

1) a) $f_1(a, b, c) = m_0 + m_2 + m_5 + m_6$

c \ a	00	01	11	10
0	1	1	1	0
1	0	0	0	1

$$f_1 = a'c' + bc' + ab'c$$

b)

d \ e	00	01	11	10
0	1	1	0	1
1	1	0	0	0

$$f_2 = d'f' + d'e' + e'f'$$

c)

x \ z	00	01	11	10
0	1	1	1	1
1	1	1	0	0

$$f_3 = z' + x'$$

d)

t \ s	00	01	11	10
0	0	1	1	1
1	1	1	1	0

$$f_4 = r't + rt' + s$$

2) a)

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

c) Min sop: $F = ac + bc' + b'c + b'd'$

d) Min Pos: $F = (a' + b + c)(b' + c' + d)$

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

3) a) Assuming that the given Maxterm expression is found from a function, $F(a, b, c, d)$:

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

b) Assuming that the given Minterm expression is found from a function, $F(a, b, c, d)$:

$$F = a'b'c'd + a'b'cd + a'bcd + a'b'c'd' + abcd$$

4) $F(a, b, c, d) = ab'd' + a'b' + a'cd + ac'd$

cd \ ab	00	01	11	10
00	1			
01	1		X	1
11	1	X		1
10	1			

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

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

$$5) F = AB'D' + A'B + A'C + CD$$

a) F:

	00	01	11	10
00	0	1	0	1
01	0	1	0	0
11	1	1	1	1
10	1	1	0	1

$$F = \sum m(0, 1, 9, 12, 13, 14)$$

$$= M_0 \cdot M_1 \cdot M_4 \cdot M_{12} \cdot M_{13} \cdot M_{14}$$

b) F':

	00	01	11	10
00	1	0	1	0
01	1	0	1	1
11	0	0	0	0
10	0	0	1	0

$$F' = A'B'C' + AC'D + ABD'$$

$$c) F = (A+B+C)(A'+C+D)(A'+B'+D)$$

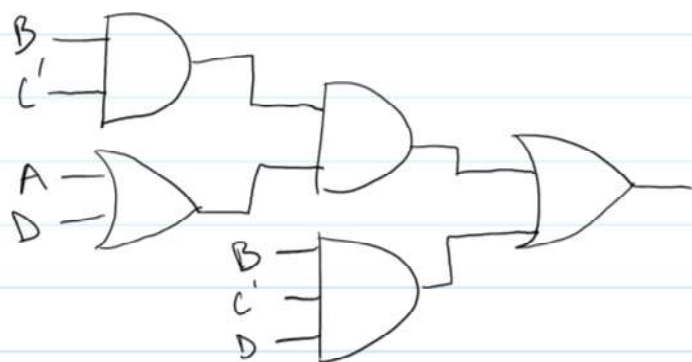
$$6) F = AB'C'D + A'B'D + A'CD + ABD + ABC$$

	00	01	11	10
00	0	0	0	0
01	1	0	1	0
11	1	1	1	0
10	0	0	1	0

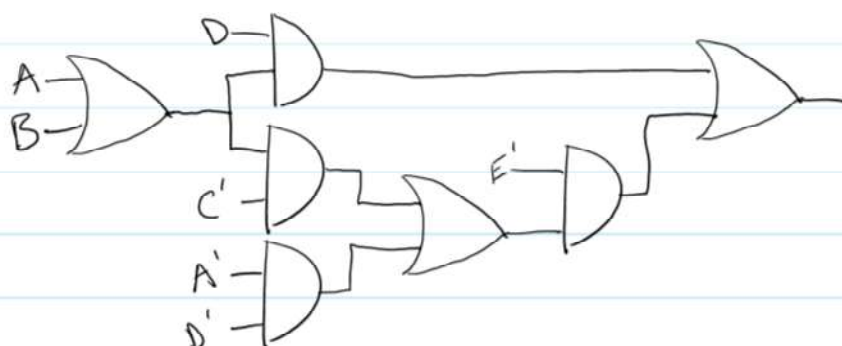
$$F = A'B'D + A'CD + ABD + ABC$$

PART B

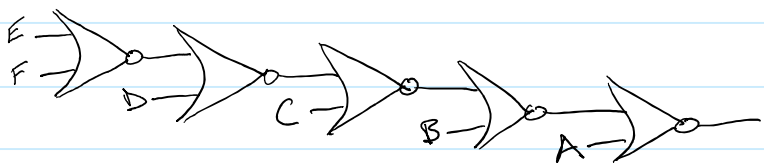
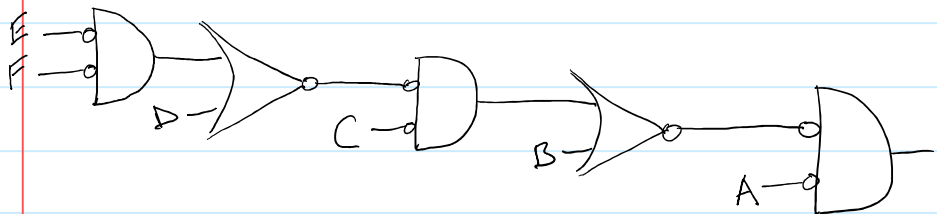
$$1) a) AC'B + AB'C + BC'D \rightarrow BC'(A+D) + BC'D$$



$$b) AE'C' + A'D'E' + DA + BE'C' + DB \rightarrow D(A+B) + E'(C'(A+B) + A'D')$$



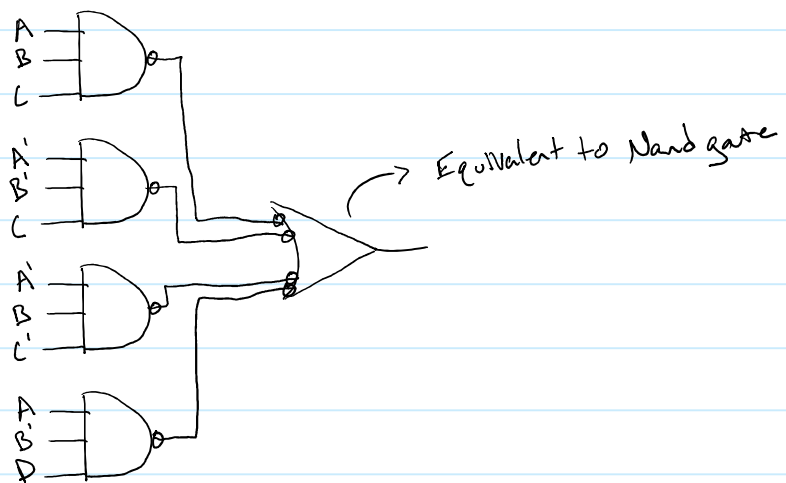
2) $Z = CDA + AB + CEFA \rightarrow A(B + CD + CEF)$
 $A(B + C(D + EF))$



3) i) $ABC + A'B'C + A'BC' + DAB'$

CD \ AB	00	01	11	10
00	0	1	0	0
01	0	1	0	1
11	1	0	1	1
10	1	0	1	0

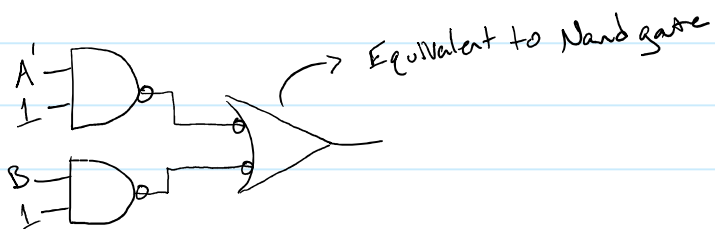
Nand \rightarrow SOP \rightarrow optimize 1s



ii) $A' + BCD' + AB$

CD \ AB	00	01	11	10
00	1	1	1	0
01	1	1	1	0
11	1	1	1	0
10	1	1	1	0

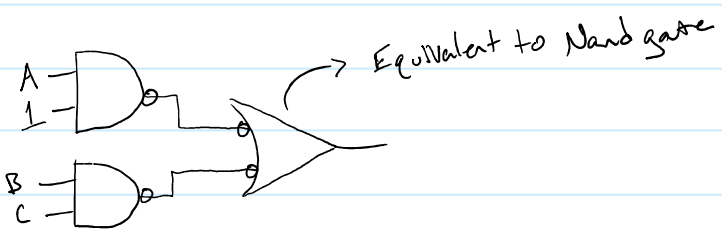
$A' + B$



iii) $A + BCA'$

AB \ C	00	01	11	10
0	0	0	1	1
1	0	1	1	1

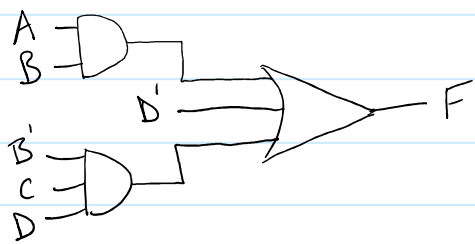
$A + BC$



4) a) $F = BD' + B'CD + ABC + ABC'D + B'D'$

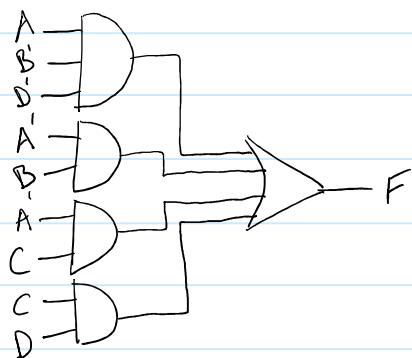
AB \ CD	00	01	11	10
00	1	1	1	1
01	0	0	1	0
11	1	0	1	1
10	1	1	1	1

$D' + AB + B'CD$



b) $F = AB'D' + A'B + A'C + CD$

AB \ CD	00	01	11	10
00	0	1	0	1
01	0	1	0	0
11	1	1	1	1
10	1	1	0	1

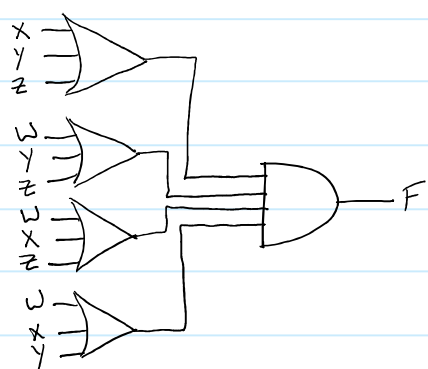


5) a)

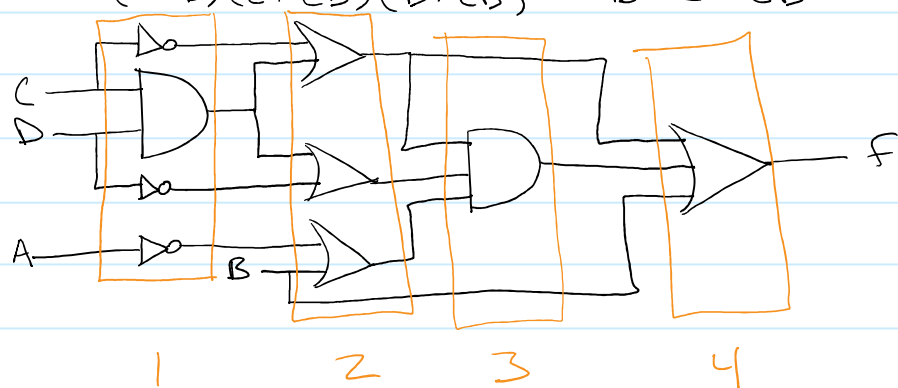
w \ yz	00	01	11	10
00	1	1	1	1
01	1	1	0	1
11	1	0	0	0
10	1	1	0	1

