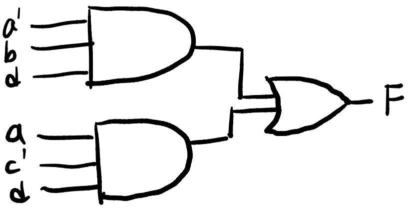
Report 3    2016314364 박수헌

Chapter 7

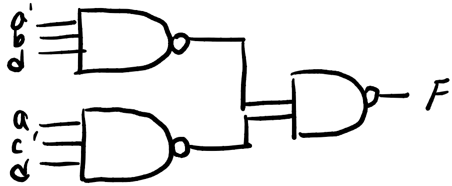
7.3) $F(a,b,c,d) = a'bd + ac'd$

i)



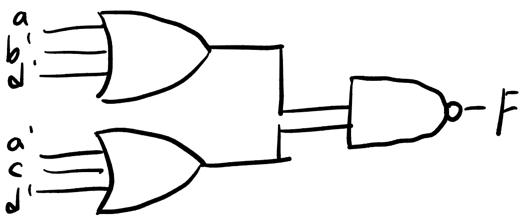

AND - OR

ii) $(F')' = ((a'bd + ac'd)')' = ((a'bd)'(ac'd)')'$



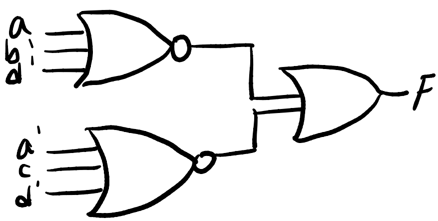

NAND - NAND

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



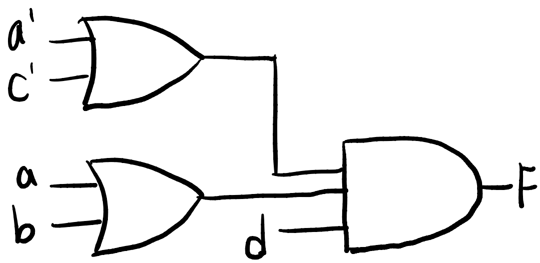

OR - NAND

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



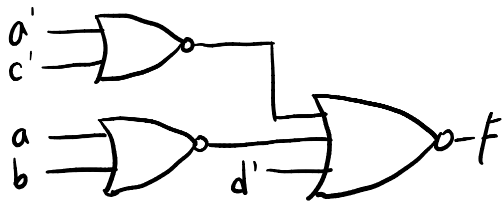

NOR - OR

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



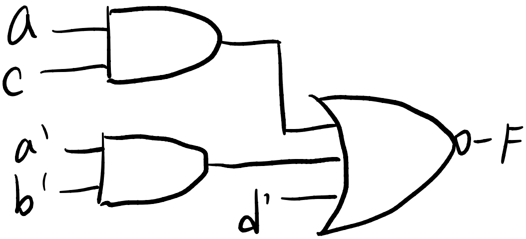

OR - AND

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



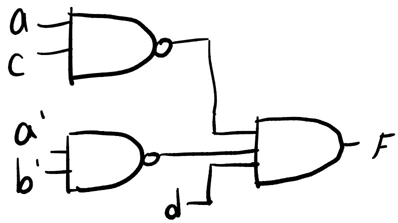

NOR - NOR

vii) $(F')' = (ac + a'b' + d')'$




AND - NOR

viii) $(F')' = (ac)'(a'b')'d$

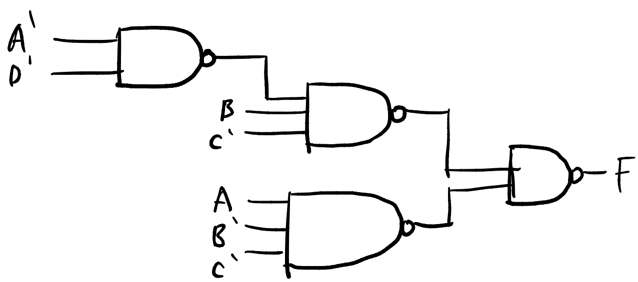



NAND - AND

7.4) $F(A,B,C,D) = \sum m(5, 10, 11, 12, 13)$

| CD \ AB | 00 | 01 | 11 | 10 |
|---|---|---|---|---|
| 00 | | | 1 | |
| 01 | | 1 | 1 | |
| 11 | | | | 1 |
| 10 | | | | 1 |

$$F(A,B,C,D) = ABC' + BC'D + AB'C$$
$$= BC'(A+D) + AB'C$$
$$= BC'(A'D')' + AB'C$$
$$= ((BC'(A'D')')'(AB'C)')'$$

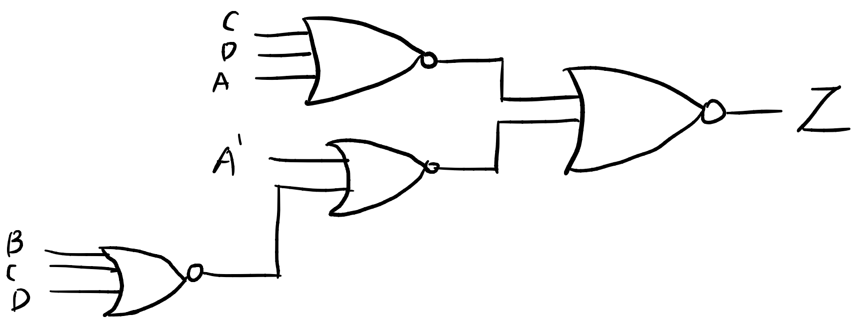


7.5) $Z = A'D + A'C + AB'C'D'$ (four NOR gates)

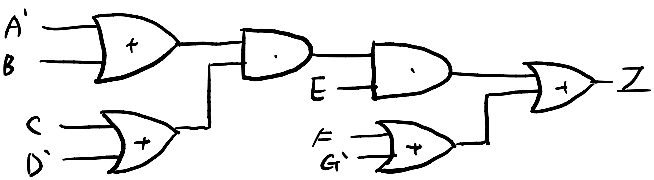
$= A'(C+D) + AB'C'D'$

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

$(Z')' = ((C+D+A)' + (A'+B'C'D')')'$




7.8) a)

