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Submitted by →
S2021 001 0027
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(Sec B)

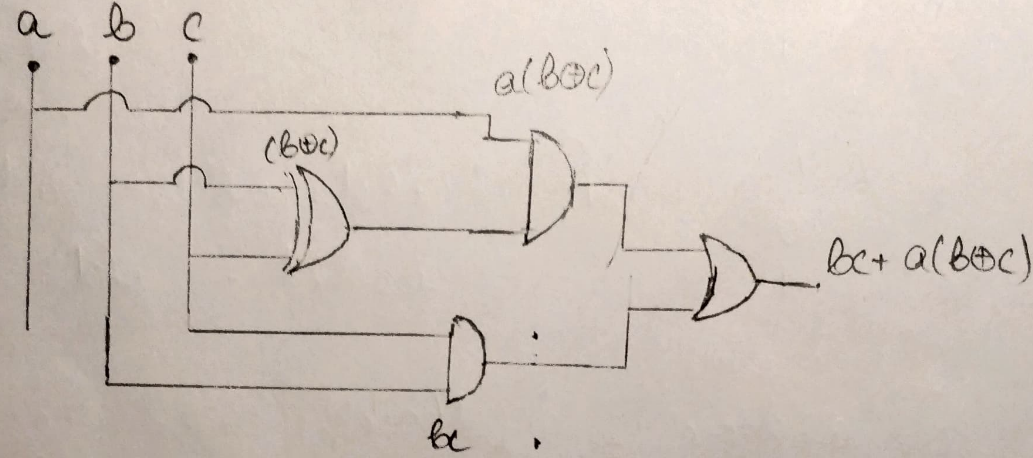
ASSIGNMENT - 2

Q1 a) $f = a'bc + ab'c + abc' + abc$

$= a'bc + abc + ab'c + abc'$

$= bc(a+a') + a(b'c + bc')$ Since $(a+a'=1)$

$= bc + a(b \oplus c)$



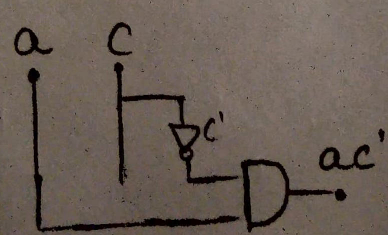
b) $f = (\bar{a}\bar{b} + \bar{a}c + \bar{a}b + ac)'$

$= (\bar{a}\bar{b} + \bar{a}b + \bar{a}c + ac)'$

$= (\bar{a}(b+\bar{b}) + c(a+\bar{a}))'$ $(x+\bar{x}=1)$

$= (\bar{a}+c)'$ By DeMorgan's law

$= ac'$



Q2 $f = a'd + b'd + bd$

$f = a'd(b+b') + b'd(a+a') + bd(a+a')$

$= \underline{a'bd} + \underline{a'b'd} + ab'd + \underline{a'b'd} + abd + \underline{a'bd}$

$f = a'bd + a'b'd + ab'd + abd$ (Since $x+x=x$)

$f = a'bd(c+c') + a'b'd(c+c') + ab'd(c+c') + abd(c+c')$

$f = a'bcd + a'bc'd + a'b'cd + a'b'c'd$
$+ ab'cd + ab'c'd + abcd + abc'd$

$\Rightarrow f = \Sigma(7, \cancel{8}5, 3, 1, 13, 9, 15; 11) \Rightarrow \underline{f = \Sigma(1,3,5,7,9,11,13,15)}$

$\Rightarrow f = \Pi(0,2,4,6,8,10,12,14)$

$\left(f' = \Sigma(0,2,4,6,8,10,12,14) \equiv \Pi(1,3,5,7,9,11,13,15)\right)$

$f = a'bcd + a'bc'd + a'b'cd + a'b'c'd + ab'cd + ab'c'd$
$+ abcd + abc'd \equiv \Sigma(1,3,5,7,9,11,13)$

$f' = (a'bcd + a'bc'd + a'b'cd + a'b'c'd + ab'cd + ab'c'd$
$+ abcd + abc'd)'$

$= (a'bcd)'(a'bc'd)'(a'b'cd)'(a'b'c'd)'$ (Following DeMorgan's law)
$(ab'cd)'(ab'c'd)'(abcd)'(ab'c'd)'$

$F' = (a+b+c+d')(a+b+c'+d')(a+b'+c'+d')(a'+b'+c+d)$
$(a+b'+c+d')(a'+b+c+d')(a'+b+c'+d')(a'+b'+c+d')$

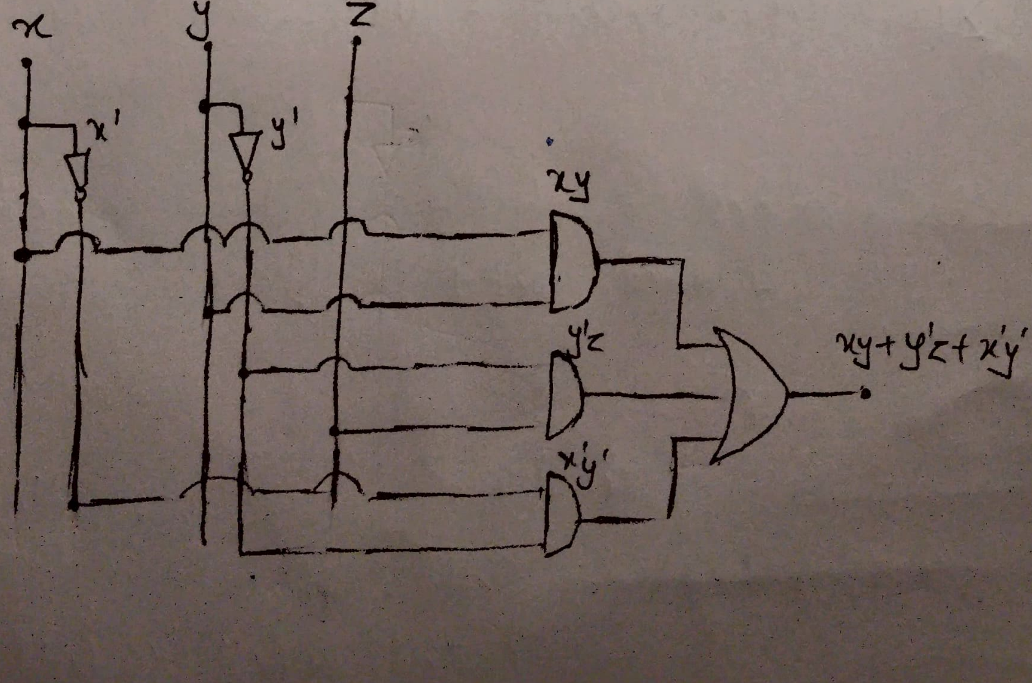
Q3 (a) $F(a,b,c) = \Sigma(1,2,6) = \Pi(0,3,4,5,7)$
$= \Pi\cancel{(0,3,5,7)}$

(b) $F(a,b,c,d) = \Pi(3,6,7,11) = \Sigma(0,1,2,4,5,8,9,10,12,13,14,15)$

Q4 $y_1 = a \oplus (c+d+e)$, $y_2 = \left[\left(f\,(c+d+e)\,b'\right)'\right]'$
$= f\,b'(c+d+e)$

Q5 $f = xy + y'z + x'y'$

(i) Use AND, OR and Inverter



~~b) With OR and inverter gates~~

~~$f = xy + x'y' + y'z$~~

~~$= (x'+y')' + ((x')' + (y')')' + ((y')' + z')'$~~

~~$= x + x' + y + y' + y + z'$~~

~~$= y + z'$~~

$[(xy + x'y' + y'z)']'$

$= (x'y' xy y'z)'$

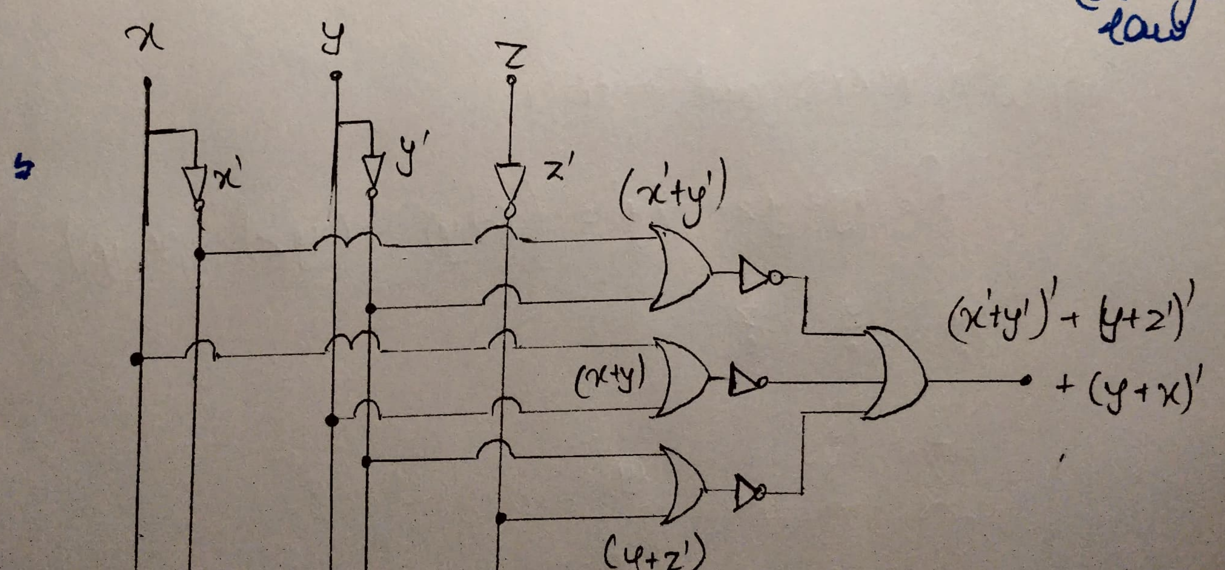
DeMorgan's $(a b) = (a' + b')'$

Since $(a + a' = 1)$ and $(1 + a = 1)$

b) With OR and inverter gates

$f = xy + x'y' + y'z = (x'+y')' + (x+y)' + (y+z')'$

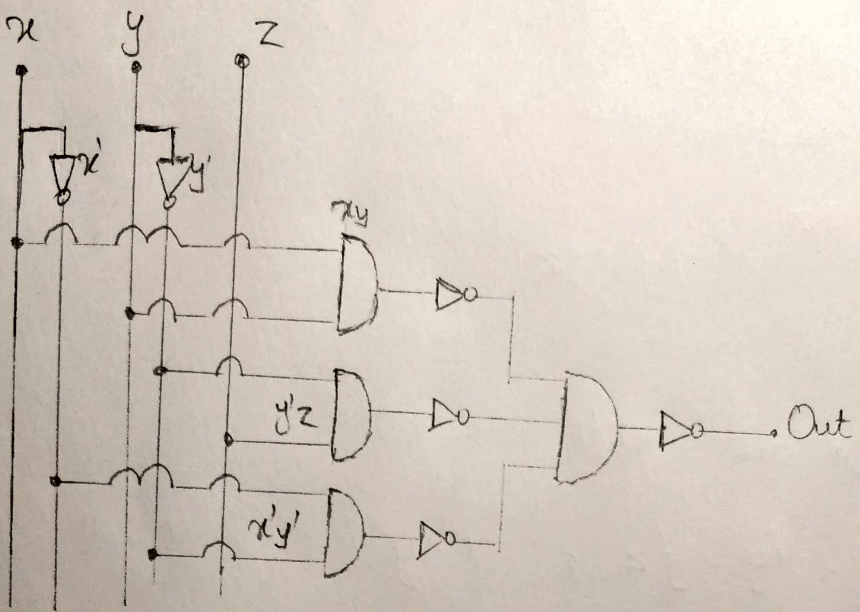
(DeMorgan law)



c) with AND and inverter

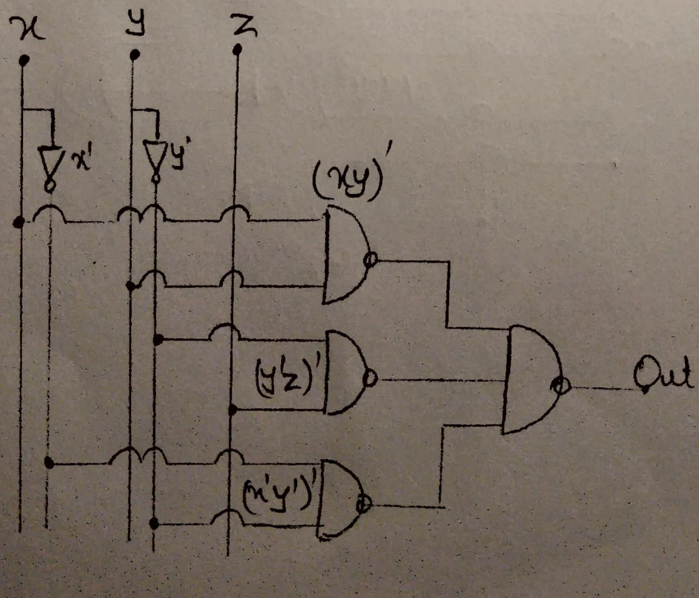
$$f = xy + y'z + x'y' = \left((xy)'\,(y'z)'\,(x'y')'\right)'$$

