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Assignment 1

Question 1:

Step	Operation	Result	Remainder
1	2347/2	1173	1
2	1173/2	586	1
3	586/2	293	0
4	293/2	146	1
5	146/2	73	0
6	73/2	36	1
7	36/2	18	0
8	18/2	9	0
9	9/2	4	1
10	4/2	2	0
11	2/2	1	0
12	1/2	0	1

$2347_{10} = (100100101011)_2$

b)

Step	Operation	Result	Remainder
1	98721/8	12340	1
2	12340/8	1542	4
3	1542/8	192	6
4	192/8	24	0
5	24/8	3	0
6	3/8	0	3

$98721_{10} = 300641_8$

Step	Operation	Result	Remainder
1	582/16	36	6
2	36/16	2	4
3	2/16	0	2

$582_{10} = 246_{16}$

c)

Step	Operation	Result	Remainder
1	13/2	6	1
2	6/2	3	0
3	3/2	1	1
4	1/2	0	1

Step	Operation	Result	Integer Part
1	0.625 2	1.25	1
2	0.25 2	0.5	0
3	0.5 2	1	1

$13.625_{10} = 1101.101_2$

Question 2:

$35_{10} = 0100011_2$

$4010 = 0101000_2$

34 + 40 in 2's complement

	0	1	0	0	0	1	1
+	0	1	0	1	0	0	0
	1	0	0	1	0	1	1

There is an overflow as the sign is changed, so the result is wrong.

b)

35-40:

$35_{10} = 0100011_2$ (7 bits)
-40 in 2's complement.
$40_{10} = 0101000_2$

0	1	0	1	0	0	0	Inverse 0to 1 and visversa
1	0	1	0	1	1	1	+1
1	0	1	1	0	0	0	-40 in 2's complement

	0	1	0	0	0	1	1
+	1	0	1	1	0	0	0
	1	1	1	1	0	1	1

<u>There is no overflow.</u>
35-40 = (1111011) 2's complement.
c)

from previous question we have -40 in 2' complement.

0	1	0	0	0	1	1	35 in binary 7 bits
1	0	1	1	1	0	0	Inverse 0to 1 and vise-versa
1	0	1	1	1	0	1	+1
							-35 in 2's complement

Cout 1	Cin 0		Cin 1				
	1	0	1	1	1	0	1
+	1	0	1	1	0	0	0
1	0	1	1	0	0	0	1

-35-40 = (0110001) 2's complement. The sigh is changed and The correct binary result for -35-40 cannot be correct in 7 bits it will in in 8 bits. Thus, and overflow is happened.

<u>Question 3:</u>

$(A+B)'(A'+B')'$	
$A'B'(A'+B')'$	DeMorgans Law
$A'B'A''B''$	DeMorgans Law
$A'B'AB''$	A'' = A Involution law
$A'AB'B$	Involution law
0	Inverse law

$$(A+B)'(A'+B')' = 0$$

$(a+b+c')(a'b'+c)$	
$a(a'b'+c)+b(a'b'+c)+c'(a'b'+c)$	Distribution law
$aa'b'+ac+ba'b'+bc+c'a'b'+c'c$	Distribution law
$0b'+ac+ba'b'+bc+c'a'b'+c'c$	$aa' = 0$ Inverse law
$ac+ba'b'+bc+c'a'b'+c'c$	$0b' = 0\ Null$
$ac+ba'b'+bc+c'a'b'$	$c'c = 0\ Inverse\ Law$
$ac+a'bb'+bc+c'a'b'$	$ba'b' = ba'b'\ Commutative\ law$
$ac+a0+bc+c'a'b'$	$b'b = 0\ Inverse\ Law$
$ac+bc+c'a'b'$	$a0 = 0\ Null$

$$(a+b+c')(a'b'+c) = ac+bc+c'a'b'$$

Question 4

F = xy + xy' + y'z

Truth table

x	**y**	**y'**	**z**	**xy**	**xy'**	**y'z**	**F**
0	0	1	0	0	0	0	0
0	0	1	1	0	0	1	1
0	1	0	0	0	0	0	0
0	1	0	1	0	0	0	0
1	0	1	0	0	1	0	1
1	0	1	1	0	1	1	1
1	1	0	0	1	0	0	1
1	1	0	1	1	0	0	1

F = bc + a'c

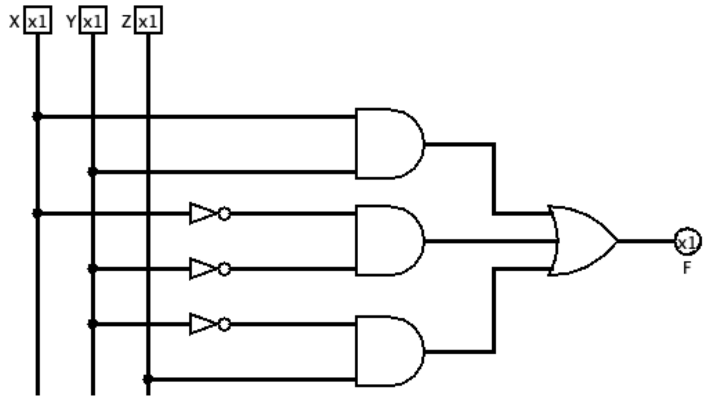
Truth table

a	a'	b	c	c'	bc	a'c'	F
0	1	0	0	1	0	1	1
0	1	0	1	0	0	0	0
0	1	1	0	1	0	1	1
0	1	1	1	0	1	0	1
1	0	0	0	1	0	0	0
1	0	0	1	0	0	0	0
1	0	1	0	1	0	0	0
1	0	1	1	0	1	0	1

