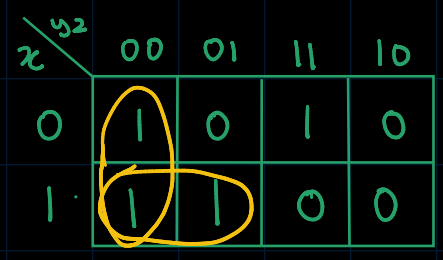
Sameed Ahmed 300366534

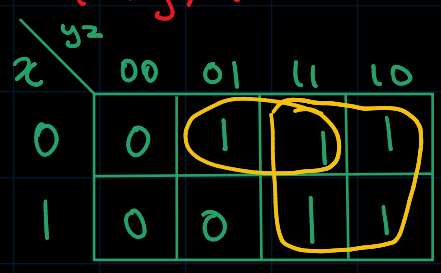
3.2 Simplify the following Boolean function using three variable K-Maps

a) $F(x,y,z) = \Sigma(0,2,4,5)$



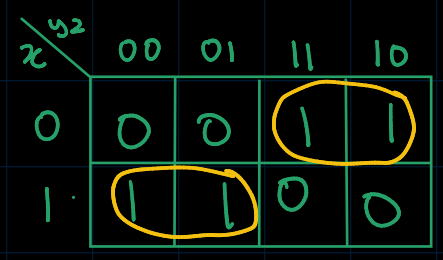
$F(x,y,z) = y'z' + xy' + x'yz$

b) $F(x,y,z) = \Sigma(1,2,3,6,7)$



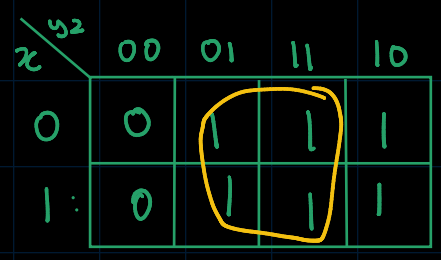
$F(x,y,z) = y + x'z$

c) $F(x,y,z) = \Sigma(2,3,4,5)$



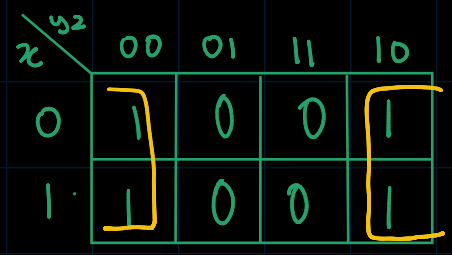
$F(x,y,z) = xy' + x'y$

d) $F(x,y,z) = (1,2,3,5,6,7)$



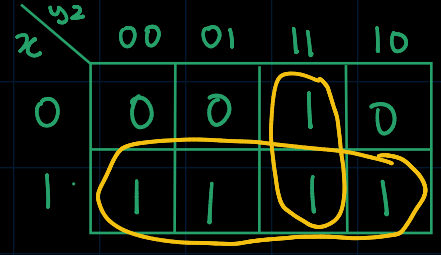
$F(x,y,z) = z + y$

e) $F(x,y,z) = (0,2,4,6)$



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

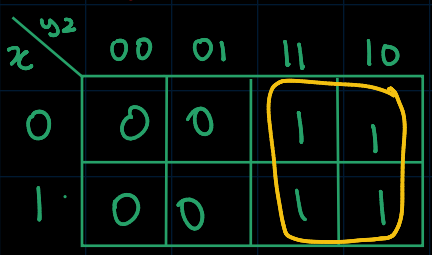
f) $F(x,y,z) = \Sigma(3,4,5,6,7)$



$F(x,y,z) = x + yz$

3.3 Simplify the following Boolean functions using K-maps

a) $F(x,y,z) = \Sigma(2,3,6,7)$

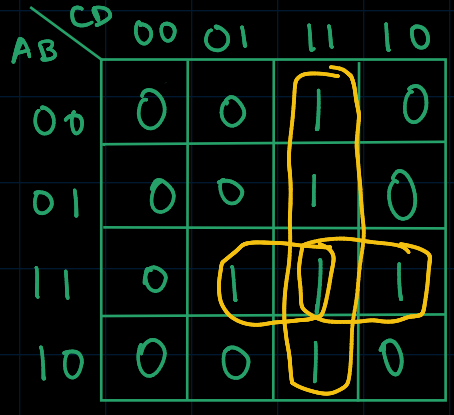


$F(x,y,z) = y$

b) $F(A,B,C,D) = \Sigma(4,6\ 7,15)$

$F(A,B,C,D) = BCD + A'BD'$

c) $F(A,B,C,D) = \Sigma(3,7,11,13,14,15)$



$F(A,B,C,D) = CD + ABD + ABC$

d) $F(w,x,y,z) = \Sigma(2,3,12,13,14,15)$

$F(w,x,y,z) = w'x'y$

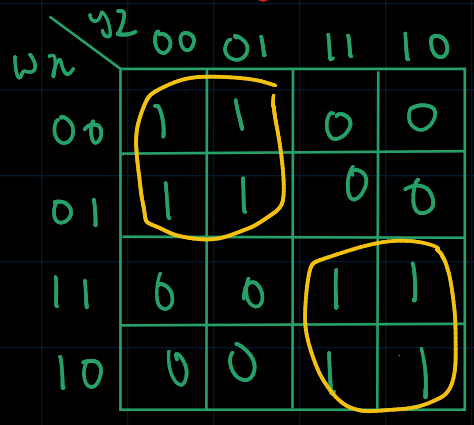
e) $F(w,x,y,z) = \Sigma(11,12,13,14,15)$