$F = \prod M(7, 11, 13, 14, 15)$
 $= (x+y+z)(w+y+z)(w+x+z)(w+x+y)$

b) $F = (x+y+z)(w+y+z)(w+x+z)(w+x+y)$



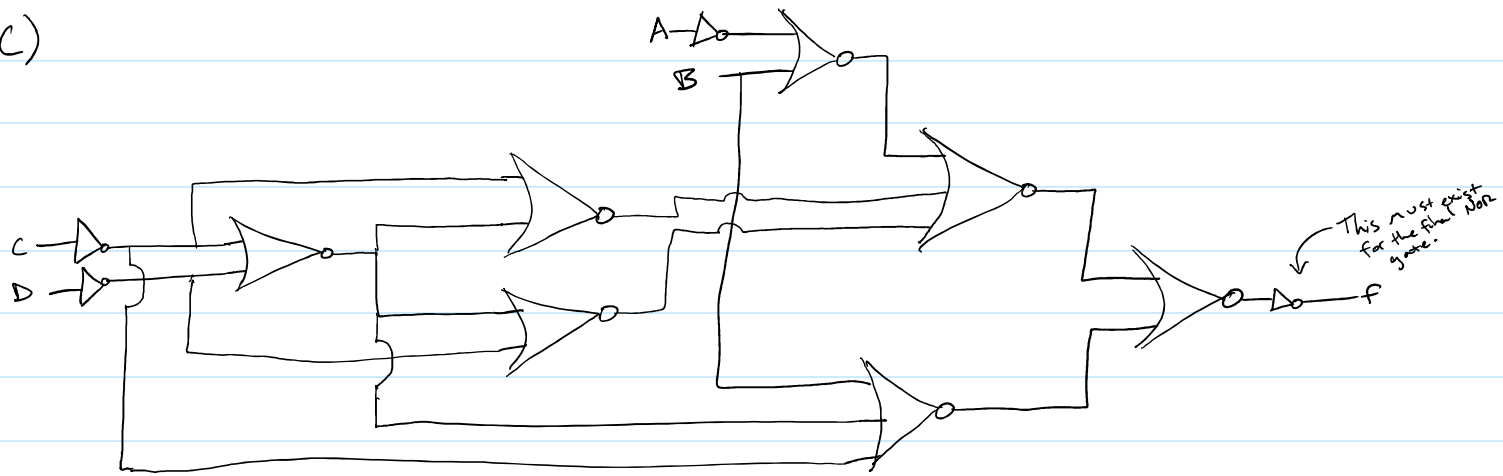
6) a) $F = ([AB']'(C(CD)')(D(CD)'))'[(B'C(CD)')]'$
 $= [AB']'(C(CD)')(D(CD)'))' + [B'C(CD)']'$
 $= (A'+B)(C'+CD)(D'+CD) + B + C' + CD$



b) $F = (A'+B)(C'+CD)(D'+CD) + B + C' + CD$
 $= (A'+B)(C'+D)(D'+C) + B + C' + D$
 $= (A'C' + A'D + BC' + BD)(D'+C) + B + C' + D$
 $= A'C'D' + A'CD + BC'D' + BCD + B + C' + D$

$$\begin{aligned}
 &= (A'c' + A'D + Bc' + BD)(D' + C) + B + C' + D \\
 &= A'c'D' + A'CD + Bc'D' + BCD + B + C' + D \\
 &= B + C' + D
 \end{aligned}$$

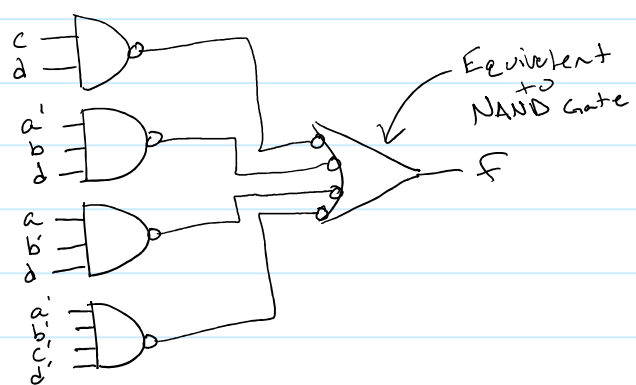
c)



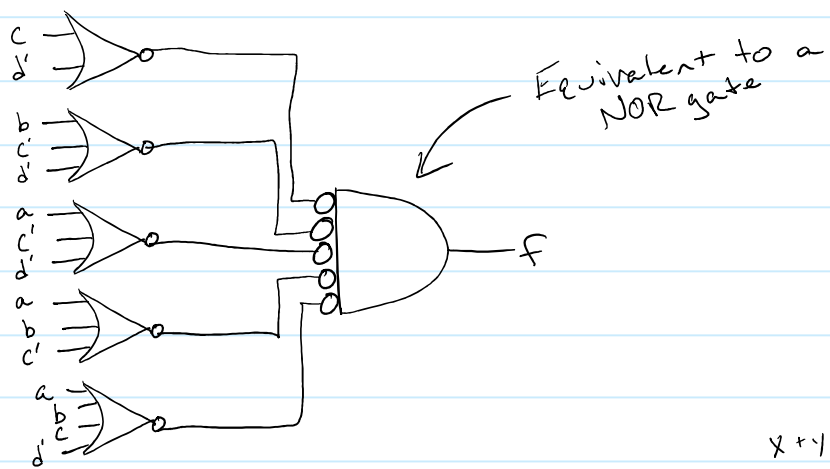
7)

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

a) $f = cd + a'b'd + ab'd + a'b'c'd'$



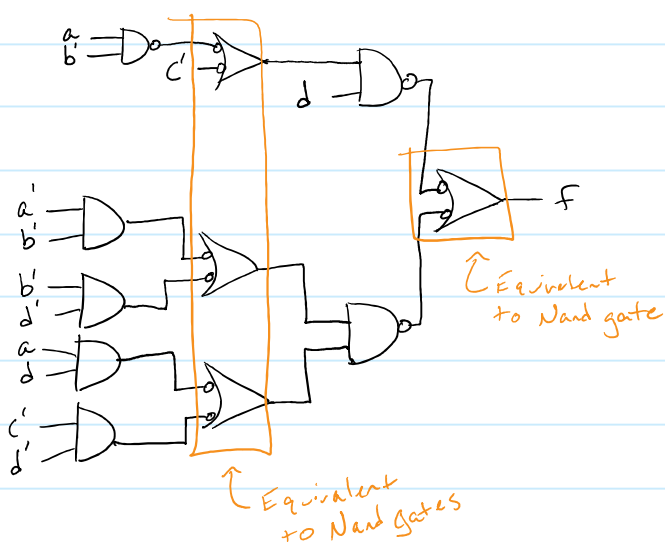
b) $f = (c+d')(b+c'+d')(a+c'+d')(a+b+c')(a+b+c+d')$

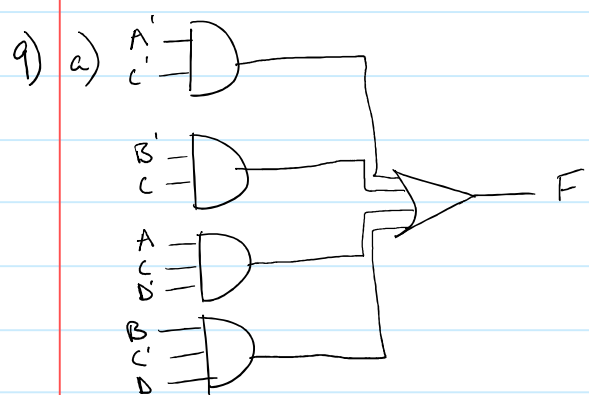
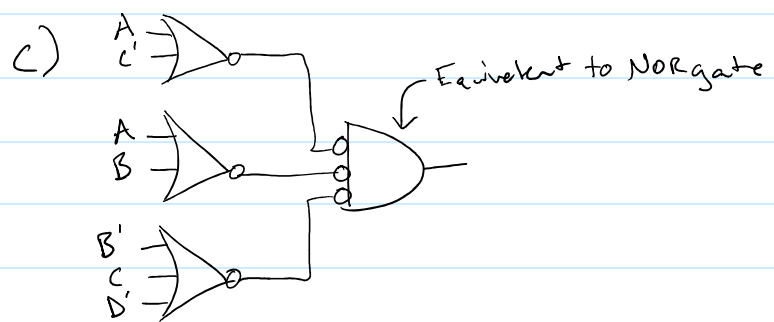
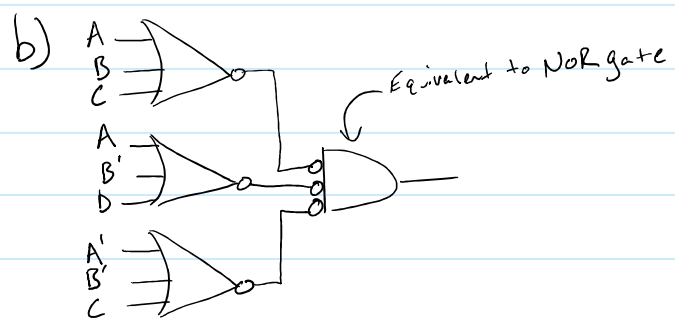
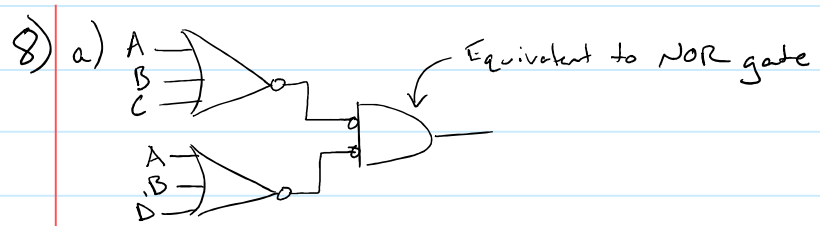


$$\begin{aligned}
 x+y+z &= (x+y)(1+z) \\
 xy+xz &= (x+z)(x+y)
 \end{aligned}$$

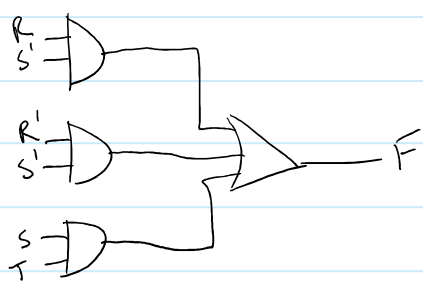
c) $f = cd + a'b'd + ab'd + a'b'c'd'$

$$\begin{aligned}
 &= d(c + a'b) + b'(ad + a'c'd') \\
 &= d(c + a'b) + b'(a'+d)(ad + c'd') \\
 &= d(c + a'b) + (b'a' + b'd)(ad + c'd')
 \end{aligned}$$





b) $F = RS' + R'S' + ST' \leftarrow \text{this is the min 2-level}$
 $= S' + T'$



c) $F = A'B' + CD' + ABC + A'B'CD' + ABCD'$
 $= A'B' + CD' + ABC$