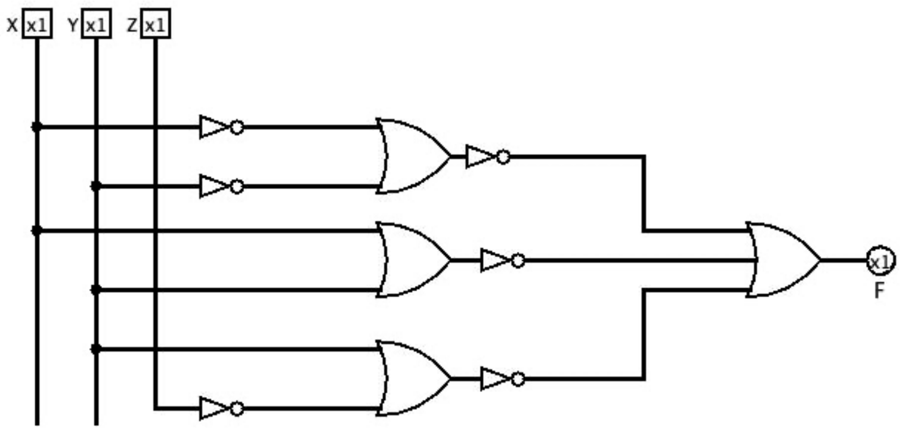
Question 5

F = xy + x’y’ + y’z

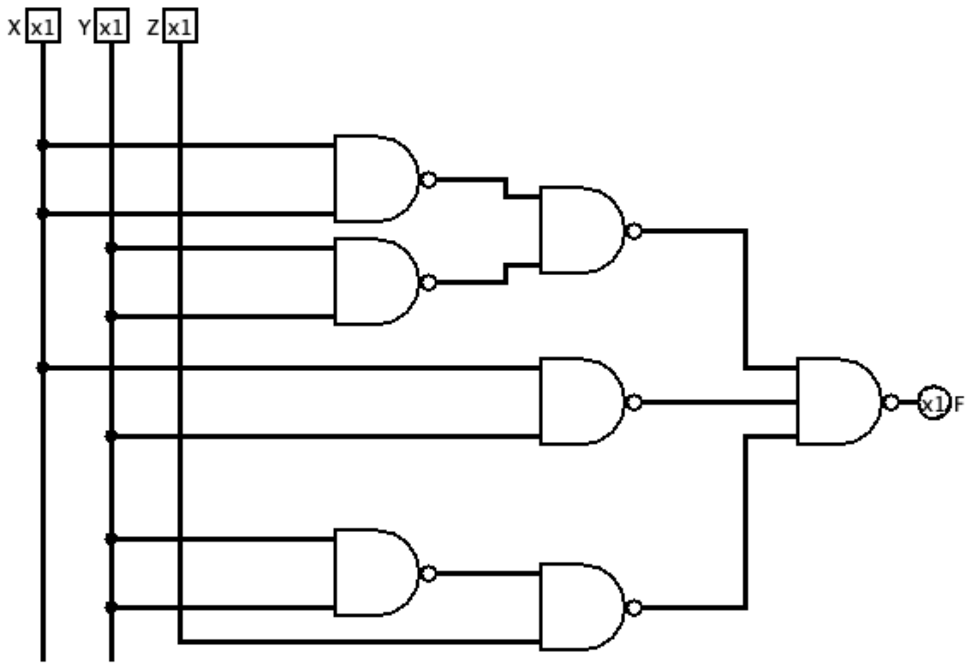
a)



b)



c)

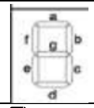


Question 6

a)

	Binary code for					Segments						
	D3	D2	D1	D0		a	b	c	d	e	f	g
0	0	0	0	0	0	1	1	1	1	1	1	0
1	0	0	0	1	1	0	1	1	0	0	0	0
2	0	0	1	0	2	1	1	0	1	1	0	1
3	0	0	1	1	3	1	1	1	1	0	0	1
4	0	1	0	0	4	0	1	1	0	0	1	1
5	0	1	0	1	5	1	0	1	1	0	1	1
6	0	1	1	0	6	1	0	1	1	1	1	1
7	0	1	1	1	7	1	1	1	0	0	0	0
8	1	0	0	0	8	1	1	1	1	1	1	1
9	1	0	0	1	9	1	1	1	1	0	1	1

b)

	Binary code for					Segments	
	D3	D2	D1	D0		g	g
0	0	0	0	0	0	0	D3+D2+D1+D0
1	0	0	0	1	1	0	D3+D2+D1+D0'
2	0	0	1	0	2	1	1
3	0	0	1	1	3	1	1
4	0	1	0	0	4	1	1
5	0	1	0	1	5	1	1
6	0	1	1	0	6	1	1
7	0	1	1	1	7	0	D3+D2'+D1'+D0'
8	1	0	0	0	8	1	1
9	1	0	0	1	9	1	1

Since we have less 0's than 1's were going to use product of sum to get the equivalent logic circuit.
So, the logic circuit is as follow: