Date:

Name: Rizwan Khan
ID # 17015
3rd Semester BS CS
Submitted To Sir Muhammad Amin
Digital Logic Design.

Q1 Convert each of the following

(a) $45.45_{10} = (?)_2$

Division Method

2	45
2	22 — 1
2	11 — 0
2	5 — 1
2	2 — 1
	1 — 0

101101 Now for ~~Multi~~ fraction multiplication

$0.25 \times 2 = 0.5 \quad -0$

$0.5 = 1 \quad -1$

$(101101.01)_2$ Ans.

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

Solution:

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

$(128+0.625)_{10}$

$(128.625)_{10}$ Ans.

c) $(4D7F)_{16} = (?)_{10}$

Solution:

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

$=(19839)_{10}$ Ans.

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

Solution:

16	128
	8 — 0

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

e) $(3A6F)_{16} = (?)_2$

Solution:

3	A	6	F
0011	1010	0110	1111

$(0011101001101111)_2$ Ans.

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f $(1100001111100101)_2 = (?)_{16}$

Solution:

1100 0011 1110 0101

C 3 E F

$(C3EF)_{16}$ Ans.

g $(6173)_8 = (?)_{16}$

Solution:

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

$= 3925$

$= (3925)_{10}$ Ans.

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

Solution:

$169/8 = 21.125 \rightarrow 0.125 \times 8 = 1$

$21/8 = 2.625 \rightarrow 0.625 \times 8 = 5$

$\frac{2}{8} = 0.25 \rightarrow 0.25 \times 8 = 2$

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

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i) $(2A7D)_{16} = (?)_8$

Solution:

Hexadecimal → Binary

2 A 7 D

0010 1010 0111 1101

Group of 3 for octa

010 101 001 111 101

2 7 1 7 5

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

j) $(11111111)_2$

Solution:

$1\times2^6 + 1\times2^5 + 1\times2^4 + 1\times2^3 + 1\times2^2 + 1\times2^1 + 1\times2^0$

$= 64+32+16+8+4+2+1$

$= 127$

Sign - bit 1

So

$(11111111)_2 = (-127)_{10}$

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

Solution:

$(-12)_{10} = (00001100)_2$

L $198 = (\ ?\ )_{BCD}$

Solution:

1 9 8

0001 1001 1000

$198 = (000110011000)_{BCD}$

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

Solution:

1000 1110000

8 7 0

So

$(100001110000)_2 = (870)_{10}$

N $(1001010)_2 = (\ ?\ )_{gray}$

Solution:

1 + → 0 + → 0 + → 1 + → 0 + 1 + → 0

1 1 0 1 1 1 1

$(1101111)_{Gray}$ Ans.

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

Solution:

1 0 1 0 1 1 1 1

1 1 0 0 1 0 1 0

$(11001010)_2$ Ans.

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e $(01000001)_2 = (?)$ ASCII

Solution:

$01000001 \rightarrow 65 \rightarrow 0$

$= (065)$ ASCII

Q $111000 = (?111000)$ Even Parity

Solution:

Must have even number of 1

$(11000) = (1111000)$ Even parity.

Q2 Calculate each of the following.

(a) $01111111_2 - 0000111_2$

Solution:

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

$$\begin{array}{r} 01111111 \\ +\ 11111001 \\ \hline 01111000 \end{array}$$

(01111000) Ans.

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

Solution:

$$
\begin{array}{r}
11110001 \\
\underline{00001110} \quad \text{1st comp} \\
00001111
\end{array}
$$

$$
\begin{array}{r}
01101010 \\
\times\ 00001111 \\
\hline
01101010 \\
01101010x \\
01101010xx \\
01101010xxx \\
00000000xxxx \\
00000000xxxxx \\
00000000xxxxxx \\
\underline{00000000xxxxxxx} \\
00010110110110
\end{array}
$$

Ans.

(c) $(10001000)_2 \div (00100010)_2$

Solution:

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d $60_{16} - 3F_{16}$

Solution:

3F: 00111111

2's Complement

00111111

11000000

+ 1

11000001 2's complement

$11000001 \Rightarrow C1_{16}$

Now add 60_{16} & $C1_{16}$

60

C1

34

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

0001	0110
0001	0101
0010	1011
3	1

(31) Ans.

