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DATA LOGIC & DESIGN

(Mid-Term) Paper

Student Name : AAMIR SALEEM
Student ID : 12290
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Instructor : Muhammad Ameen
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Q1: Convert the following;

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

Sol

2	45	=	1
2	22	=	0
2	11	=	1
2	5	=	1
2	2	=	0
	1		

101101

2	.25	=	0.
2	.5	=	0
2	2	=	
	1		

0.01

$45.25 = 101101.01_2$ Ans.

(b) $01111111.1010_2 = 127.625_{10}$

Sol:

$0\times2^7 + 1\times2^6 + 1\times2^5 + 1\times2^4 + 1\times2^3 + 1\times2^2 + 1\times2^1 + 1\times2^0$
$+ 1\times2^{-1} + 0\times2^{-2} + 1\times2^{-3} + 0\times2^{-4} =$
$0+64+32+16+8+4+2+1+0.5+0+0.125+0 =$

$= 127.625_{10}$ Ans.

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Q1 (c) $3A6F_{(16)} = (?)$

Sol:

Conversion to decimal

$3A6F_{16} = 3\times16^3 + 10\times16^2 + 6\times16^1 + 15\times16^0 = 12288 + 2560 + 96 + 15$

$= 14959_{(10)}$

Conversion to binary

2	14959	= 1
2	7479	= 1
2	3739	= 1
2	1869	= 1
2	934	= 0
2	467	= 1
2	233	= 1
2	116	= 0
2	58	= 0
2	29	= 1
2	14	= 0
2	7	= 1
2	3	= 1
	1	

$14959_{10} = 11101001101111_2$ Answer

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Q1 (d) $10101010_2 = \pm (?)_{10}$

Sol:

$10101010_2 = 1\times2^7+0\times2^6+1\times2^5+0\times2^4+1\times2^3+0\times2^2+1\times2^1$
$+0\times2^0 = 128+0+32+0+8+0+2+0 = 170$

$10101010_2 = 170_{10}$ Ans.

Q1 (e) $-1_{10} = (?)_2$

Sol:

$-1_{10} = -1_2$ Ans.

Q1 (f) 156_{10} = BCD

Sol:

1 = 0001 5 = 0101 6 = 0110

$= 000101010110_{BCD}$ Ans.

Q1 (g) 1001010_2 = Gray.

Sol:

1101111_{Gray} Answer

Q1 (h) 111000 = (?101001) Even parity.

Sol:-

111000 the number of 1's is odd, so

111000 = (1101001) Ans
Even parity.

Q2 Calculate the following;

(a) 9B + 8A

Solution:

B to Dec = 11

A to Dec = 10

So,

~~9 11~~ 9B

~~8 10~~ + 8A

~~21~~ [125] Ans.

∴ All addition values are converted back to Hex.

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

Solution:

F7

− D6

[21] Ans.

(c) $1100_2 + 1011_2$

Solution:

1100

+ 1011

10111 Ans.

(d) $01111111_2 - 00000111_2$

Solution:

