VE270 Homework 2

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Problem 1.

x	y	$x \oplus y'$	$x' \oplus y$	$(x \oplus y)'$
0	0	1	1	1
0	1	0	0	0
1	0	0	0	0
1	1	1	1	1

$$x \oplus y' = x' \oplus y = (x \oplus y)'$$

Problem 2.

(a)

$$S \oplus E$$

(b)

$$S + H'$$

(c)

$$(S \oplus E)(S + H') = SE' + S'EH'$$

Problem 3.

$$\begin{aligned} F &= a'b(c + d') + a(b' + c) + a(b + d)c \\ &= a'bc + a'bd' + ab' + ac + abc + acd \\ &= a'bc + a'bd' + ab' + ac(1 + b + d) \\ &= a'bc + a'bd' + ab' + ac \end{aligned}$$

Problem 4.

$$\begin{aligned}
F' &= (abc + a'b)' \\
&= (abc)'(a'b)' \\
&= (a' + b' + c')(a + b') \\
&= aa' + ab' + ac' + a'b' + b' + b'c' \\
&= 0 + b'(1 + a + c') + ac' \\
&= b' + ac'
\end{aligned}$$

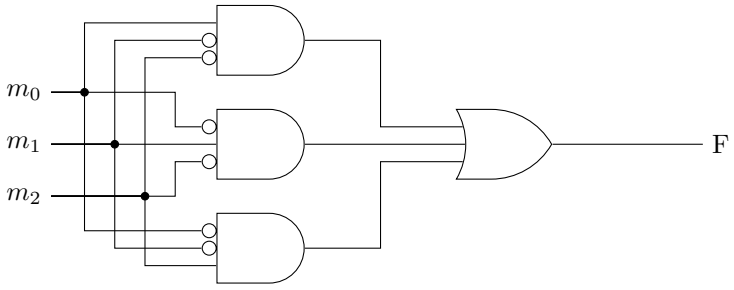
Problem 5.

$$\begin{aligned}
F &= a'b'c' + a'bc' + ab'c' + ab'c + abc' \\
&= a'c'(b + b') + ac'(b + b') + ab'c \\
&= a'c' + ac' + ab'c \\
&= c' + ab'c \\
&= c' + ab'
\end{aligned}$$

Problem 6.

$$\begin{aligned}
F(a, b, b) &= abc + ab + a + b + c \\
&= m_1 + m_2 + m_3 + m_4 + m_5 + m_6 + m_7 \\
&= \sum m(1, 2, 3, 4, 5, 6, 7)
\end{aligned}$$

Problem 7.

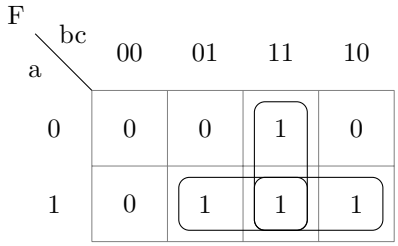


Problem 8.

(a)

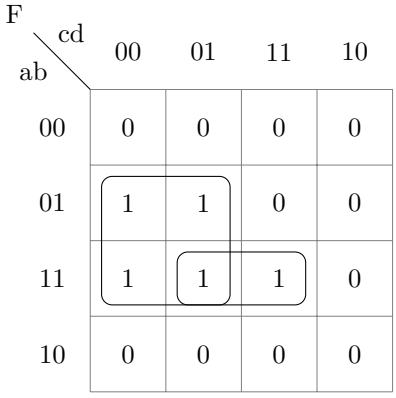
$$\begin{aligned} F(a,b,b) &= ab'c + abc + a'bc + abc' \\ &= ab(c + c') + ac(b + b') + bc(a + a') \\ &= ab + ac + bc \end{aligned}$$

(b)



$F(a,b,b) = ab + ac + bc$

Problem 9.



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

Problem 10.

F: ab \ cd	00	01	11	10
00	0	0	X	0
01	0	1	X	0
11	X	X	X	X
10	0	0	X	1

$$F(a, b, b) = ac + bd$$

Problem 11.