Q3 Apply CRC to the data bits 11010011_2 using the gernator code 1010_2 to produce the tramitted CRC

D = 11010011

G = 1010

D = 11010011000000

D = 11010011000000

P = 1010

```
11010011 00000
1010
 1110
 1010
  1000
  1010
   1011
   1010
    1000
    1010
     0100
```

R ≠ 0

```
11010011 01000
1010
 1110
 1010
  1000
  1010
   1011
   1010
    1010
    1010
      00
```

R = 0

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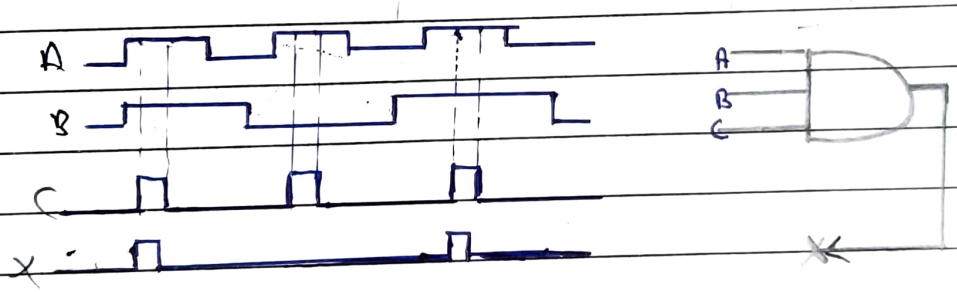
* Transmitted code (11010011010100)

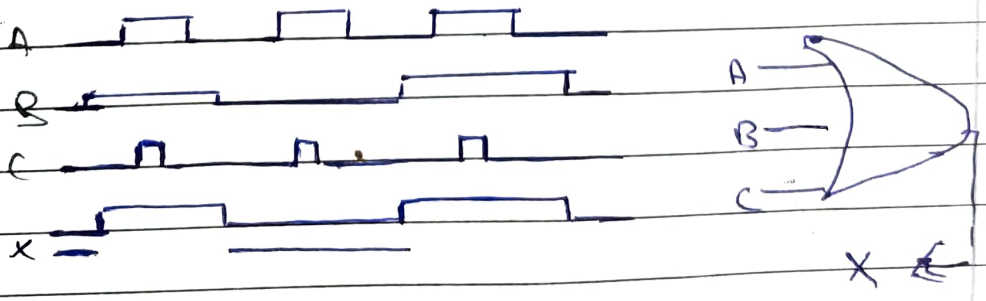
Q4 Assume that the code produced in problem Q.3 occur an error in the most significant bit during transm. Apply CRC to detect the error.

?

