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SECTION : A

SEMESTER : 4th BS(SE)

SUBJECT : DIGITAL LOGIC AND DESIGN

INSTRUCTOR : MUHAMMAD AMIN

EXAMINATION : MIDTERM EXAM

Q3) **CONVERT THE FOLLOWING:**

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

SOLUTION:

We first take 45

2	45
2	22 - 1
2	11 - 0
2	5 - 1
2	2 - 1
	1 - 0 ↑

101 10

Now we take .25

$.25 \times 2 = 1$

$0.5 \times 2 = 1$

$1 = 1$ ↑

Now combining all

10110111

So $(45.25)_{10} = (10110111)_2$

$\boxed{(10110111)_2}$ Ans

b) $01111111 . 1010_2 = (?)_{10}$

SOLUTION:

$$(0 \times 2^7) + (1 \times 2^6) + (1 \times 2^5) + (1 \times 2^4) + (1 \times 2^3)$$
$$(1 \times 2^2) + (1 \times 2^1) + (1 \times 2^0)$$

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

$$= 127$$

Now $.1010$

$$(1 \times 2^{-1}) + (0 \times 2^{-2}) + (1 \times 2^{-3}) + (0 \times 2^{-4})$$

$$= -8 + 0 + (-2) + 0$$

$$= -8 - 2$$

$$= -10$$

Now $(01111111.1010_2) = (127.-10)$

$$\boxed{(01111111.1010)_2 = (127.-10)_{10}}$$

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

SOLUTION:

First we'll write down the hexa number.

3	A	6	F
3	10	6	15
↓	↓	↓	↓
0011	1010	0110	1111

Now read 1's and 0's from left to right to get hena binary number.

$$(3A6F)_{16} = (0011101001101111)_2$$

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

SOLUTION:

10101010

$(1 \times 2^7) + (0 \times 2^6) + (1 \times 2^5) + (0 \times 2^4) + (1 \times 2^3)$
$(0 \times 2^2) + (1 \times 2^1) + (0 \times 2^0)$

$= 128 + 0 + 32 + 0 + 8 + 0 + 2 + 0$

$= 170$

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

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

SOLUTION:

Use compliments

$1 = 00000001$

$-1 = 11111110$

So now take compliments

```
  1111110
        1
-------------
  1111111
  1111110
-------------
 100000001
```

$$(-1)_{10} = (100000001)_2$$

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

SOLUTION:

BCD code for 156

1	5	6
↓	↓	↓
0001	0101	0110

$$(156)_{10} = (000101010110)_{BCD}$$

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

SOLUTION:

Binary	gray
0000	0000
0001	0001
0010	0010
0011	0011
0100	0100

Binary = 1001010

gray = 11001111

$(1001010)_2 = (11001111)_{gray}$

h) $111000 = (?101001)_{G.P}$

SOLUTION:

Even parity

(0101010)

Even -

Q3) Calculate each of the following.

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

SOLUTION:

$9B_{16} + 8_{16}$ — 1010

$9 \rightarrow 1001$, $B \rightarrow 1011$

$8 \rightarrow 1000$

$\Rightarrow (10011011)_2$

$+ (10001010)_2$

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

$(2\ 2\ 5)_{16}$

$(125)_{16}$ Ans

Q2
b) $F.7_{16} - D6_{16}$

SOLUTION:

$$(F7)_{16}$$
$$- (D6)_{16}$$

$(F7)_{16}$

1 5 7

$(D6)_{16}$

1 3 6

$$1\ 5\ 7$$
$$-1\ 3\ 6$$

$(2\ 1)_{16}$ $\boxed{(21)_{16}}$ Ans

2

d) 01111111_2 = 00000111 (use 2's compliment)

SOLUTION:

```
  1 1 1 1 1 1 1 1
  0 0 0 0 0 1 1 1
-----------------
  1 1 1 1 1 0 0 0
```

Now add 1 : 11111000 + 1 = 11111001

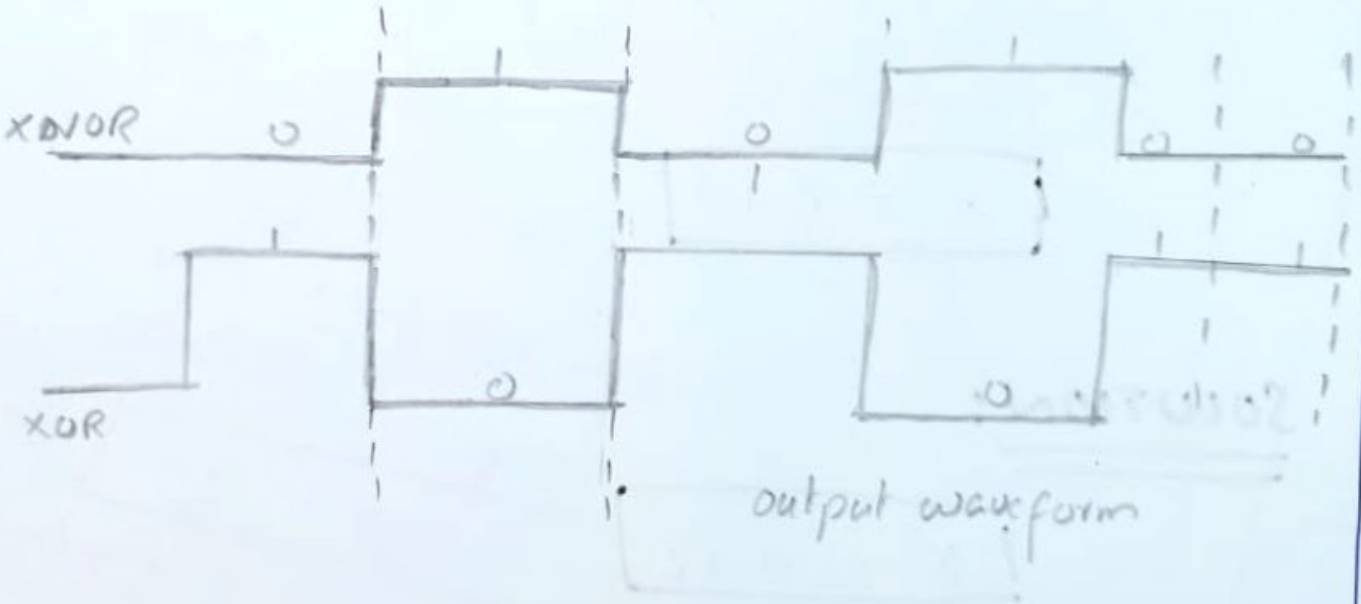
```
  1 1 1 1 1 1 1 1
    0 1 1 1 1 1 1 1
+   1 1 1 1 1 0 0 1
-------------------
  1 0 1 1 1 1 0 0 0
```

01111000

Ans

Q
3) **SOLUTION:**

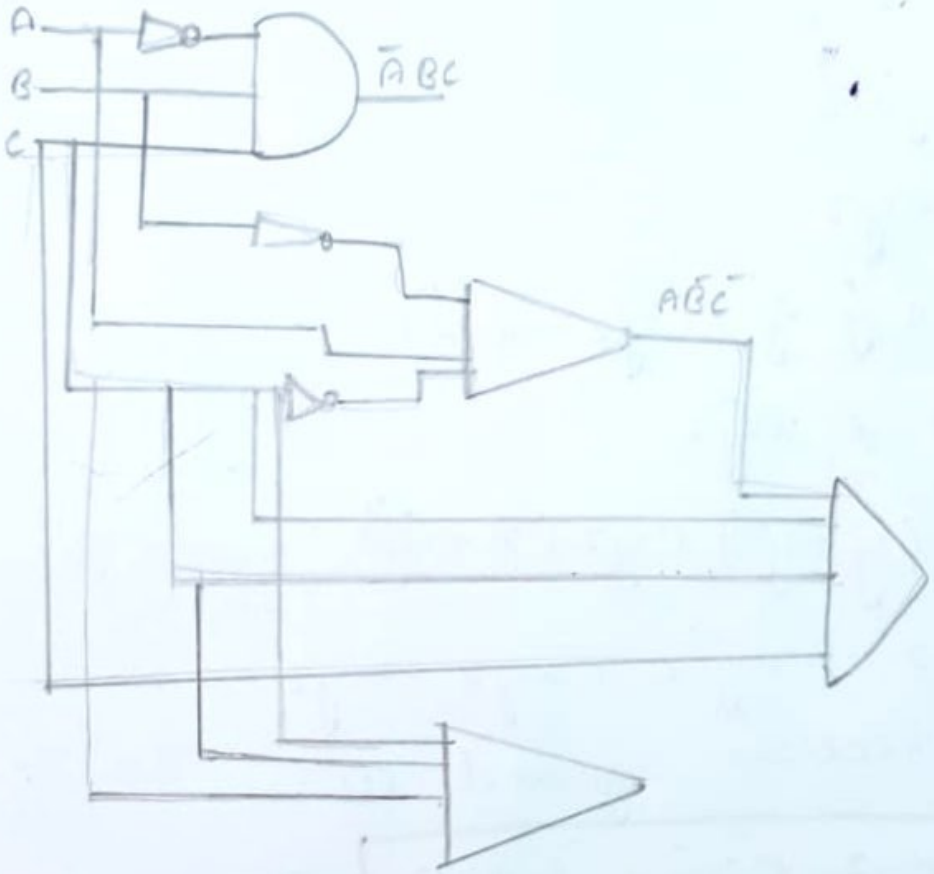
A	B	XNOR	XOR
1	0	0	1
1	1	1	0
0	1	0	1
0	0	1	0
1	0	0	1
0	1	0	1



Q4 DRAW LOGIC CIRCUIT FOR

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

SOLUTION:



Q 4) b)

SIMPLIFICATION BY BOLEAN ALGEBRA:

SOLUTION:

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

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

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

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

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

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

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

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

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

$$= BC + A(B + C)$$

$$= AB + ABC + AC + \bar{A}B\bar{C} + ABC$$

Q5)

a) **SOLUTION:**

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

To standard SOP

$$= \overline{xy + z}$$

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

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

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

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

$$= xz(y+\bar{y}) + yz(x+\bar{x})$$

$$= xyz + x\bar{y}z + xyz + \bar{x}yz$$

Duplication ignored so

$$= \boxed{xyz + x\bar{y}z + \bar{x}yz}$$ SOP form

b) $\overline{xyz + x\bar{y}z + \bar{x}yz}$

to POS form

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

Q5
c)

TRUTH TABLE:

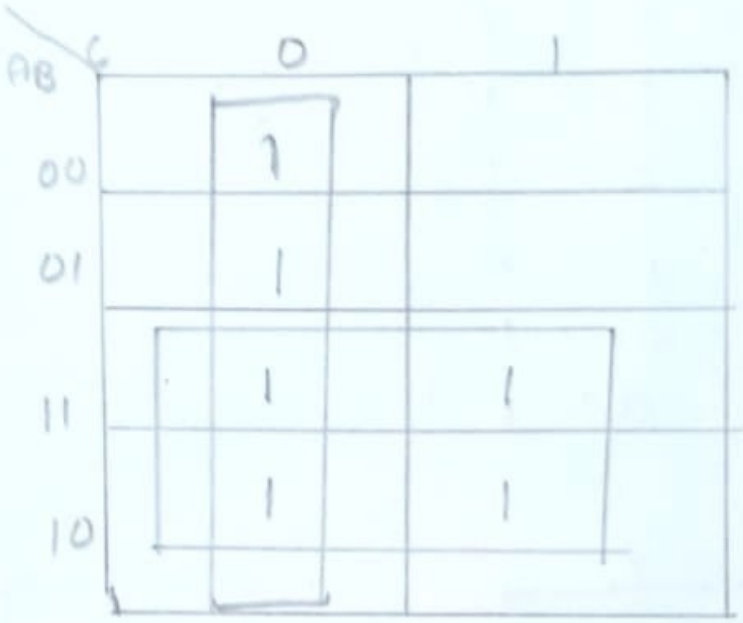
SOLUTION:

x	y	z	output
0	0	0	0
0	0	1	0
0	1	0	0
0	1	1	1
1	0	0	0
1	0	1	1
1	1	0	0
1	1	1	1

Q 6)

a) **SOLUTION:**

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



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

b) **SOLUTION:**

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