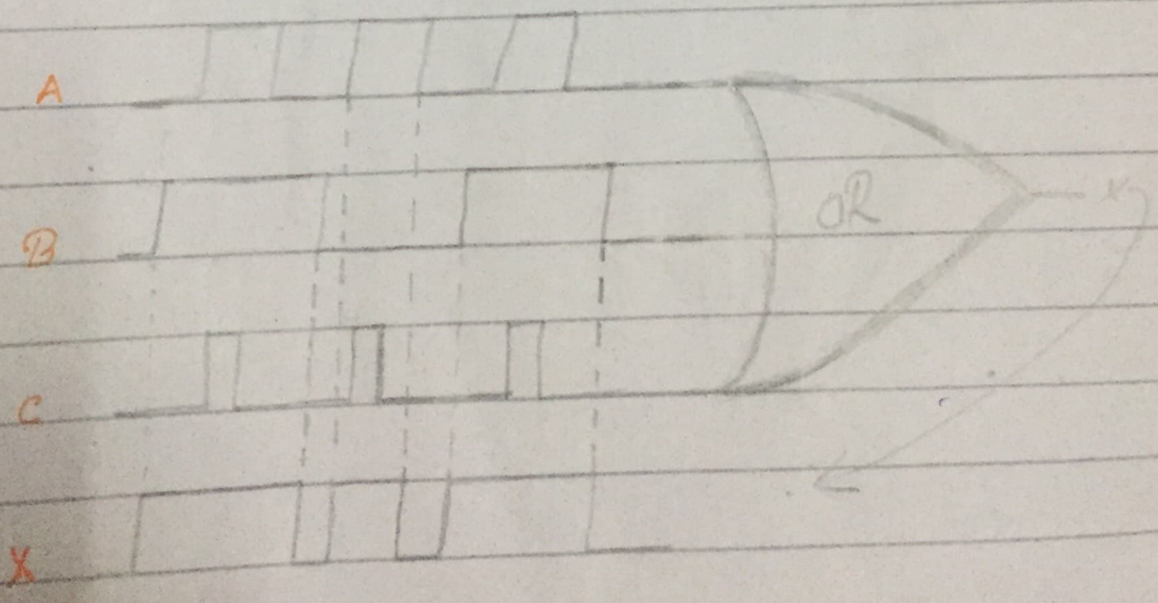
$$\begin{array}{rr} 0010 & 1011 \\ & +0110 \\ \hline 0011 & 0001 \end{array}$$

$$\begin{array}{cc} \underline{0011} & \underline{0001} \\ 3 & 1 \end{array}$$

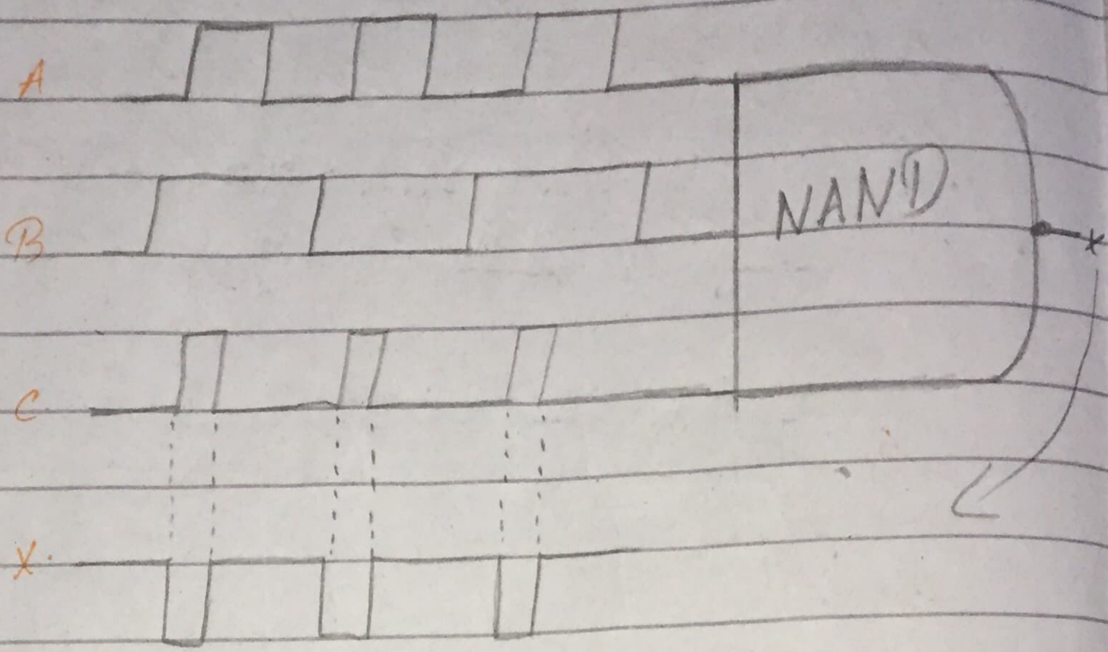
Q5) The input waveform in figure 1 is applied to a 3-input AND gate. Show the output waveform in proper relation to the input with a timing diagram.



