Mid Exam Summer

Course Name: DLD

Submitted By:

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BS (SE-8) Section: A

Submitted To:

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Department of Computer Science,
IQRA National University, Peshawar Pakistan

Digital Logic & Design/Digital Systems

Programs: BS(CS)/BS(SE)/BS(TELC)
Course Codes: CSC-201/ SEC-201/TSC-201
EDP Codes: 102007016
Instructor: Muhammad Amin
Examination: Mid Term
Semester: Summer 2020
Total Marks: 30
Date: August 22, 2020
Timing: 2:00 pm – 6:00 pm

Q.1	Q.2	Q.3	Q.4	Q.5	Q.6	Total Marks
0.5 x 8 = 4	1 x 4 = 4	1 x 2 = 2	3 x 2 = 6	3 x 3 = 9	3 + 2 = 5	30

Q.1 Convert each of the following:

(a) $45.25_{10} = (?)_2$ (b) $01111111.1010_2 = (?)_{10}$ (c) $3A6F_{16} = (?)_2$

(d) $10101010_2 = \pm (?)_{10}$ (e) $-1_{10} = (?)_2$ (f) $156_{10} = (?)_{BCD}$

(g) $1001010_2 = (?)_{Gray}$ (h) $111000 = (?101001)_{\text{Even parity}}$ **Q.2**

Q 1)

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

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

Happened $45_{10} = 101101_2$

Now $.25$

0	.25
.	2
0	5
	2
1	0

$0.25_{10} = 0.01$

$= 101101_2 + 0.01_2$

$= 101101.01_2$

(b) $0111111.1010_2 = (?)_{10}$

$0111111.1010_2 = 0.2^7 + 1.2^6 + 1.2^5 + 1.2^4$
$+ 1.2^3 + 1.2^2 + 1.2^1 + 1.2^0 + 1.2^{-1} + 0.2^{-2} + 1.2^{-3}$
$+ 0.2^{-4}$

$= 0 + 64 + 32 + 16 + 8 + 4 + 2 + 1 + 0.5 + 0 + 0.125 + 0$

$= 127.625_{10}$

(c) $3AbF_{16} = (?)_2$

3	A	b	F
0011	1010	0110	1111

$(3A6F_{16}) = (0011\ 1010\ 0110\ 1111)_2$

(d) $10101010_2 = \pm (?)_{10}$

$10101010 = 1 \times 2^7 + 0 \times 2^6 + 1 \times 2^5 + 0 \times 2^4 + 1 \times 2^3$
$+ 0 \times 2^2 + 1 \times 2^1 + 0 \times 2^0$

$= 1 \times 128 + 0 \times 64 + 1 \times 32 + 0 \times 16$
$\times 8 + 0 \times 4 + 1 \times 2 + 0 \times 1$

$10101010_2 = (170)_{10}$

(e) $-1_{10} = (?)_2$

$-1_{10} = (?)_2$

$$\begin{array}{r|l|l} 2 & -1 & \\ \hline & 0 & \underline{1} \end{array}$$

$(1) = (-1)_2$

(f) $156_{10} = (?)_{BCD}$

1 5 6

0001 0101 0110

$(156)_{10} = (0001\ 0101\ 0110)_{BCD}$

(g) $1001010_2 = (?)_{Gray}$

$1001010 = ?$

$g_6 = b_6 = 1$

$g_5 = b_6 \oplus b_5 = 1 \oplus 0 = 1$

$g_4 = b_5 \oplus b_4 = 0 \oplus 0 = 0$

$g_3 = b_4 \oplus b_3 = 0 \oplus 1 = 1$

$g_2 = b_3 \oplus b_2 = 1 \oplus 0 = 1$

$g_1 = b_2 \oplus b_1 = 0 \oplus 1 = 1$

$g_0 = b_1 \oplus b_0 = 1 \oplus 0 = 1$

$1001010_2 = (1101111)_{Gray\ code}$.

(h) $111000 = (?\,101001)_{Even\ parity}$

101001 is odd since it's not divisible by 2, As remainder is equal to 1, when divid by (2).

