Sezgi Şensöz
10792020
COMP 249- LC

Assignment #2

1). **Using the properties of a general Boolean Algebra (whose elements are not only 0 and 1), reduce the following expressions into a minimum sum of products form:**
(a) x'y'z'+ x'y'z + x'yz + xy'z + xyz + xyz '
(b) a'b'c'+ a'bc'+ a'bc + ab'c + abc'+ abc

a) x'y'z'+ x'y'z + x'yz + xy'z + xyz + xyz ' =
= x'y'z'+ xyz + x'y'z + xyz' + x'yz + xy'z (Ax. 1)
= (x'y'z + xyz) +(x'y'z + xyz') + (x'yz + xy'z) (Associativity)
= 1 + 1 + (x'yz + xy'z)
= 1 + z (x'y + xy')
= 1 + z . 1
= 1 + z
= 1

b) a'b'c'+ a'bc'+ a'bc + ab'c + abc'+ abc =
= a'b'c' + abc + a'bc'+ ab'c + a'bc + abc'
=(a'b'c' + abc) + (a'bc'+ ab'c) + (a'bc + abc')
= 1 + 1 + (a'bc + abc')
= 1 + b (a'c + ac')
= 1 + b . 1
= 1 + b
= 1

2) **Consider a Boolean algebra with S = {0, 1}. Let f : S 3 −→ S whose values are given as f (i) = 0 for i = 1, 2, 5, 7 and f (i) = 1 for i = 0, 3, 4, 6.**

(a) Derive the Boolean function in sum of minterms canonical form.
(b) Derive the Boolean function in product of maxterms canonical form.
(c) Derive the Boolean function in Reed-Muller canonical form.

a) We will take f(i)=1 for sum of minterms.

$$f(x_1, x_2, x_3) = f(0)*m_0+f(3)*m_3+f(4)*m_4+f(6)*m_6$$
$$= x_1'x_2'x_3'+x_1'x_2x_3+x_1x_2'x_3'+x_1x_2x_3'$$

All of f(0), f(3), f(4) and f(6) is equal 1 cause of definition.And (1.x) = x

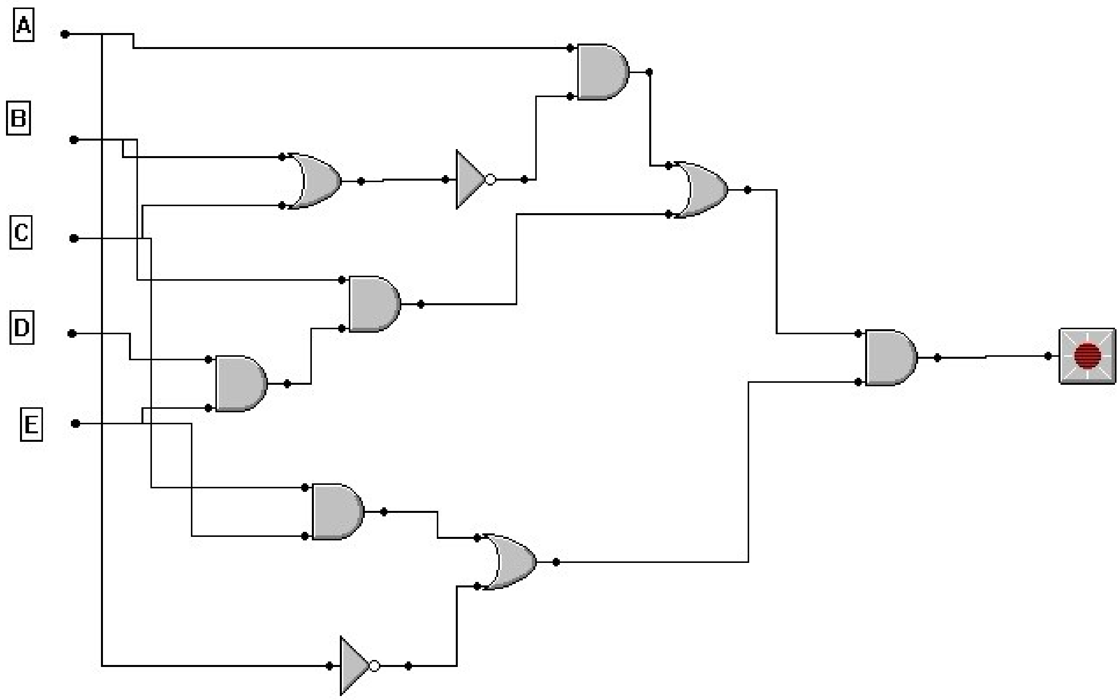
b) We will take f(i)= 0 for product of maxterms.