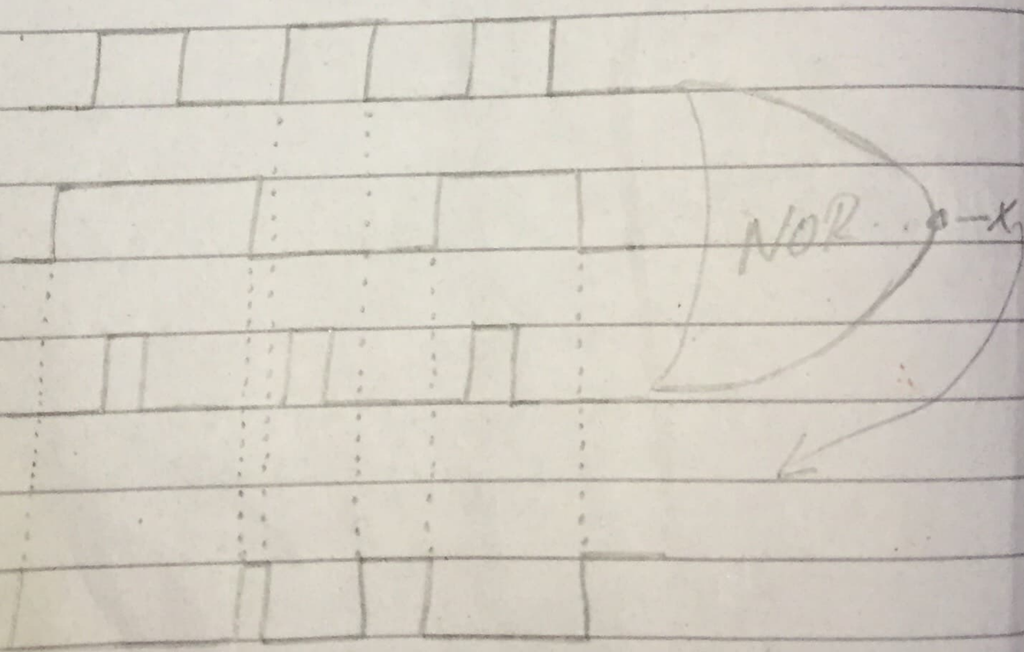
Q6) Repeat Q.5 for a 3input OR gate.