1 1 1 1 1 1 1

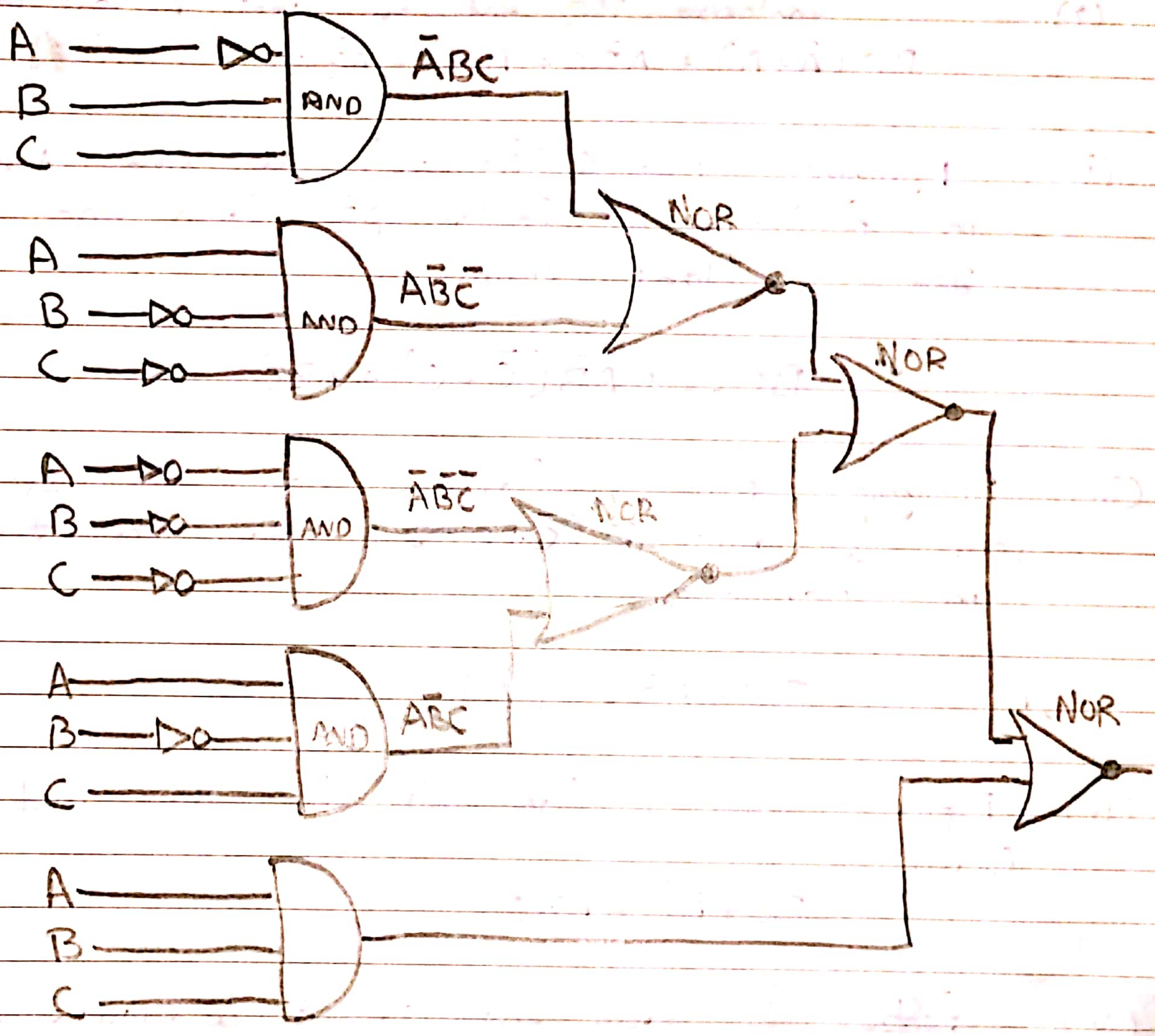
− 0 0 0 0 1 1 1

1 1 1 1 0 0 0 Ans.

Date:

Q4: (a) Draw logic circuit for the following expression;

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



Q4 (b) Using boolean algebra simplify the expression in (a)

Solution:-

(i) Factorize BC out of first & last terms

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

(ii) Applying rule 6 $(\bar{A}+A=1)$ to the term in parathesis & factor $A\bar{B}$ from the 2nd & last terms

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

(iii) Applying rule 4 (drop 1) to the 1st term & rule 6 $(\bar{C}+C=1)$ to the term in paranthesis.

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

(iv) Apply rule 4 (drop 1) to the 2nd term

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

(v) Factor $\bar{B}$ from the second & third terms.

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

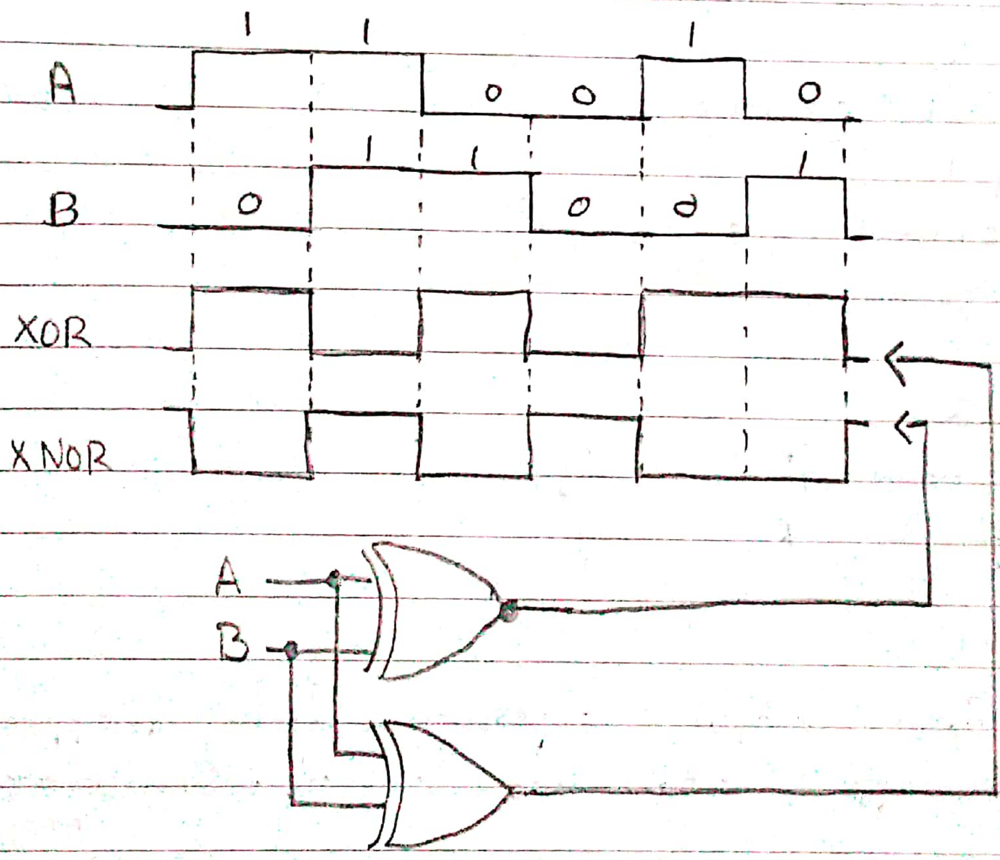
(vi) Applying rule 11 $(A+\bar{A}\bar{C} = A+\bar{C})$ to the term in paranthesis