$$F(x_1, x_2, x_3) = [f(1)+M_1]*[f(2)+M_2]*[f(5)+M_5]*[f(7)+M_7]$$
$$= [x_1+x_2+x_3']*[x_1+x_2'+x_3]*[x_1'x_2'x_3]*[x_1'x_2'x_3']$$

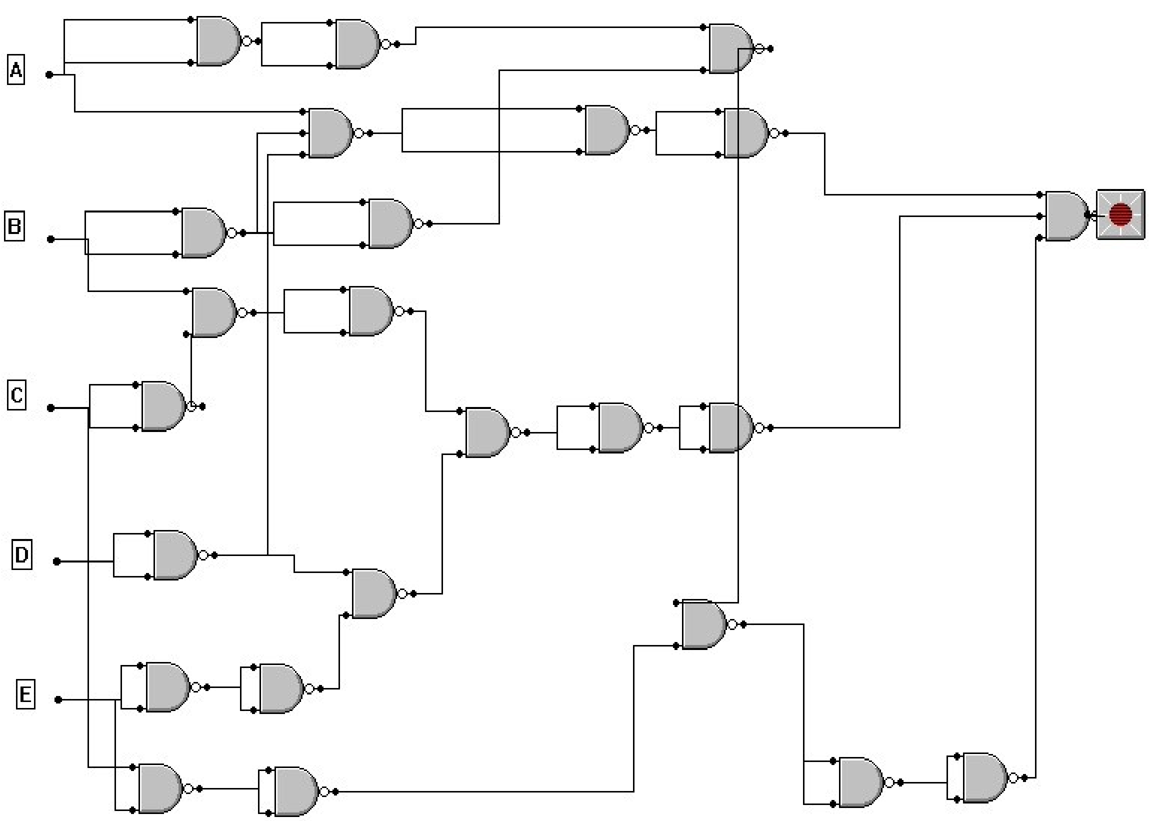
All of f(1), f(2), f(5) and f(7) is equal 0 cause of denifition. And (0 + x)= x

c) redd muller unutmussun

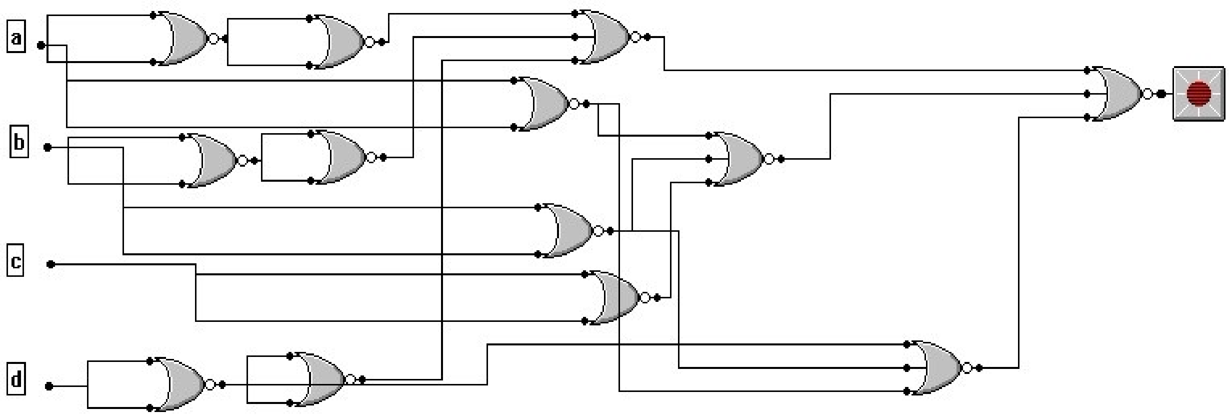
3)



4)



5)



6) **A minority function has an output value of 1 if there are less 1's than 0's on its inputs. The output is 0 otherwise. Consider the design of the four input minority function.**

a)

X	Y	Z	T	output
0	0	0	0	1
0	0	0	1	1
0	0	1	0	1
0	0	1	1	0
0	1	0	0	1
0	1	0	1	0
0	1	1	0	0
0	1	1	1	0
1	0	0	0	1
1	0	0	1	0
1	0	1	0	0
1	0	1	1	0
1	1	0	0	0
1	1	0	1	0
1	1	1	0	0
1	1	1	1	0

b) f(i)= 1, for all i=0,1,2,4,8

SOM = f(0) . (x'y'z't') + f(1) . (x'y'z't) + f(2) (x' y' z t') + f(4) (x' y z' t') + f(8) (x y' z' t')

f(i)=0, for all i=3,5,6,7,9,10,11,12,13,14,15

POS = [f(3) + (x + y + z' + t')]
* [f(5) + (x + y' +z + t')]
* [f(6) + (x + y' + z' + t')]
* [f(9) + (x' + y + z + t')]
* [f(10) + (x' +y + z' + t)]
* [f(11) + (x' + y' + z + t')]
* [f(12) + (x' + y' + z+ t)]
* [f(13) + (x' + y' + z + t')]
*[f(14) + (x' + y' + z' + t)]
* [f(15) + (x' + y' + z' + t')]

c) SOM= x'y'z't' + x'y'z't + x'y'z t' + x'yz' t' + x y'z't'
=x'y'z' (t' + t) + x't' (y'z + yz') + xy'z't'
= x'y'z' . 1 + x't' . 1 + x y'z't'
= x'y'z' + x't' + x y'z' t'