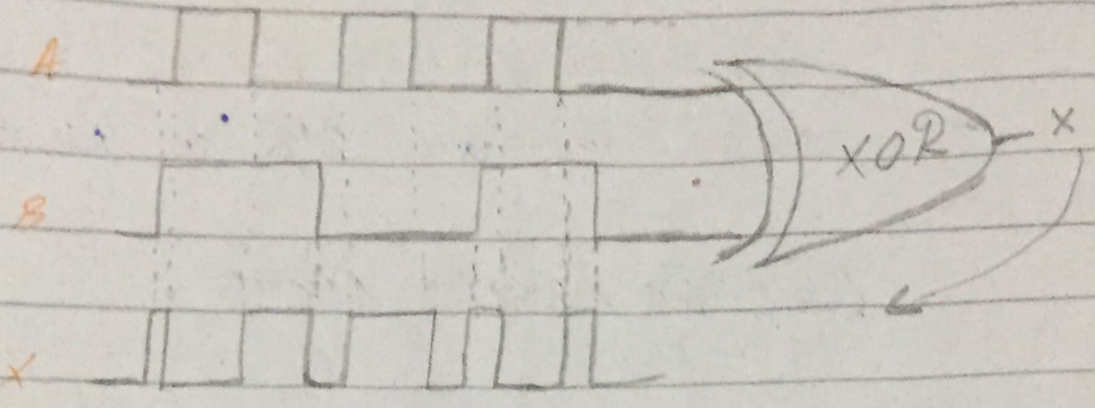
Q7) Repeat Q:5 NAND Gate



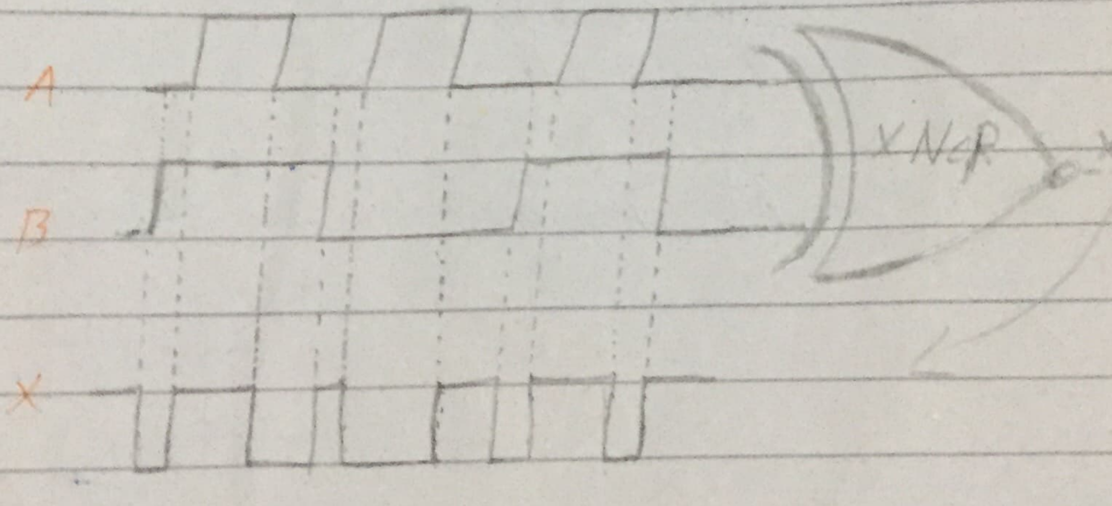
Q8) Repeat Q5 NOR Gate.



Q9) The input waveforms in figure are applied to a XOR gate, Show the output waveform with timing diagram.



Q10) Repeat Q:9 for XNOR Gate.



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Q11) using Boolean Algebra tecqniqes simply the following expression as much as possible.

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

using Boolean Algebra Rules.

$\underline{A\bar{B} + A\bar{B}C} + A\bar{B}CD + A\bar{B}CDE$

$A + AB = A$

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

$A + AB = A$

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

$A + AB = A$

$A\bar{B}$ Answer.

R.W

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

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

$A+1 = 1$

$A\bar{B}(1)$

$(A\bar{B})$

Q12) Convert the following expression into Standard (SOP) form.

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

Sol:-

First convert the given expression to SOP form.

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

Distributing:

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

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

Domain of this SOP is ACD.

Term CA is missing D

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

Term CD is missing A

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

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

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

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Term DD is missing A and C

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

Term DDA and $DD\bar{A}$ is missing 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 Resolving SOP form

$[C\bar{A}\bar{D} + C\bar{A}\bar{D} + CDA + CD\bar{A} + D\bar{A}C + D\bar{A}\bar{C} + DDAC + DDA\bar{C} + DD\bar{A}C + DD\bar{A}\bar{C}]$

Q13) write the standard Pos expression using the standard sop expression obtained in Q12. ~~and Q13~~

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

sol:-

Evalution of the Pos Expression is

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

Since there are three variable in the domain of this Expression, $2^3 = 8$ Possible combinations. four of which are contained by this Expressions the rest are:

~~(000)~~

000, 010, 011, 001

hence the equalent Pos Expressions is

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

Q14) Draw the single truth for both the standard POS and standard SOP expression obtained in Q12 and Q:13.

A	C	D	X	POS / SOP
0	0	0	0	$(A+C+D)$
0	0	1	0	$(A+C+\bar{D})$
0	1	0	0	$(A+\bar{C}+D)$
0	1	1	0	$(A+\bar{C}+\bar{D})$
1	0	0	1	$(A\bar{C}\bar{D})$
1	0	1	1	$(A\bar{C}D)$
1	1	0	1	$(AC\bar{D})$
1	1	1	1	(ACD)

POS Expression;

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

SOP Expression;

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

Q15) use a karnaugh map to ~~simply~~ simplify the following expression to minimum SOP form:

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

Sol:

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

$000 \quad 011 \quad 101 \quad 110$

AB \ C	0	1	
00	1		$(\bar{A}\bar{B}\bar{C})$
01		1	$(\bar{A}BC)$
11	1		$(AB\bar{C})$
01		1	$(A\bar{B}C)$

$(\bar{A}\bar{B}\bar{C}) + (\bar{A}BC) + (AB\bar{C}) + (A\bar{B}C)$ is minimum SOP.

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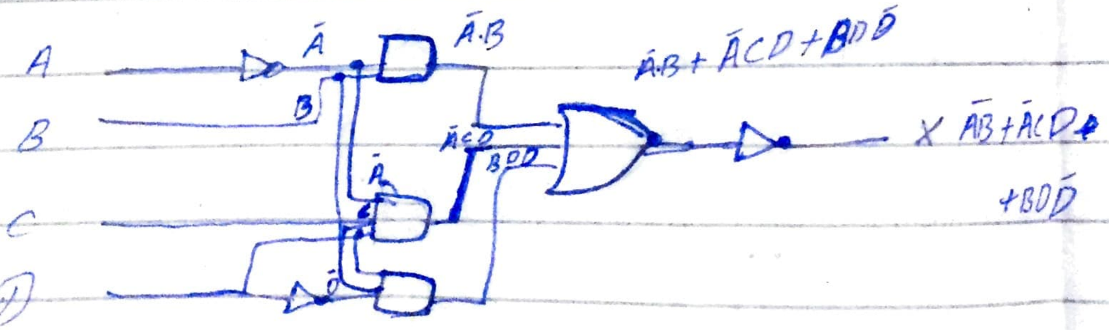
Q16) Obtain minimum POS expression from Karnaugh map used in Q:15.

AB \ C		
00	1	0
01	0	1
11	1	0
10	0	1

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

Since $(A+B+\bar{C})(A+\bar{B}+C)(A+B+\bar{C})(\bar{A}+B+C)$ is minimum POS expression.

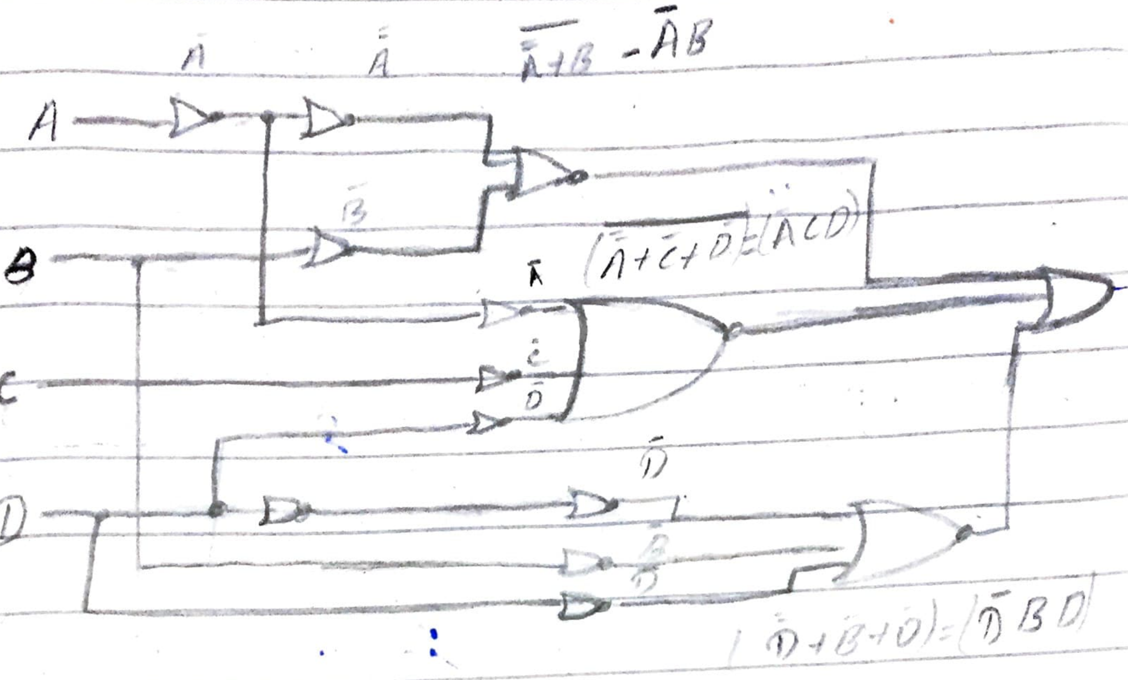
Q17) write the output expression for circute in figure.



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

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

Q18) Implement the logic circuit in Figure 3 using only NOR gates.



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

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

Q20) Implement a logic circuit for the truth table.

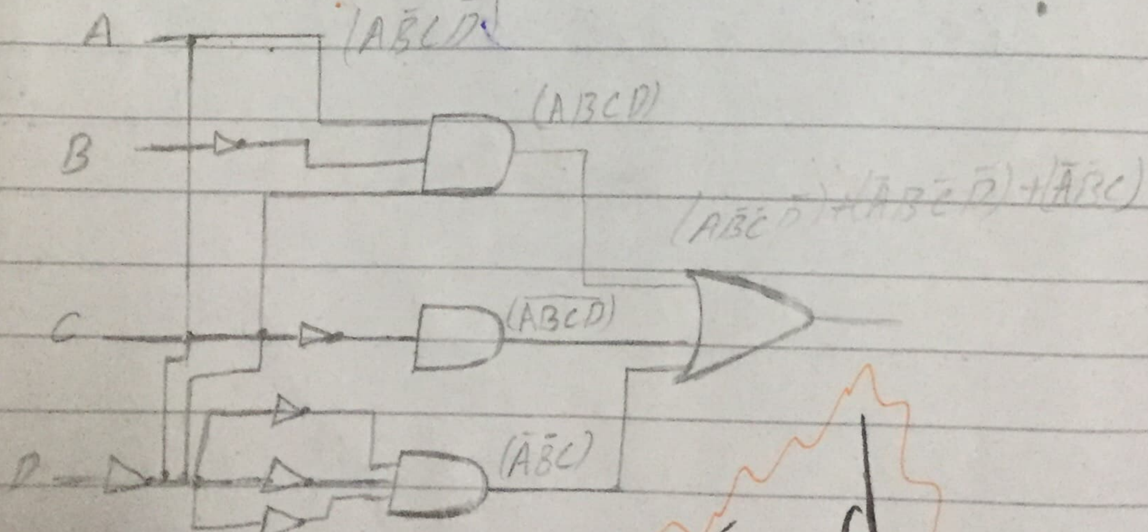
Sol:-

we obtained from truth table is.

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

using the Boolean Law

$(A\bar{B}\bar{C}\bar{D}) + (\bar{A}BC\bar{D}) + (\bar{A}\bar{B}C).$



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