Q. 2 Calculate each of the following:

(a) $9B_{16} + 8A_{16}$ (b) $F7_{16} - D6_{16}$ (c) $1100_2 + 1011_2$ [Use modulo-2]

(d) $01111111_2 - 00000111_2$ [use 2's complement]

Q2)

(a) $9B_{16} + 8A_{16}$

Sol :

$$\begin{array}{ccc} & 1 & \\ 1 & 9 & B \\ + & 8 & A \\ \hline & 2 & 5 \end{array}$$

① $= B_{16} + A_{16} \Rightarrow 11_{10} + 10_{10}$

$\Rightarrow 21_{10}$

$= 16 \times 1 + 5 \Rightarrow 15_{16}$

Sum $= 5$, carry $= 1$

② $\Rightarrow 1 + 9_{16} + 8_{16}$

$\Rightarrow 1 + 9_{10} + 8_{10}$

$= 18_{10} \Rightarrow 16 \times 1 + 2$

$= 12_{16}$

Sum $= 2$, carry $= 1$

(b) $F7_{16} - D6_{16}$

Sol :

$$\begin{array}{ccc} & F & 7 \\ - & D & 6 \\ \hline & 2 & 1 \end{array}$$

$\therefore 7 - 6$, $7 > 6$

So, $\Rightarrow 7 - 6 \Rightarrow 1_{16}$

$\therefore F - D$, $F = 15, D = 1$

$= 15 - 13 = 2_{16}$

(c) $1100_2 + 1011_2$

Sol :-

①

$$\begin{array}{r} 1\ 1\ 0\ 0 \\ +\ 1\ 0\ 1\ 1 \\ \hline 0\ 1\ 1\ 1 \end{array}$$

①
$\therefore 0_2 + 1_2 \Rightarrow 0_{10} + 1_{10}$

$\Rightarrow 1_{10} = 1_2$

Sum = 1

②
$\therefore 0_2 + 1_2 \Rightarrow 0_{10} + 1_{10}$

$= 1_{10} \Rightarrow 1_2$

Sum = 1

③
$\therefore 1_2 + 0_2 \Rightarrow 1_{10} + 0_{10}$

$\Rightarrow 1_{10} \Rightarrow 1_2$

Sum = 1

④
$\therefore 1_2 + 1_2 \Rightarrow 1_{10} + 1_{10}$

$= 2_{10} \Rightarrow 2 \times 1 + 0$

$= 10_2$, Sum = 0, carry = 1

(d) $01111111_2 - 00000111_2$

Sol :-

$$\begin{array}{r} 1\ 1\ 1\ 1\ 1\ 1\ 1 \\ -\ 0\ 0\ 0\ 0\ 1\ 1\ 1 \\ \hline 1\ 1\ 1\ 1\ 0\ 0\ 0 \end{array}$$

①
$\therefore 1 - 1 \Rightarrow 0$

$\Rightarrow 0_2$

②
$\therefore 1 - 1 \Rightarrow 0_2$

③
$\therefore 1 - 1 \Rightarrow 0_2$

④
$\therefore 1 - 0 \Rightarrow 1 > 0$

$\Rightarrow 1 - 0 \Rightarrow 1_2$

⑤
$\therefore 1 > 0 \Rightarrow 1 - 0$

$\Rightarrow 1_2$

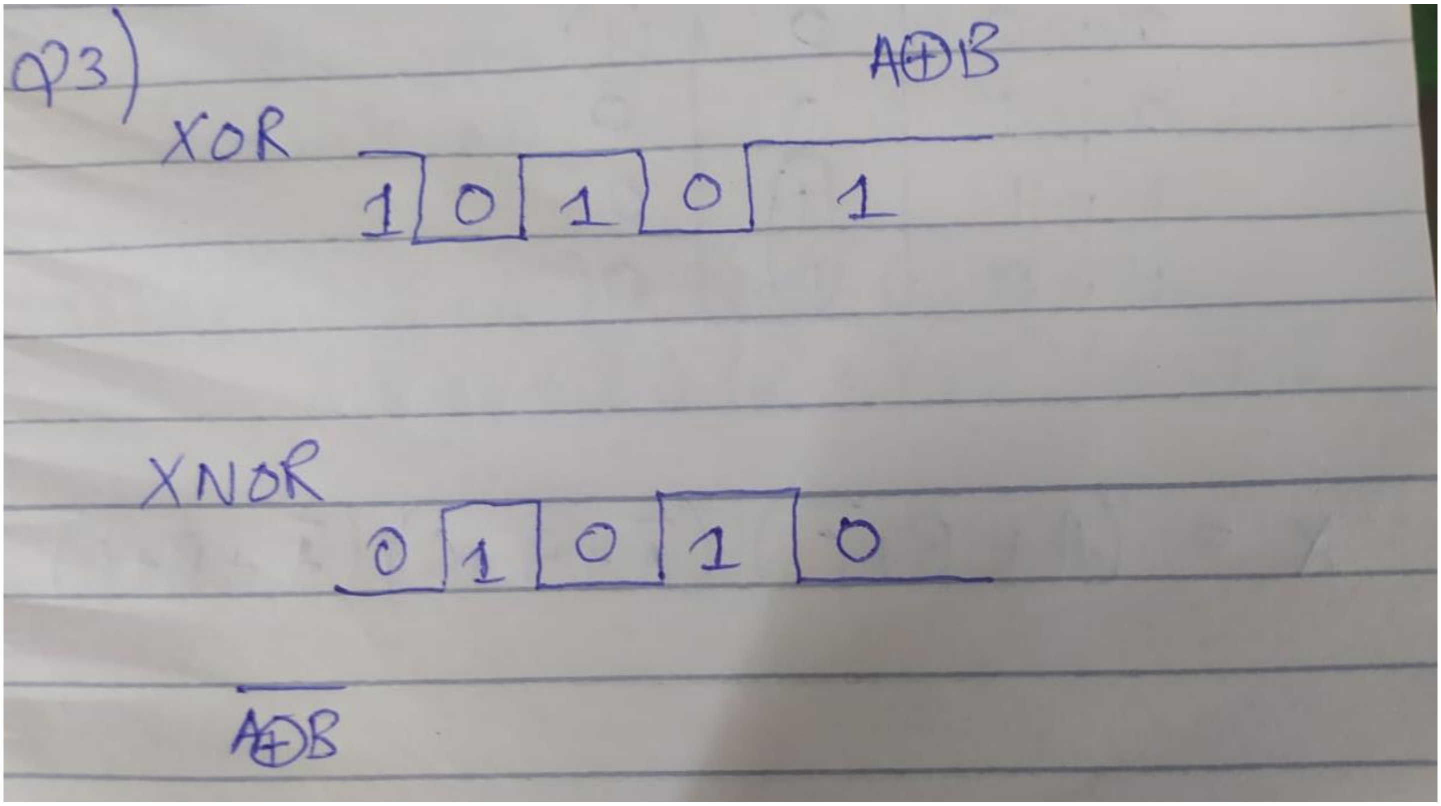
⑥
$\therefore 1 > 0 \Rightarrow 1 - 0$

$\Rightarrow 1_2$

⑦
$\therefore 1 > 0 \Rightarrow 1 - 0$

1_2

Q.3 Determine the output waveforms for the XOR and XNOR gates, given the input waveforms, A and B, in Figure 01.



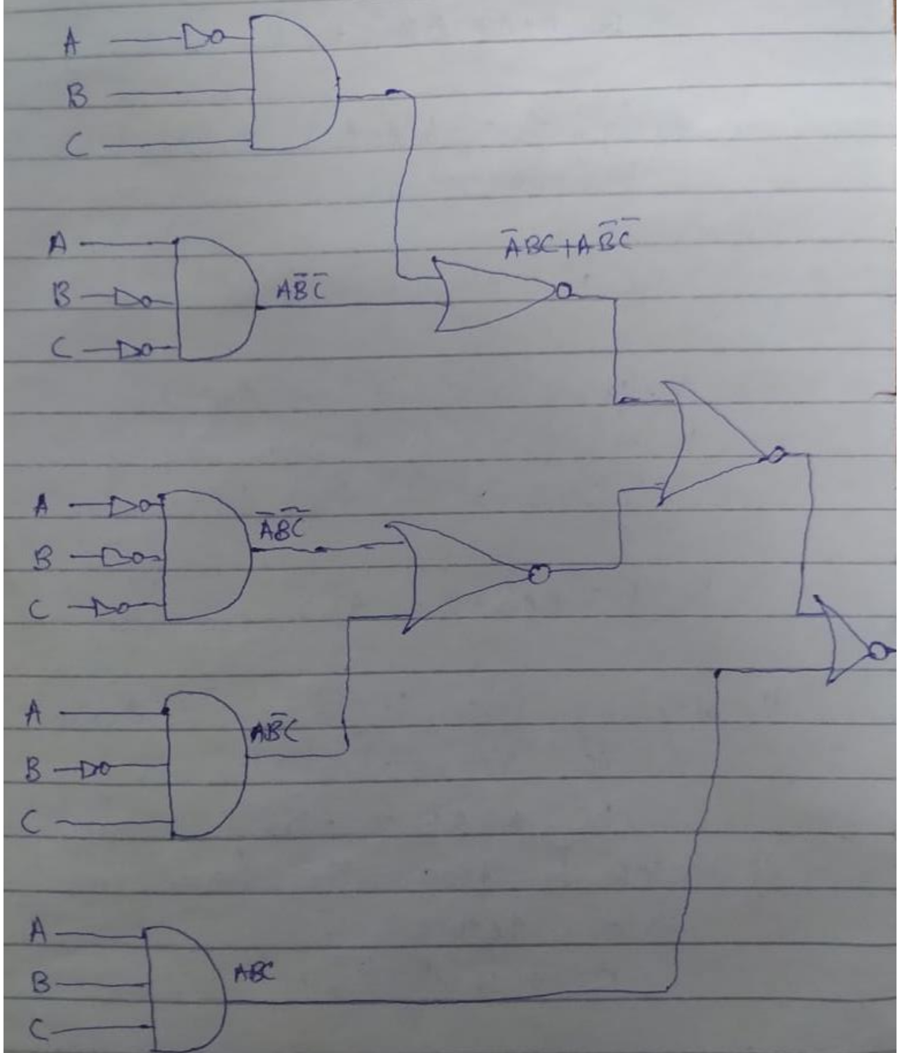
Q.4 (a) Draw the logic circuit for the following expression:

$$X = \overline{A}BC + A\overline{B}\,\overline{C} + \overline{A}\,\overline{B}\,\overline{C} + AB\overline{C} + ABC$$

(b) Using Boolean algebra, simplify the expression given in part (a).

Q 4 (A)

$x = \bar{A}BC + \bar{A}\bar{C} + \bar{A}\bar{B}\bar{C} + A\bar{B}C + ABC$



$= \bar{A}BC + A\bar{B}\bar{C} + \bar{A}\bar{B}\bar{C} + A\bar{B}C + ABC$

Q4) (b)

Sol :-

1) Factor BC out of the first & last

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

2) Applying rule 6 $(\bar{A}+A=1)$ to the term in parenthesis,

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

3) Applying rule 4 (drop the 1) to the first term and rule 6 $(\bar{C}+C=1)$ to the term

$BC + A\bar{B}\cdot 1 + \bar{A}\bar{B}\bar{C}$

4) Applying rule 4 (drop the 1) to the 2nd term

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

5) Factor $\bar{B}$ from the second and third terms

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

6) Applying rule 11 $(A + \bar{A}\bar{C} = A + \bar{C})$ to the term in parentheses

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

7) Use the distributive and Cummutative Laws to get the following expression.

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

Q.5 (a) Convert the following expressions to standard SOP form: $A = \overline{X}+\overline{Y}+Z$

(b) Convert the standard SOP expression obtained in part (a) to standard POS form.

(c) Develop a single truth table for the standard SOP and standard POS expressions obtained in part (a) and part (b) respectively.

Q5) part (a)

$$A = \overline{\overline{X+Y}+Z}$$

Solution :

$$A = \overline{\bar{X} + \bar{Y} + Z}$$

$$A = \bar{\bar{X}} \;\bar{+}\; \bar{\bar{Y}} \;\bar{+}\; \bar{Z}$$

$$A = X \cdot Y \cdot \bar{Z}$$

part (b)

$$A = XY\bar{Z}$$

There are total 8 combinations
the SOP contains 1 of these,
So the POS must contains
the other 7 which are
000, 010, 011, 100, 101, 110, 111

$$(X+Y+Z)(X+\bar{Y}+Z)(X+\bar{Y}+\bar{Z})(\bar{X}+Y+Z)$$
$$(\bar{X}+Y+\bar{Z})(\bar{X}+\bar{Y}+Z)(\bar{X}+\bar{Y}+\bar{Z})$$

part (c)

X	Y	Z	Expressions
0	0	0	$(x+y+z)$
0	0	1	$(x\,y\,\bar{z})$
0	1	0	$(x+\bar{y}+z)$
0	1	1	$(x+\bar{y}+z)$
1	0	0	$(\bar{x}+y+z)$
1	0	1	$(\bar{x}+y+\bar{z})$
1	1	0	$(\bar{x}+\bar{y}+z)$
1	1	1	$(\bar{x}+\bar{y}+\bar{z})$

Q.6 (a) Use a Karnaugh map to find the minimum SOP form for the following expression: $X = \bar{A}\bar{B}\bar{C} + \bar{A}\bar{B}C + \bar{A}B\bar{C} + AB\bar{C} + ABC + AB\bar{C}$

(b) Determine minimum POS form the Karnaugh map used in part (a).

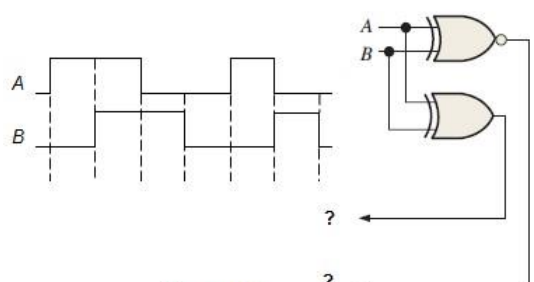


Figure 01

Q6 Part a)

$$X = \bar{A}\bar{B}\bar{C} + A\bar{B}\bar{C} + \bar{A}\bar{B}\bar{C} + ABC + A\bar{B}C$$

A	B	C = 0	C = 1
0	0	1	
0	1	1	1
1	1		1
1	0		1

part (b)

A	B	0	1
0	0	0	1
0	1	0	0
1	1	1	0
1	0	1	0

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

*********Wish You All the Best*********