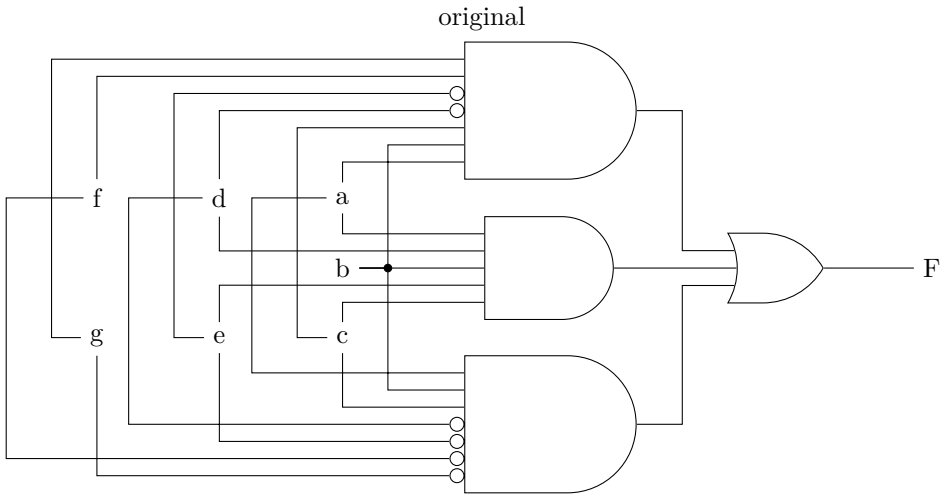
The squared implicants are prime implicants.

F: ab \ cd	00	01	11	10
00	0	0	0	0
01	0	0	1	1
11	0	1	1	0
10	1	1	0	0

The squared implicants are essential prime implicants.

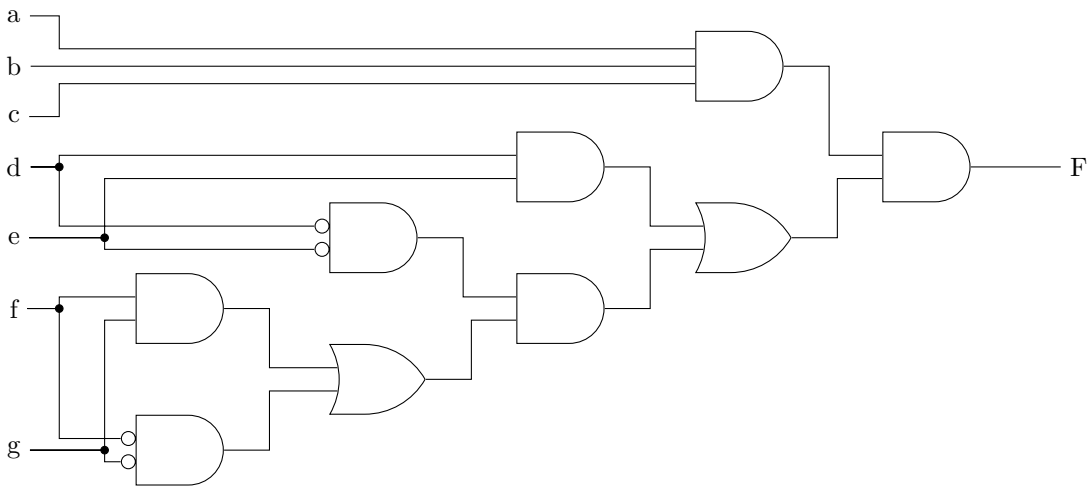
F: ab \ cd	00	01	11	10
00	0	0	0	0
01	0	0	1	1
11	0	1	1	0
10	1	1	0	0

Problem 12.



delay: 2 gate inputs: 22

$$F(a, b, b, d, e, f, g) = abcde + abcd'e'fg + abcd'e'f'g'$$
$$= abc[de + d'e'(fg + f'g')]$$



delay: 5 gate inputs: 19