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



Q6 3- input OR gate



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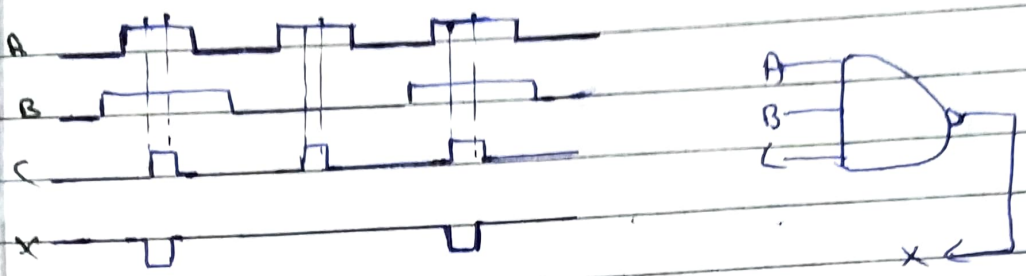
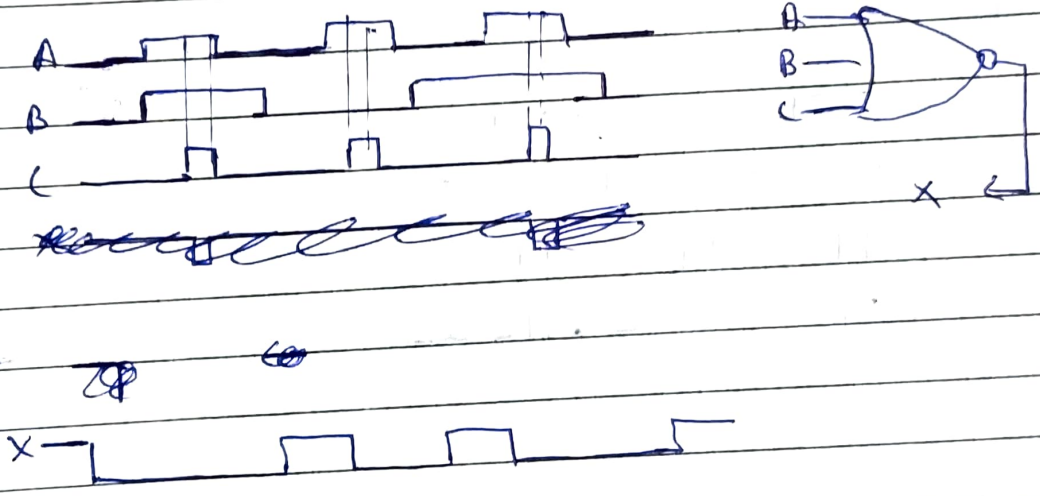
Q1 3- input NAND gate



Q2 3 - input NOR gate.



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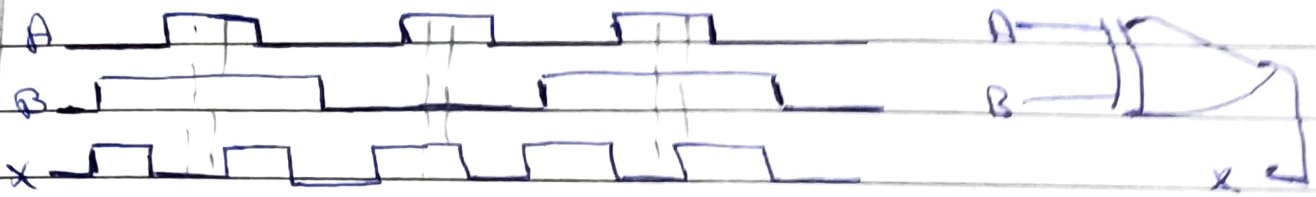
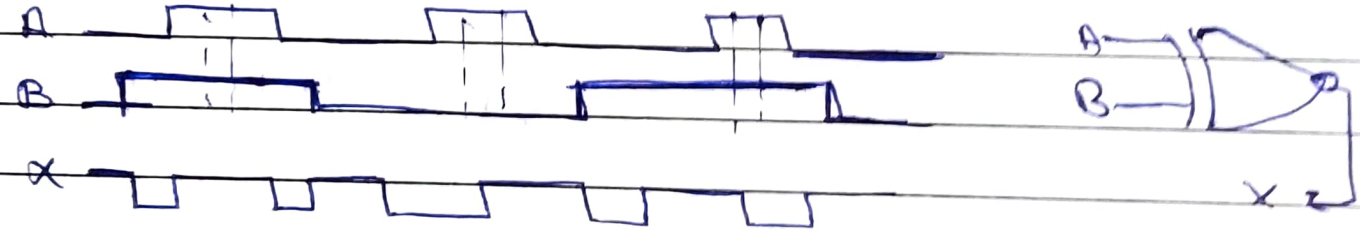
Q9 2 input XOR gate.



Q10

XNOR GATE



Q11 Using Boolean Algebra techniques, Simplify the following expressions as much as possible.

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

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

$= A\bar{B}(1) + A\bar{B}CD(1)$

$= A\bar{B} + A\bar{B}CD$

$= A\bar{B}(1+CD)$

$= A\bar{B}(1)$

$= A\bar{B}$

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Q 12 Convert the following expressions to standard SOP form $(C+D)(\bar{A}+D)$

Solution:

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

$= C\bar{A}+CD+D\bar{A}+D$ multiply missing

$= C\bar{A}(D+\bar{D})+CD(A+\bar{A})+DA(B+\bar{B})+D(A+\bar{A})$ term.