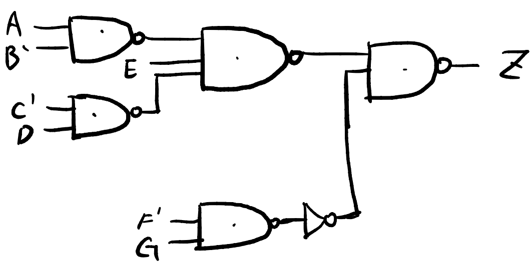



$Z = (A'+B)(C+D')E + (F+G')$

$= E(AB')'(C'D)' + F + G'$

$= E(AB')'(C'D)' + (F'G)'$

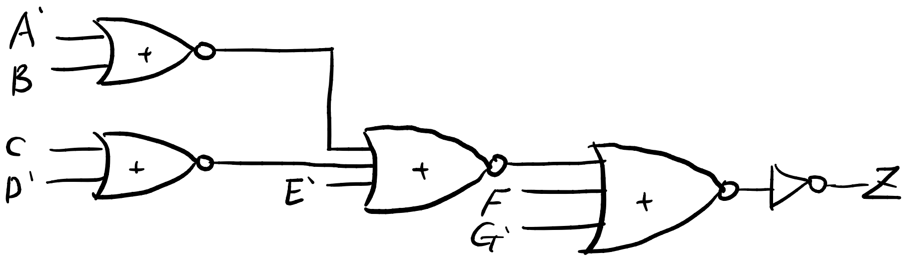
$= ((E(AB')'(C'D)')'(F'G))'$



b) $Z = (A'+B)((C+D')E + (F+G')$ $\qquad (A+B)'$

$= ((A'+B)' + ((C+D')' + E')' + F + G'$

$= ((A'+B)' + (C+D')' + E')' + (F+G')$




1.10) $f_1(a,b,c,d) = \sum m(3,4,6,9,11)$

$f_2(a,b,c,d) = \sum m(2,4,8,10,11,12)$

$f_3(a,b,c,d) = \sum m(3,6,7,10,11)$

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

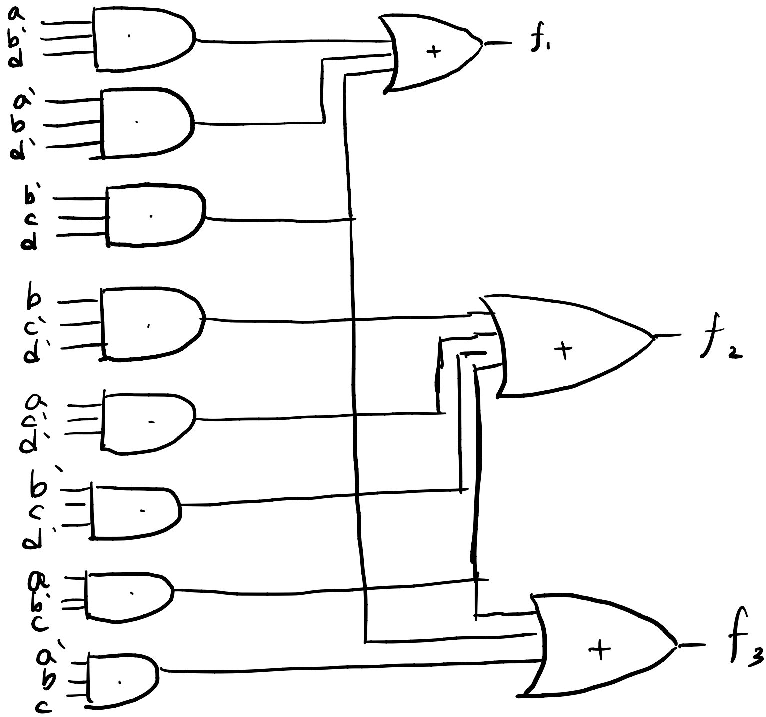
$f_1 = ab'd + b'cd + a'bd'$

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

$f_2 = bc'd' + ac'd' + b'cd' + ab'c$

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

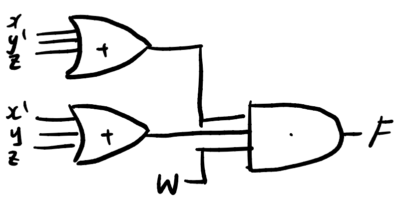
$f_3 = ab'c + b'cd + a'bc$




AND — OR

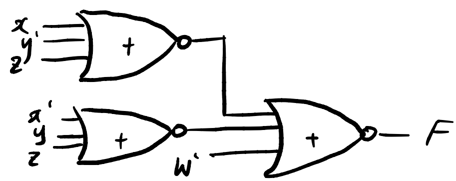
1.18) a) $F(W,x,y,z) = (x+y'+z)(x'+y+z)W$

i)



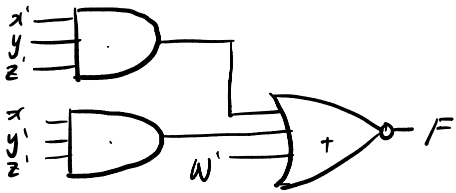

OR — AND

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



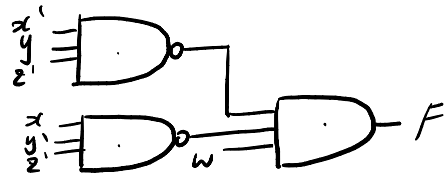

NOR — NOR

iii) $F = (x'yz' + xy'z' + w')'$




AND — NOR

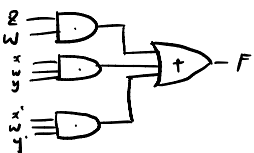
iv) $F = (x'yz')'(xy'z')'w$




NAND — AND

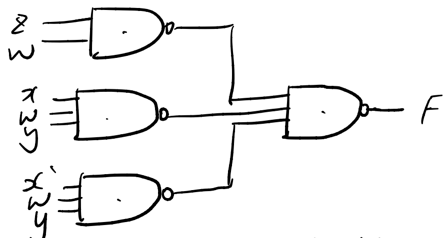
v) $F = (z + (x+y')(x'+y))w$

$= w(z + xy + x'y') = zw + xwy + x'wy'$



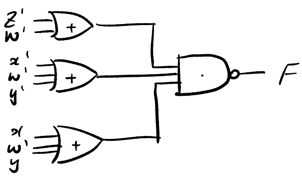

AND — OR

vi) $(F')' = ((zw)'(xwy)'(x'wy')')'$



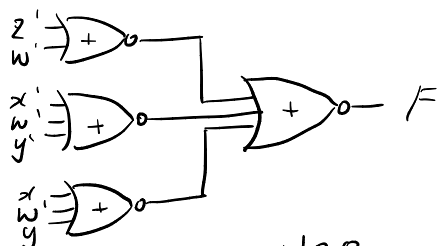

NAND — NAND

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




OR — NAND

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




NOR NOR

b) $F(a,b,c,d)=\sum m(4,5,8,9,13)$

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

$F = a'bc' + ab'c' + \begin{cases} bc'd \\ \text{or} \\ ac'd \end{cases}$

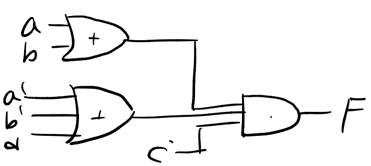
$(bc'd) \to = a'bc' + ab'c' + bc'd = c'(a'b + ab' + bd)$

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

$(ac'd) \to = a'bc' + ab'c' + ac'd = c'(a'b + ab' + ad)$

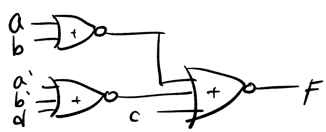
$= c'(a'b + a(b'+d)) = c'(b+a)(a'+b'+d)$

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



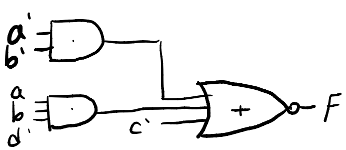

OR - AND

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



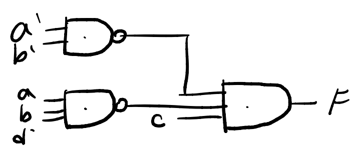

NOR - NOR

iii) $(F')' = (a'b' + abd' + c')'$



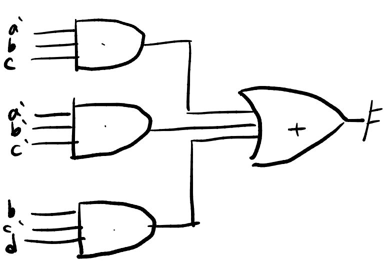

AND - NOR

iv) $(F')' = (a'b')'(abd')'c$

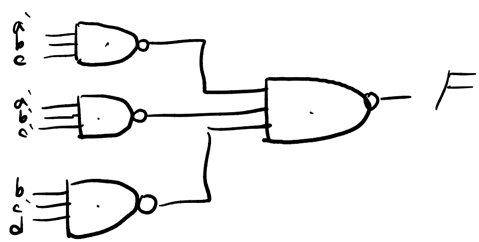



NAND - AND

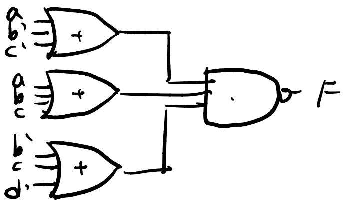
v) $F = a'bc + a'b'c' + bc'd$




vi) $(F')' = ((a'bc)'(a'b'c')'(bc'd)')'$

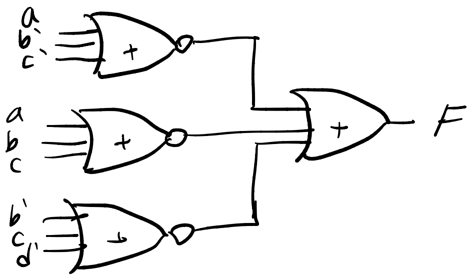


vii) $(F')' = ((a+b'+c')(a+b+c)(b'+c+d'))'$




OR - NAND

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



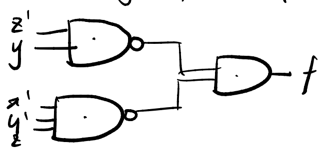

NOR - OR

7.19) $f(x,y,z) = \sum m(0,1,3,4,7) = x'y'z' + x'y'z + x'yz + xy'z' + xyz$

$= x'y' + yz + xy'z' = yz + y'(x'+xz') = yz + y'(x'+z')$

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

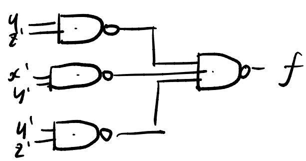
a) $(f')' = (z'y + xy'z)' = (z'y)'(x'y'z)'$




NAND - AND

b) $f = yz + x'y' + y'z'$

$(f')' = ((yz)'(x'y')'(y'z')')'$

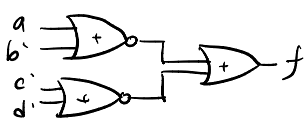



NAND - NAND

7.20) $f(a,b,c,d) = \sum m(3,4,5,6,7,11,15)$

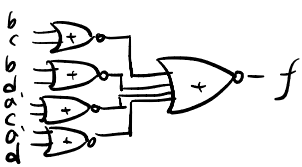
| cd \ ab | 00 | 01 | 11 | 10 |
|---|---|---|---|---|
| 00 | 0 | 1 | 0 | 0 |
| 01 | 0 | 1 | 0 | 0 |
| 11 | 1 | 1 | 1 | 1 |
| 10 | 0 | 1 | 0 | 0 |

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

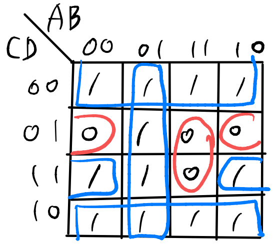



NOR - OR

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

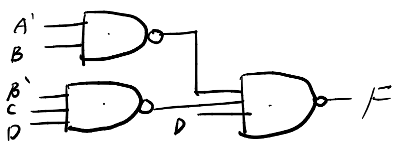


2.21) a) $F(A,B,C,D) = BD' + B'CD + A'BC + A'BC'D + B'D'$




$f = D' + A'B + B'CD$

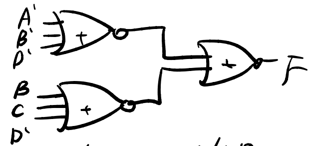
$= (D(A'B)'(B'CD)')'$




NAND – NAND

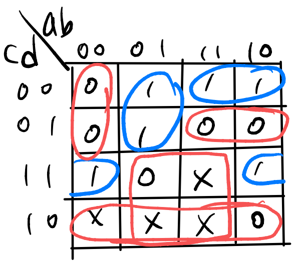
$F = (A'+B'+D')(B+C+D')$

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



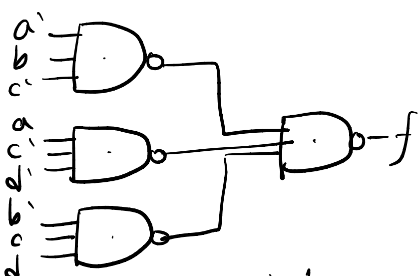

NOR – NOR

b) $f(a,b,c,d) = \Pi M(0,1,7,9,10,13) \cdot \Pi D(2,6,14,15)$




$f = a'bc' + ac'd' + b'cd$

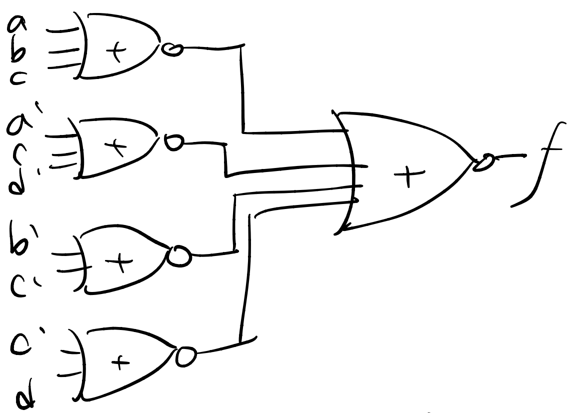
$= ((a'bc')'(ac'd')'(b'cd)')'$




NAND – NAND

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

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



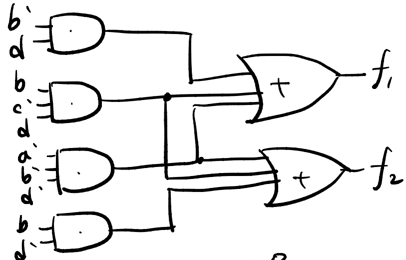

NOR – NOR

1.45) a) $f_1 = b'd + a'b' + c'd$ $\qquad$ $f_2 = a'd' + bc' + bd'$

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

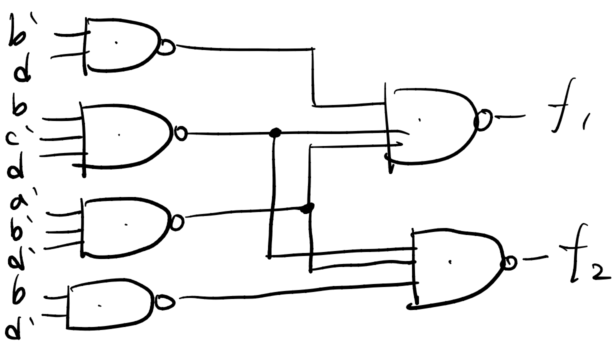
| cd \ ab | 00 | 01 | 11 | 10 |
|---|---|---|---|---|
| 00 | 1 | 1 | 1 | |
| 01 | | 1 | 1 | |
| 11 | | | | |
| 10 | 1 | 1 | 1 | |

$f_1 = b'd + \underline{bc'd + a'b'd'}$ $\qquad$ $f_2 = bd' + \underline{bc'd + a'b'd'}$



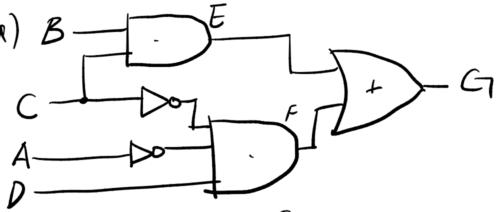

AND — OR

b) $f_1 = ((b'd)'\underline{(bc'd)'(a'b'd')'})'$ $\qquad$ $f_2 = ((bd')'\underline{(bc'd)'(a'b'd')'})'$

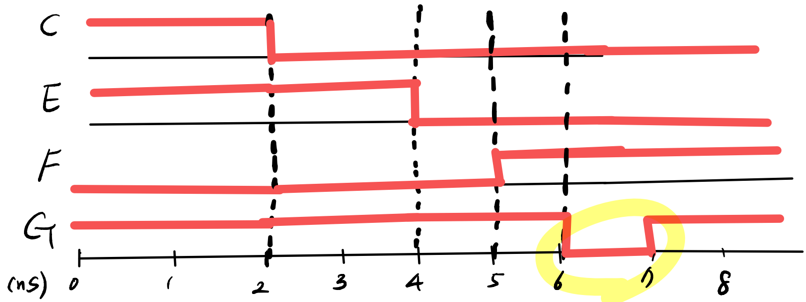


# Chapter 8

8.3) a)



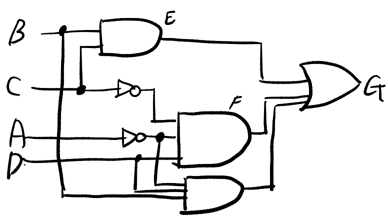

$A = 0$
$B = C = D = 1$
$C \to 0$ at 2ns




static 1-hazard

b) $G = BC + A'C'D \quad \to G = BC + A'C'D + A'BD$

| CD \ AB | 00 | 01 | 11 | 10 |
|---|---|---|---|---|
| 00 | | | | |
| 01 | 1 | 1 | | |
| 11 | | 1 | 1 | |
| 10 | | 1 | 1 | |




8.4) $A = 1$ $\quad C = 1 \cdot Z = X \quad E = C' = X \quad G = E \cdot F = 0$

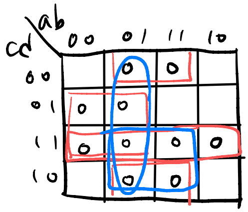
$B = Z \quad D = A + B = 1 + Z = 1 \quad F = D' = 0 \quad H = E + F = X$

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

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

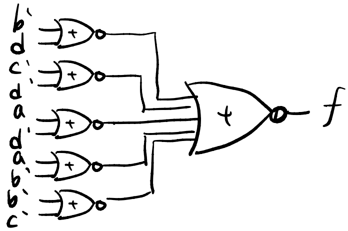
Static 0-hazard
0111 — 1111
0111 — 0110
1111 — 1110
0110 — 0100
1110 — 1100
0100 — 0101
1011 — 0011

b) $f$



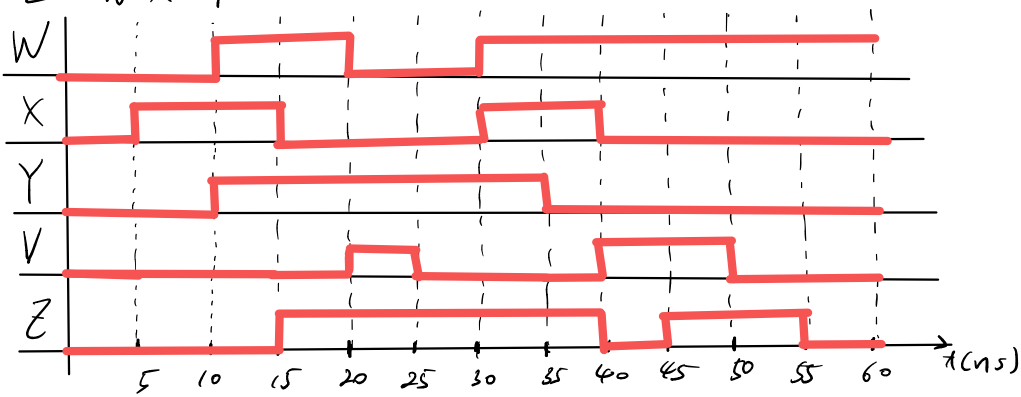

$f = (b'+d)(c'+d')(a+d')\ (a+b')(b'+c')$

$= \left((b'+d)' + (c'+d')' + (a+d')' + (a+b')' + (b'+c')'\right)'$




NOR – NOR

8.10) $Z = W \cdot X + Y$




8.14) $A = Z$

$B = 0$

$C = A' = Z' = X$

$D = A \cdot B = Z \cdot 0 = 0$

$E = Z$

$F = C + D + B$

$= X + 0 + 0$

$= X$

$G = (B \cdot E)'$

$= (0 \cdot Z)'$

$= 0' = 1$

$H = (F+G)' = (X+1)' = 1' = 0$

Design Problems 8.A

$X_1 = \sum m(0,2,3,5,7,8,9) + \sum d(10,11,12,13,14,15)$

$X_2 = \sum m(0,1,2,3,4,7,8,9) + \sum d(10,11,12,13,14,15)$

$X_3 = \sum m(0,1,3,4,5,6,7,8,9) + \sum d(10,11,12,13,14,15)$

$X_4 = \sum m(0,2,3,5,6,8) + \sum d(10,11,12,13,14,15)$

$X_5 = \sum m(0,2,6,8) + \sum d(10,11,12,13,14,15)$

$X_6 = \sum m(0,4,5,6,8,9) + \sum d(10,11,12,13,14,15)$

$X_7 = \sum m(2,3,4,5,6,8,9) + \sum d(10,11,12,13,14,15)$

$X_1 = A + B'D' + BD + B'C$

| CD \ AB | 00 | 01 | 11 | 10 |
|---|---|---|---|---|
| 00 | 1 | | X | 1 |
| 01 | | 1 | X | 1 |
| 11 | 1 | 1 | X | X |
| 10 | 1 | | X | X |

$X_2 = B' + C'D' + CD$

| CD \ AB | 00 | 01 | 11 | 10 |
|---|---|---|---|---|
| 00 | 1 | 1 | X | 1 |
| 01 | 1 | | X | 1 |
| 11 | 1 | 1 | X | X |
| 10 | 1 | | x | X |

$X_3 = C' + D + B$

| CD \ AB | 00 | 01 | 11 | 10 |
|---|---|---|---|---|
| 00 | 1 | 1 | X | 1 |
| 01 | 1 | 1 | X | 1 |
| 11 | 1 | 1 | X | X |
| 10 | | 1 | X | x |

$X_4 = B'D' + B'C + CD' + BC'D$

| CD \ AB | 00 | 01 | 11 | 10 |
|---|---|---|---|---|
| 00 | 1 | | X | 1 |
| 01 | | 1 | X | |
| 11 | 1 | | X | X |
| 10 | 1 | 1 | X | X |

$X_5 = B'D' + CD'$

| CD \ AB | 00 | 01 | 11 | 10 |
|---|---|---|---|---|
| 00 | 1 | | X | 1 |
| 01 | | | X | |
| 11 | | | X | X |
| 10 | 1 | 1 | X | X |

$X_6 = A + C'D' + BC' + BCD'$

| CD \ AB | 00 | 01 | 11 | 10 |
|---|---|---|---|---|
| 00 | 1 | 1 | X | 1 |
| 01 | | 1 | X | 1 |
| 11 | | | X | X |
| 10 | | 1 | X | X |

$X_7 = A + B'C + BD' + BC'D$

| CD \ AB | 00 | 01 | 11 | 10 |
|---|---|---|---|---|
| 00 | | 1 | X | 1 |
| 01 | | 1 | X | 1 |
| 11 | 1 | | X | X |
| 10 | 1 | 1 | X | X |

$X_1 = (A'(B'D')'(BD)'(B'C)')'$

$X_2 = (B(C'D')'(CD)')'$

$X_3 = (CD'B')'$

$X_4 = ((B'D')'(B'C)'(CD')'(BC'D)')'$

$X_5 = ((B'D')'(CD')')'$

$X_6 = (A'(C'D')'(BC')'(BCD')')'$

$X_7 = (A'(B'C)(BD')'(BC'D)')'$

$A' = X(1,6,7)$

$B'D' = X(1,4,5)$

$BD = X(1)$

$B'C = X(1,4,7)$

$B = X(2)$

$C'D' = X(2,6)$

$CDB' = X(3)$

$CD' = X(4,5)$

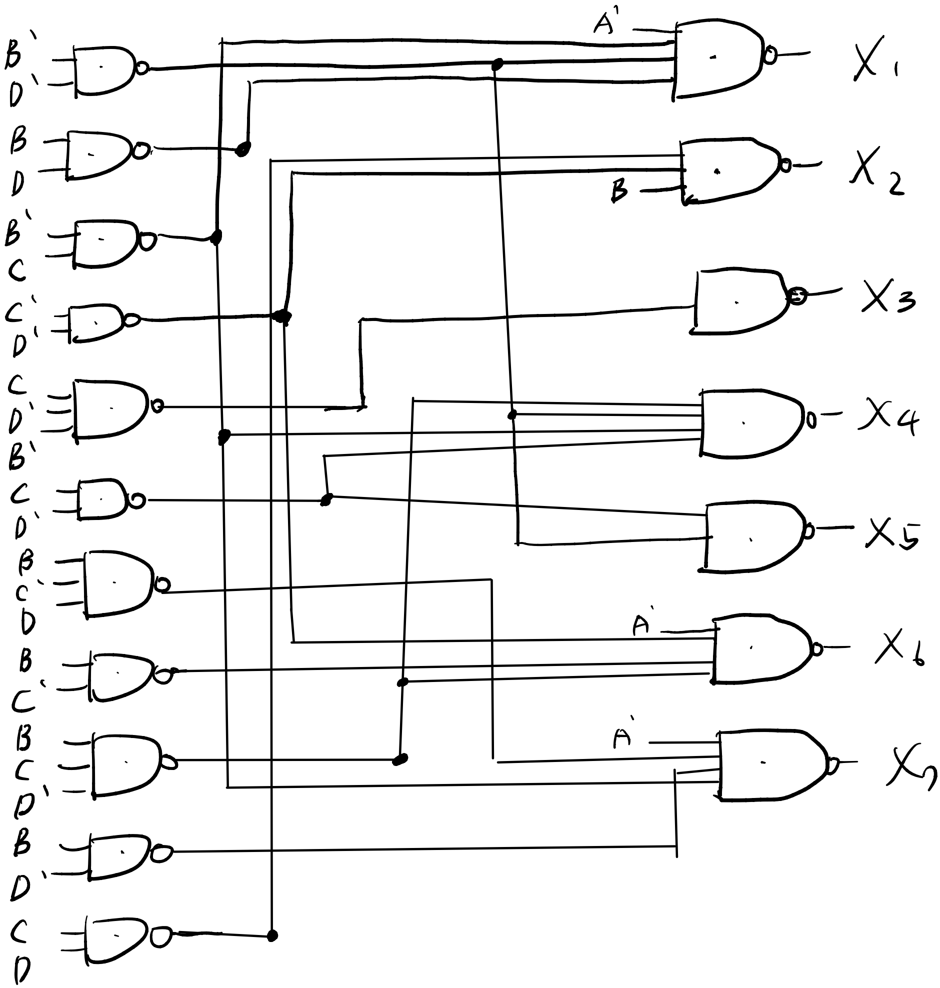
$BC'D = X(4,7)$

$BC' = X(6)$

$BCD' = X(6)$

$BD' = X(7)$

$CD = X(2)$

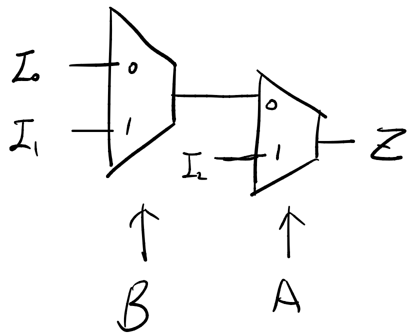


# Chapter 9

9.1) a) $Z = A'I_0 + AI_1 \rightarrow Z = B'I_0 + BI_1$

$\rightarrow Z = (B'I_0 + BI_1)A' + I_2 A = A'B'I_0 + A'BI_1 + AI_2$

| A | B | Z |
|---|---|---|
| 0 | 0 | $I_0$ |
| 0 | 1 | $I_1$ |
| 1 | X | $I_2$ |




b) 3 control inputs

2-to-1 : $Z = A'I_0 + AI_1$

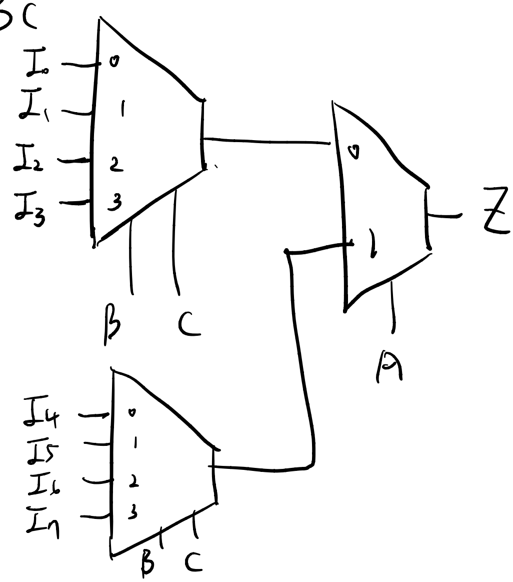
4-to-1 : $Z = B'C'I_0 + B'CI_1 + BC'I_2 + BCI_3$

$Z = (B'C'I_0 + B'CI_1 + BC'I_2 + BCI_3)A' + (B'C'I_0 + B'CI_1 + BC'I_2 + BCI_3)A$

$= I_0(A'B'C' + AB'C') + I_1(A'B'C + AB'C) + I_2(A'BC' + ABC') + I_3(A'BC + ABC)$

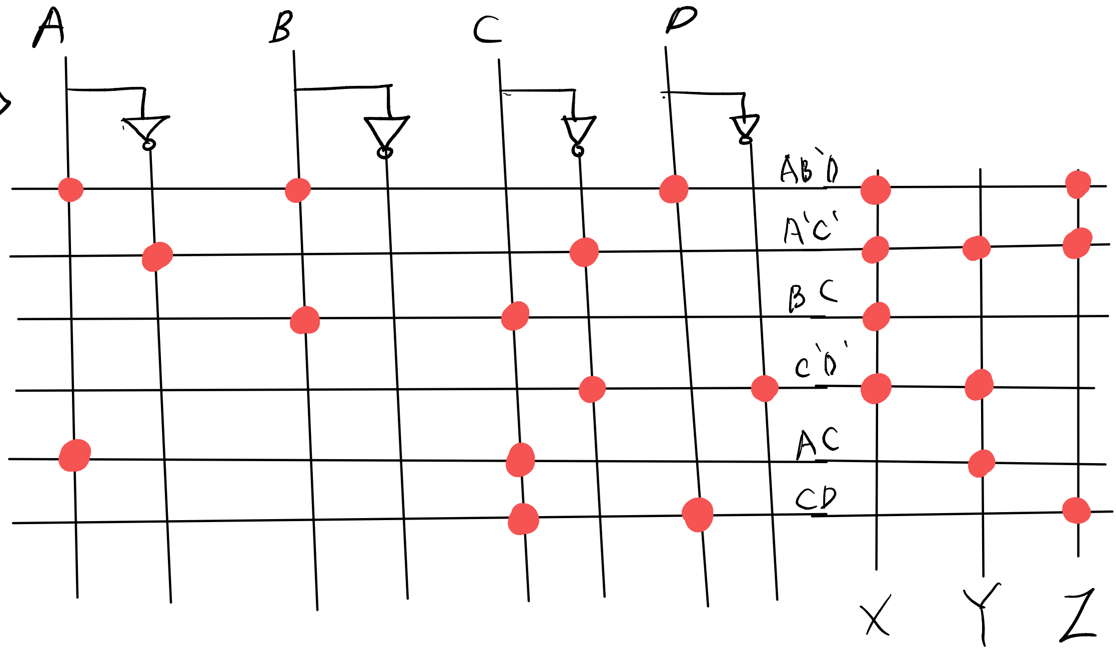
$= I_0B'C' + I_1B'C + I_2BC' + I_3BC$

| A | B | C | Z |
|---|---|---|---|
| 0 | 0 | 0 | $I_0$ |
| 0 | 0 | 1 | $I_1$ |
| 0 | 1 | 0 | $I_2$ |
| 0 | 1 | 1 | $I_3$ |
| 1 | 0 | 0 | $I_4$ |
| 1 | 0 | 1 | $I_5$ |
| 1 | 1 | 0 | $I_6$ |
| 1 | 1 | 1 | $I_7$ |



9.8)

a)




b) $X = AB'D + A'C' + BC + C'D' = AB'(C+C')D + A'(B+B')C'(D+D') + (A+A')BC(D+D') + (A+A')(B+B')C'D'$

$Y = A'C' + AC + C'D' = A'(B+B')C'(D+D') + A(B+B')C(D+D') + (A+A')(B+B')C'D'$

$Z = CD + A'C' + AB'D = (A+A')(B+B')CD + A'(B+B')C'(D+D') + AB'(C+C')D$

| A | B | C | D | X | Y | Z |
|---|---|---|---|---|---|---|
| 0 | 0 | 0 | 0 | 1 | 1 | 1 |
| 0 | 0 | 0 | 1 | 1 | 1 | 1 |
| 0 | 0 | 1 | 0 | 0 | 0 | 0 |
| 0 | 0 | 1 | 1 | 0 | 0 | 1 |
| 0 | 1 | 0 | 0 | 1 | 1 | 1 |
| 0 | 1 | 0 | 1 | 1 | 1 | 1 |
| 0 | 1 | 1 | 0 | 1 | 0 | 0 |
| 0 | 1 | 1 | 1 | 1 | 0 | 1 |
| 1 | 0 | 0 | 0 | 1 | 1 | 0 |
| 1 | 0 | 0 | 1 | 1 | 0 | 1 |
| 1 | 0 | 1 | 0 | 0 | 1 | 0 |
| 1 | 0 | 1 | 1 | 1 | 1 | 1 |
| 1 | 1 | 0 | 0 | 1 | 1 | 0 |
| 1 | 1 | 0 | 1 | 0 | 0 | 0 |
| 1 | 1 | 1 | 0 | 1 | 1 | 0 |
| 1 | 1 | 1 | 1 | 1 | 1 | 1 |

## 9.9) Truth table for full subtractor

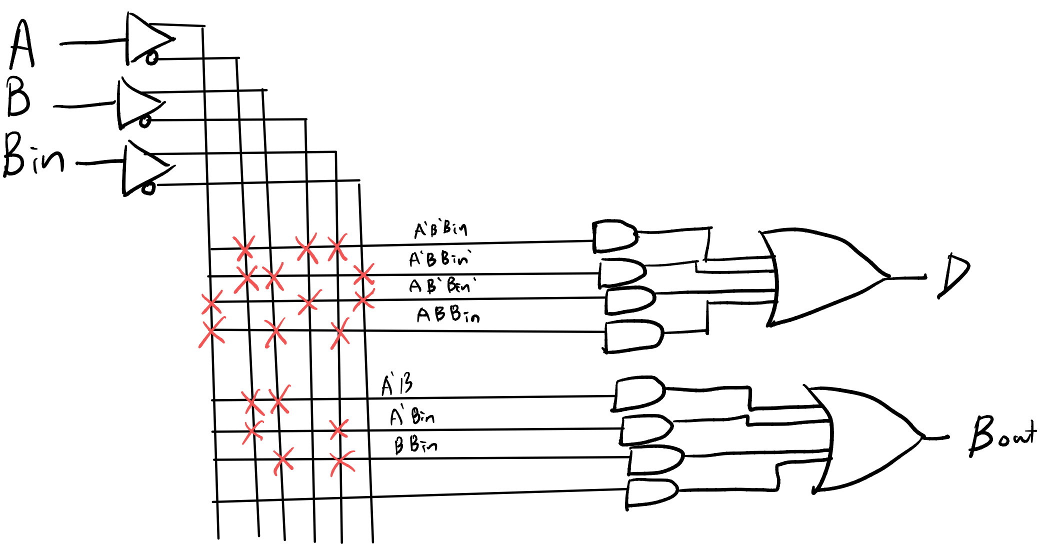
| Input | | | Output | |
|---|---|---|---|---|
| A | B | $B_{in}$ | D | $B_{out}$ |
| 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 1 | 1 | 1 |
| 0 | 1 | 0 | 1 | 1 |
| 0 | 1 | 1 | 0 | 1 |
| 1 | 0 | 0 | 1 | 0 |
| 1 | 0 | 1 | 0 | 0 |
| 1 | 1 | 0 | 0 | 0 |
| 1 | 1 | 1 | 1 | 1 |

$$D = A'B'B_{in} + A'BB_{in}' + AB'B_{in}' + ABB_{in}$$

$$B_{out} = A'B'B_{in} + A'BB_{in}' + A'BB_{in} + ABB_{in} = A'B + A'B'B_{in} + ABB_{in}$$

$$= A'(B + B'B_{in}) + ABB_{in} = A'(B + B_{in}) + ABB_{in} = A'B + A'B_{in} + ABB_{in}$$

$$= A'B + B_{in}(A' + AB) = A'B + B_{in}(A' + B) = A'B + A'B_{in} + BB_{in}$$



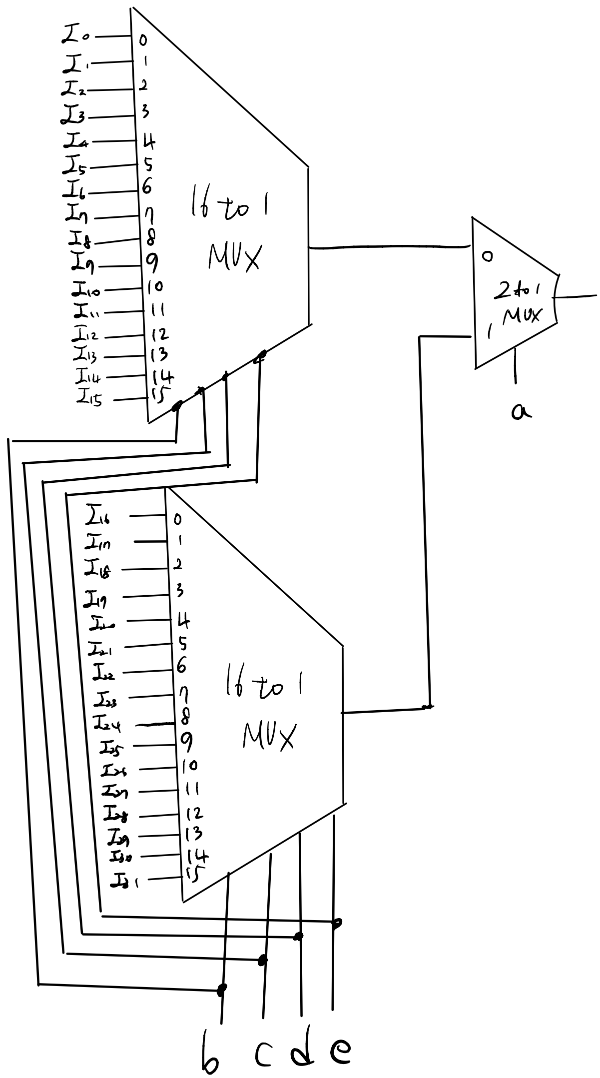
9.13> $F = ab'cde' + bc'd'e + a'cd'e + ac'de'$

about b $\quad F_0 = acde' + a'cd'e + ac'de'$

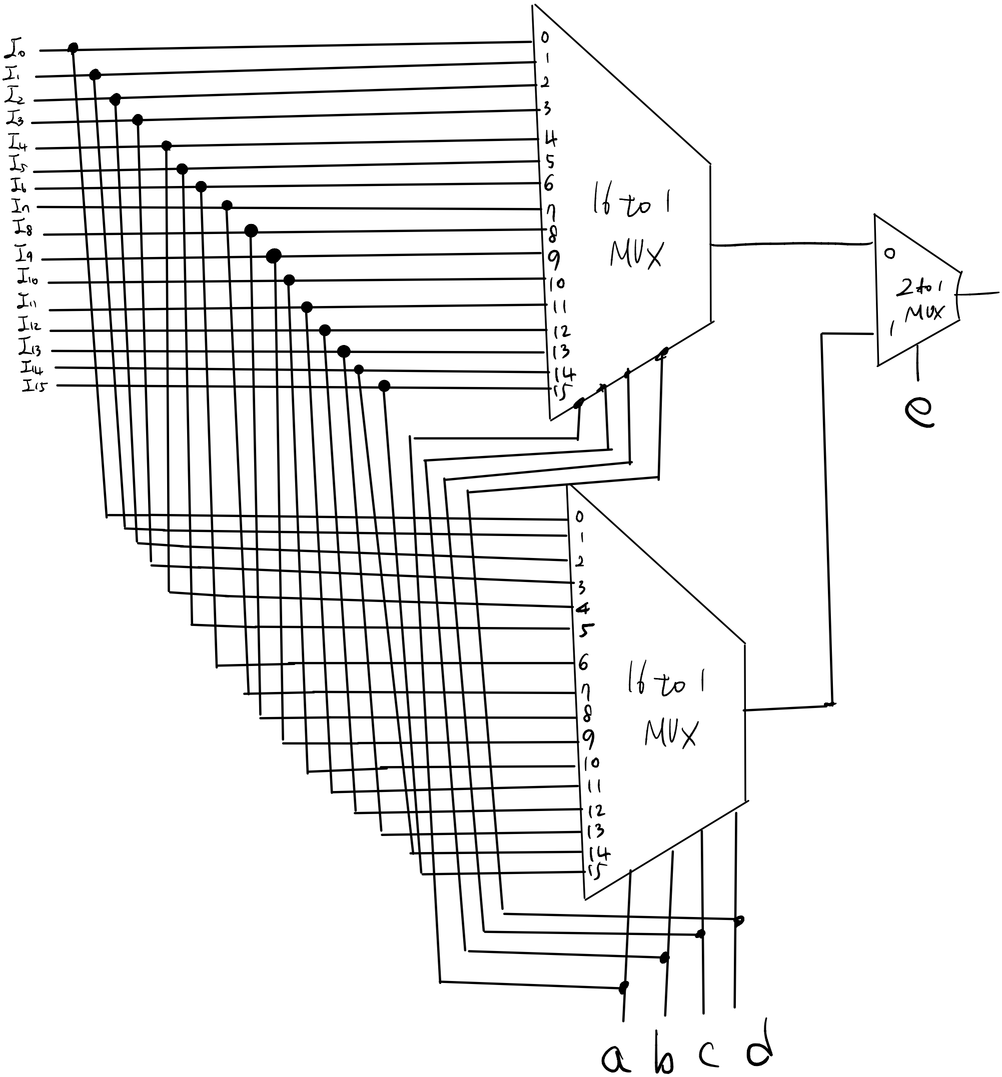
$F_1 = c'd'e + a'cd'e + ac'de'$

$F = b'F_0 + bF_1 = b'(acde' + a'cd'e + ac'de') + b(c'd'e + a'cd'e + ac'de')$

9.16> a)



b)


I0
I1
I2
I3
I4
I5
I6
I7
I8
I9
I10
I11
I12
I13
I14
I15
16 to 1 MUX
16 to 1 MUX
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15
2 to 1 MUX
0
1
e
a b c d

9,18) BCD + 0011 = excess-3 code

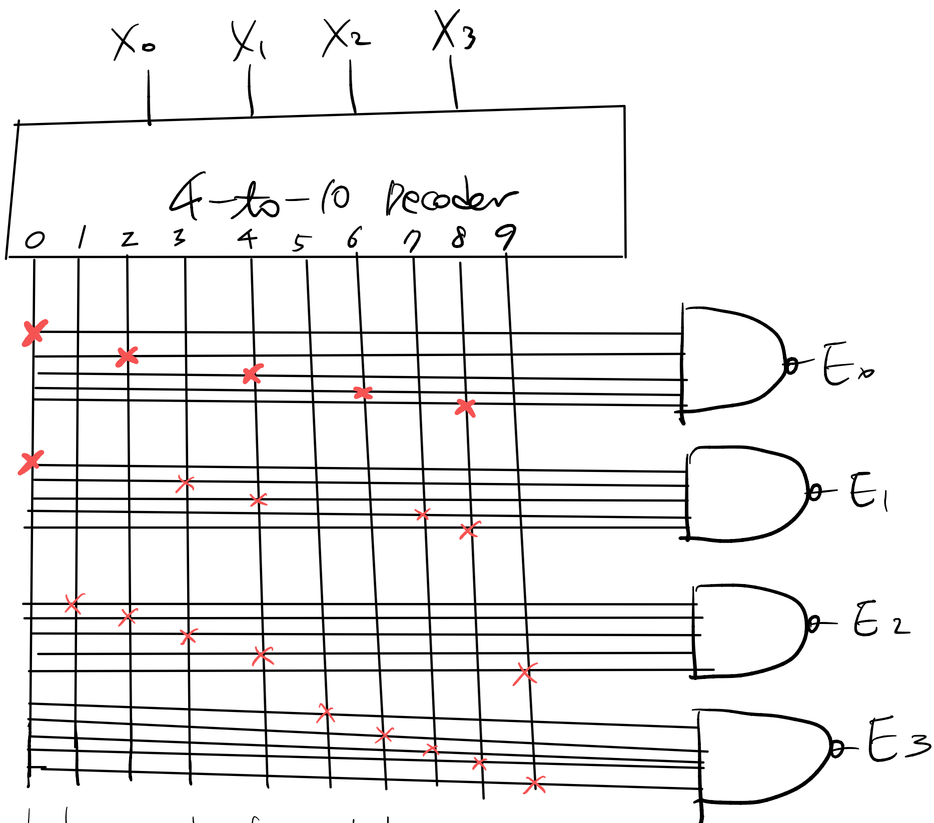
| $X_3$ | $X_2$ | $X_1$ | $X_0$ | $E_3$ | $E_2$ | $E_1$ | $E_0$ |
|---|---|---|---|---|---|---|---|
| 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 |
| 0 | 0 | 0 | 1 | 0 | 1 | 0 | 0 |
| 0 | 0 | 1 | 0 | 0 | 1 | 0 | 1 |
| 0 | 0 | 1 | 1 | 0 | 1 | 1 | 0 |
| 0 | 1 | 0 | 0 | 0 | 1 | 1 | 1 |
| 0 | 1 | 0 | 1 | 1 | 0 | 0 | 0 |
| 0 | 1 | 1 | 0 | 1 | 0 | 0 | 1 |
| 0 | 1 | 1 | 1 | 1 | 0 | 1 | 0 |
| 1 | 0 | 0 | 0 | 1 | 0 | 1 | 1 |
| 1 | 0 | 0 | 1 | 1 | 1 | 0 | 0 |

$$E_0 = X_0'X_1'X_2'X_3' + X_0'X_1X_2'X_3' + X_0'X_1'X_2X_3 + X_0'X_1X_2X_3' + X_0'X_1'X_2'X_3$$
$$= ((X_0'X_1'X_2'X_3')'(X_0'X_1X_2'X_3')'(X_0'X_1'X_2X_3)'(X_0'X_1X_2X_3')'(X_0'X_1'X_2'X_3)')'$$

$$E_1 = X_0'X_1'X_2'X_3' + X_0X_1X_2'X_3' + X_0'X_1'X_2X_3' + X_0X_1X_2X_3' + X_0'X_1'X_2'X_3$$
$$= ((X_0'X_1'X_2'X_3')'(X_0X_1X_2'X_3')'(X_0'X_1'X_2X_3')'(X_0X_1X_2X_3')'(X_0'X_1'X_2'X_3))'$$

