

VE270 Homework 2

Liu Yihao 515370910207

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.

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

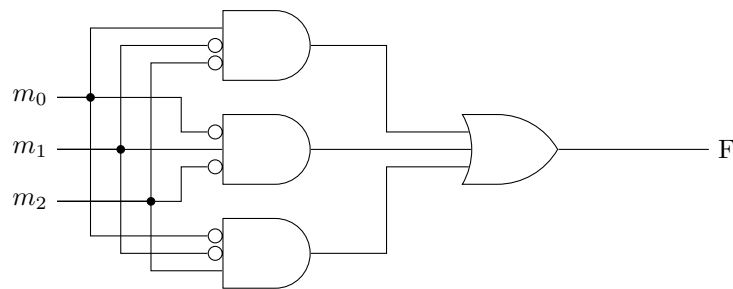
Problem 5.

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

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)

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

(b)

| | | | | | |
|---|---|----|----|----|----|
| | | bc | | | |
| | | 00 | 01 | 11 | 10 |
| a | 0 | 0 | 0 | 1 | 0 |
| | 1 | 0 | 1 | 1 | 1 |

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

Problem 9.

| | | | | | |
|----|----|----|----|----|----|
| | | cd | | | |
| | | 00 | 01 | 11 | 10 |
| ab | 00 | 0 | 0 | 0 | 0 |
| | 01 | 1 | 1 | 0 | 0 |
| | 11 | 1 | 1 | 1 | 0 |
| | 10 | 0 | 0 | 0 | 0 |

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

Problem 10.

| | | | | | |
|----|----|----|----|----|----|
| F | | cd | | | |
| | | 00 | 01 | 11 | 10 |
| ab | 00 | 0 | 0 | X | 0 |
| | 01 | 0 | 1 | X | 0 |
| | 11 | X | X | X | X |
| | 10 | 0 | 0 | X | 1 |

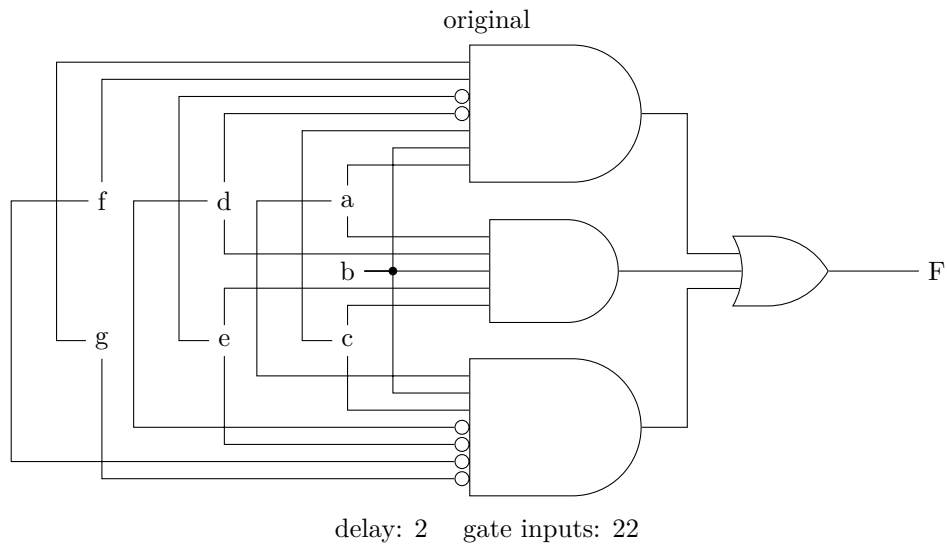
$$F(a, b, c) = ac + bd$$

Problem 11.

| | | | | | |
|----|----|----|----|----|----|
| F | | cd | | | |
| | | 00 | 01 | 11 | 10 |
| ab | 00 | 0 | 0 | 0 | 0 |
| | 01 | 0 | 0 | 1 | 1 |
| | 11 | 0 | 1 | 1 | 0 |
| | 10 | 1 | 1 | 0 | 0 |

The squared implicants are all prime implicants, but none of them is essential prime implicants.

Problem 12.



$$\begin{aligned}
 F(a, b, b, d, e, f, g) &= abcde + abcd'e'fg + abcd'e'f'g' \\
 &= abc[de + d'e'(fg + f'g')]
 \end{aligned}$$