(DeMorgan's law)



d) with NAND and inverter

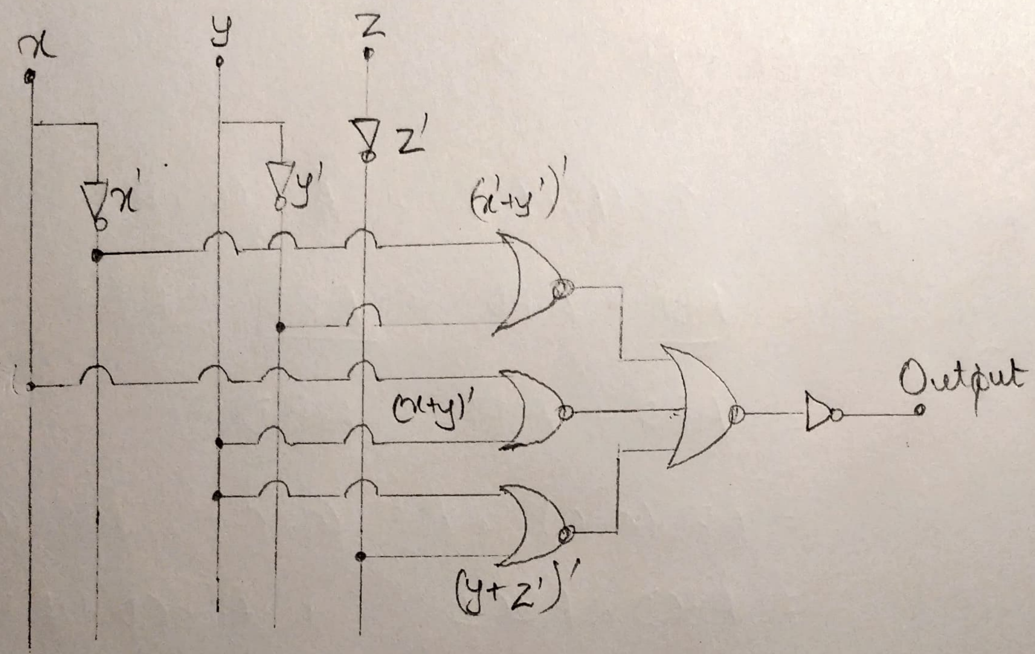
$$f = xy + y'z + x'y' = \left((xy)'\,(y'z)'\,(x'y')'\right)'$$



(e) With NOR and inverter gates.

$$F = xy + x'y' + y'z = (x'+y')' + (x+y)' + (y+z')'$$

(By DeMorgan's law)



Q6 Show AND followed by inverter and inverter followed by OR are the same.

$\Rightarrow$ TP: $(AB)' = (A'+B')$

or TP: (i) $AB + (A'+B') = 1$ and (ii) $AB(A'+B') = 0$

(i) LHS $\Rightarrow$ $AB + (A'+B') = (A'+B'+A)(A'+B'+B)$ $\quad [x+ab = (x+a)(x+b)]$

$= (1+B')(1+A')$ $\quad [1+x = x]$

$= 1 \cdot 1 = 1 =$ RHS

Proved

(ii) LHS = $AB(A'+B') = AA'B + ABB'$ $[xx'=0]$

$= 0 + 0 = 0$

Therefore $(AB)' = (A'+B')$ proved

Q7 $F(A,B,C,D) = BD + AD + BD$

$f = BD + AD = BD(A+A') + AD(B+B')$

$= ABD + A'BD + ABD + AB'D$

$[x+x=x]$ $= ABD + A'BD + AB'D$

$= ABD(C+C') + A'BD(C+C') + AB'D(C+C')$

$= ABCD + ABC'D + A'BCD + A'BC'D$

$+ AB'CD + AB'C'D$

$\Rightarrow f = \Sigma(15, 13, 7, 5, 11, 9) \equiv \Sigma(5, 7, 9, 11, 13, 15)$

$\Rightarrow f = \Pi(0, 1, 2, 3, 4, 6, 8, 10, 12, 14)$

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

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

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

Q8 (a) $F = xy + xy' + y'z$

$F = x(y+y') + y'z$

$= x + y'z$

Truth table:

x	y	z	F
0	0	0	0
0	0	1	1
0	1	0	0
0	1	1	0
1	0	0	1
1	0	1	1
1	1	0	1
1	1	1	1

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

Truth table:

$\overset{a}{\cancel{x}}$	$\overset{b}{\cancel{y}}$	$\overset{c}{\cancel{z}}$	bc	$a'c'$	F
0	0	0	0	1	1
0	0	1	0	0	0
0	1	0	0	1	1
0	1	1	1	0	1
1	0	0	0	0	0
1	0	1	0	0	0
1	1	0	0	0	0
1	1	1	1	0	1