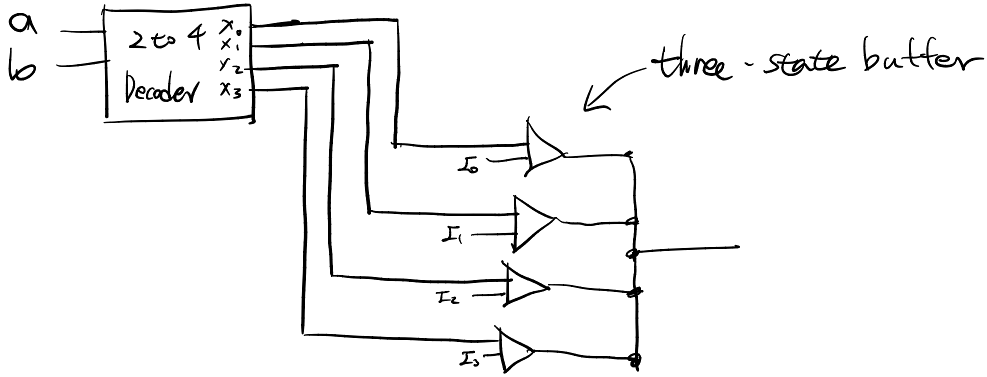
$$E_2 = X_0X_1'X_2'X_3' + X_0'X_1X_2'X_3' + X_0X_1X_2'X_3' + X_0'X_1'X_2X_3' + X_0X_1'X_2'X_3$$
$$= ((X_0X_1'X_2'X_3')'(X_0'X_1X_2'X_3')'(X_0X_1X_2'X_3')'(X_0'X_1'X_2X_3')'(X_0X_1'X_2'X_3))'$$

$$E_3 = X_0X_1'X_2X_3 + X_0'X_1X_2X_3' + X_0X_1X_2X_3' + X_0'X_1'X_2'X_3 + X_0X_1'X_2'X_3$$
$$= ((X_0X_1'X_2X_3)'(X_0'X_1X_2X_3')'(X_0X_1X_2X_3')'(X_0'X_1'X_2'X_3)'(X_0X_1'X_2'X_3)')'$$




9.24) 2 to 4 decoder generates four outputs

| a | b | X0 | X1 | X2 | X3 |
|---|---|---|---|---|---|
| 0 | 0 | 1 | 0 | 0 | 0 |
| 0 | 1 | 0 | 1 | 0 | 0 |
| 1 | 0 | 0 | 0 | 1 | 0 |
| 1 | 1 | 0 | 0 | 0 | 1 |



9.26) Truth table for full subtractor

| Input | | | Output | |
|---|---|---|---|---|
| A | B | $B_{in}$ | D | $B_{out}$ |
| 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 1 | 1 | 1 |
| 0 | 1 | 0 | 1 | 1 |
| 0 | 1 | 1 | 0 | 1 |
| 1 | 0 | 0 | 1 | 0 |
| 1 | 0 | 1 | 0 | 0 |
| 1 | 1 | 0 | 0 | 0 |
| 1 | 1 | 1 | 1 | 1 |

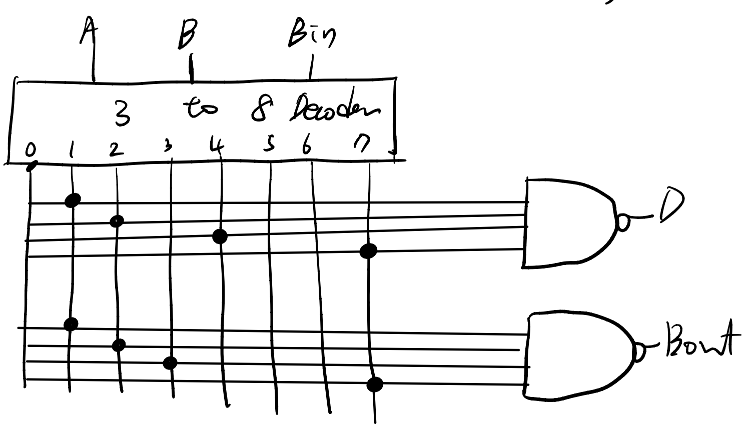
$$D = A'B'B_{in} + A'BB_{in}' + AB'B_{in}' + ABB_{in}$$

$$B_{out} = A'B'B_{in} + A'BB_{in}' + A'BB_{in} + ABB_{in}$$

a) two NAND gates

$$D = \left((A'B'B_{in})'(A'BB_{in}')'(AB'B_{in}')'(ABB_{in})'\right)'$$

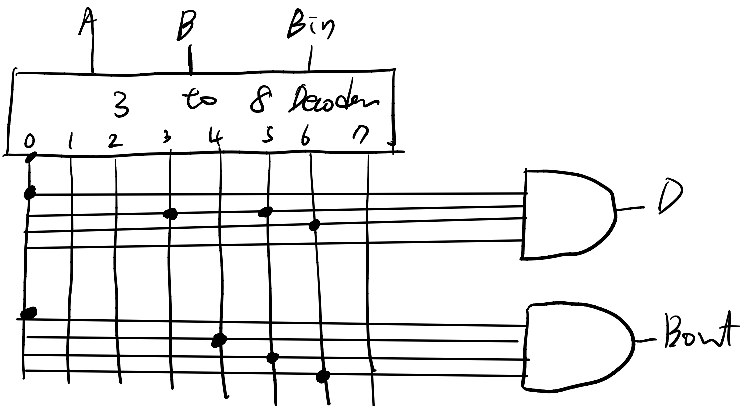
$$B_{out} = \left((A'B'B_{in})'(A'BB_{in}')'(A'BB_{in})'(ABB_{in})'\right)'$$



b) two AND gates

$D = \prod M(0,3,5,6)$

$B_{out} = \prod M(0,4,5,6)$




9.41) a) about d $F_0 = a' + ac' + b'c$

$F_1 = a' + a$

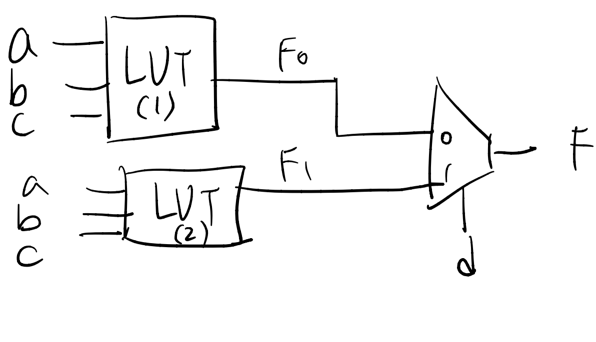
$F = F_0 d' + F_1 d = d'(a' + ac' + b'c) + d(a' + a)$

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

b) $F_0 = a' + ac' + b'c = a'(b+b')(c+c') + a(b+b')c' + (a+a')b'c$

$= \sum m(0,1,2,3,4,5,6)$

$F_1 = a' + a = 1 = \sum m(0,1,2,3,4,5,6,7)$



c) LUT(1) Truth table

| a | b | c | $F_0$ |
|---|---|---|---|
| 0 | 0 | 0 | 1 |
| 0 | 0 | 1 | 1 |
| 0 | 1 | 0 | 1 |
| 0 | 1 | 1 | 1 |
| 1 | 0 | 0 | 1 |
| 1 | 0 | 1 | 1 |
| 1 | 1 | 0 | 1 |
| 1 | 1 | 1 | 0 |

LUT(2) Truth Table

| a | b | c | $F_0$ |
|---|---|---|---|
| 0 | 0 | 0 | 1 |
| 0 | 0 | 1 | 1 |
| 0 | 1 | 0 | 1 |
| 0 | 1 | 1 | 1 |
| 1 | 0 | 0 | 1 |
| 1 | 0 | 1 | 1 |
| 1 | 1 | 0 | 1 |
| 1 | 1 | 1 | 1 |