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

(vii) Using distributive & commutative laws to get the following expression;

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

Q3 Determine the output waveform for XOR & XNOR gate, give the input waveforms A & B



Solution:

When XOR is 1
XNOR is 1 on opposite levels.

Q6:(a) Use a karnaugh map do find the minimum SOP form.

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

Step 1: input $\Sigma(0,2,4,5,6,7)$

	$\bar{B}\bar{C}$	$\bar{B}C$	BC	$B\bar{C}$
$\bar{A}$	(1) 0	0 1	0 3	(1) 2
A	(1) 4	(1) 5	(1) 7	(1) 6

Step 2:- Cell grouping

Group 1

positions = {0, 2, 4, 6}

Expression = $\bar{C}$

	$\bar{B}\bar{C}$	$\bar{B}C$	BC	$B\bar{C}$
$\bar{A}$	1	0	0	1
A	1	0	0	1

Group 2

positions = {4, 5, 7, 6}

Expression = A

	$\bar{B}\bar{C}$	$\bar{B}C$	BC	$B\bar{C}$
$\bar{A}$	0	0	0	0
A	1	1	1	1

Step 3:- Form output expression from mapped & unmapped variables output = sum (unmapped & mapped cells)

$$y = \bar{C} + A$$

Answer.

Q6 (b) Minimum POS form the karnaugh map used in part (a)

Ans:- Solution:-

Product of sums

Map

	$\bar{C}$	C
$\bar{A}\bar{B}$	1	0
$\bar{A}B$	1	0
AB	1	1
$A\bar{B}$	1	1

map layout

	$\bar{C}$	C
$\bar{A}\bar{B}$	0	1
$\bar{A}B$	2	3
AB	6	7
$A\bar{B}$	4	5

$\bar{y} = \bar{A}.C$

$\bar{\bar{y}} = \overline{\bar{A}.C}$

$y = (A + C')$

Truth table =

S.No	A	B	C	Y
0	0	0	0	1
1	0	0	1	0
2	0	1	0	1
3	0	1	1	0
4	1	0	0	1
5	1	0	1	1
6	1	1	0	1
7	1	1	1	1

Q5. (a) Conversion to SOP form

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

Solution:

$A = \overline{\bar{x} + \bar{y} + z}$

$A = \bar{\bar{x}} + \bar{\bar{y}} + \bar{z}$

$A = x \cdot y \cdot \bar{z}$

(b) Conversion to POS form.

Solution:

Total combinations are 8

Sop contains 1 of these

So the POS must contains the other 7 which are

000, 010, 011, 100, 101, 110, 111

$(x+y+z)(x+\bar{y}+z)(x+\bar{y}+z)(\bar{x}+y+z)$
$(\bar{x}+y+\bar{z})(\bar{x}+\bar{y}+z)(\bar{x}+\bar{y}+\bar{z})$

(c) Truth table

x	y	z	Exp
0	0	0	$x+y+z$
0	0	1	$xy\bar{z}$
0	1	0	$x+\bar{y}+z$
0	1	1	$x+y+z$
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	$\bar{x}+\bar{y}+\bar{z}$