$= C\bar{A}D+C\bar{A}\bar{D}+CDA+CD\bar{A}+DA\bar{B}+D\bar{A}\bar{B}+DA+D\bar{A}$

$= C\bar{A}D+C\bar{A}\bar{D}+CDA+CD\bar{A}+DA\bar{B}+DA\bar{B}+DA(C+\bar{C})+D\bar{A}(B+\bar{B})$

$= C\bar{A}D+C\bar{A}\bar{D}+CDA+CD\bar{A}+DA\bar{B}+DA\bar{B}+DAC+DA\bar{C}+D\bar{A}B+D\bar{A}\bar{B}$

$= ACD+\bar{A}CD+\bar{A}C\bar{D}+\bar{A}\bar{C}D+A\bar{B}D+\bar{A}\bar{B}D+A\bar{B}\bar{D}+\bar{A}\bar{B}\bar{D}$.

Q 13 Write the standard POS expression using the standard SOP expression obtained in Q.12

Solution:

$ACD+\bar{A}CD+\bar{A}C\bar{D}+\bar{A}\bar{C}D+\bar{A}\bar{B}D$

$(1\,1\,1)\quad (0\,1\,1)+(0\,1\,0)+(0\,0\,1)+(1\,0\,1)$

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

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

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Q 14 Draw a single truth table for both POS and SOP expression obtained in Q12 and Q13.

A	C	D	X	POS / SOP
0	0	0	0	$A+C+D$
0	0	1	0	$A+C+\bar{D}$
1	0	1	0	$\bar{A}+C+\bar{D}$
1	1	0	0	$\bar{A}+\bar{C}+D$
0	1	0	0	$A+\bar{C}+D$
1	1	1	1	~~$A+\bar{C}+D$~~ ACD
0	1	1	1	$\bar{A}CD$
0	1	0	1	$\bar{A}C\bar{D}$
0	0	1	1	$\bar{A}\bar{C}D$
1	0	1	1	$A\bar{C}D$

POS:

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

SOP:

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

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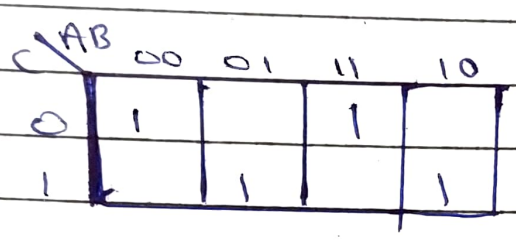
Q.15 Use a karnaugh map to simplify expression to a minimum SOP form

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

Solution:

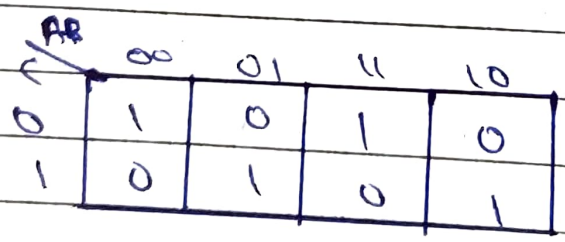
$(0\,0\,0) + (0\,1\,0) + (1\,0\,1) + (1\,1\,0)$



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

Q.16 Obtain the minimum POS expression for the karnaugh map used in Q.15

Ans:



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

Q 17 Write the output expression for circuit.

No Answer ?

Q 18 (B)

No Answer?

Q 19

9 don't know Answer.

Q 20 Implement a logic circuit for the truth table.

Solution.

$(\bar{A}\bar{B}C\bar{D}) + (\bar{A}\bar{B}CD) + (\bar{A}BC\bar{D}) + (A\bar{B}C\bar{D}) + (ABC\bar{D})$
$+ (AB\bar{C}\bar{D}) + (A\bar{B}CD) + (ABCD.$

Simplify form

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

Don't know about Gates.