$F(w,x,y,z) = wx + wyz$

f) $F(w,x,y,z) = \Sigma(8,10,12,13,14)$

$\Sigma F(w,x,y,z)$
$= wx'z' + wy'z' + wxz$

g) $F(w,x,y,z) = \Sigma(0,1,4,5,10,11,14,15)$

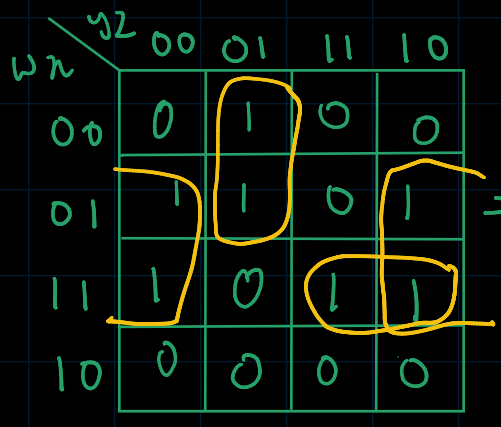


$F(w,x,y,z)$
$= w'y' + wy$

h) $F(w,x,y,z) = \Sigma(2,3,6,7,9,11,13)$

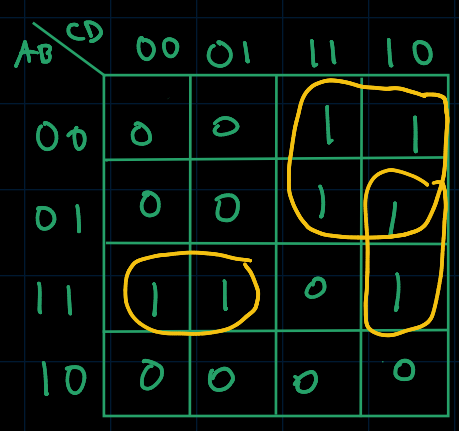
$F(w,x,y,z)$
$= wy' + w'y$

a) $F(w,x,y,z) = \Sigma(1,4,5,6,12,14,15)$



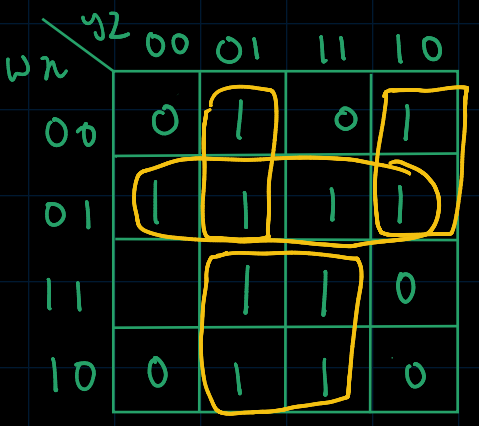
$F(w,x,y,z) =$
$= xz' + wxy + w'y'z$

b) $F(A,B,C,D) = \Sigma(2,3,6,7,12,13,14)$



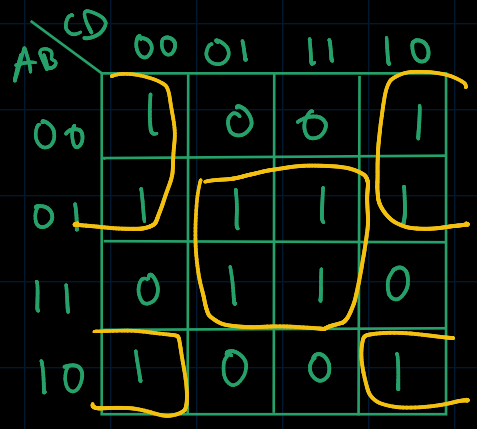
$F(A,B,C,D) =$
$A'C + BCD' + ABC'$

c) $F(w,x,y,z) = \Sigma(1,3,4,5,6,7,9,11,13,15)$



$F(w,x,y,z) =$
$w'x + wz + w'y'z + w'yz'$

d) $F(A,B,C,D) = \Sigma(0,2,4,5,6,7,8,10,13,15)$



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

3.5 Simplify the following Boolean functions using four-variable K-maps

3.8 Find the minterms of the following Boolean expressions by first plottting each function in a K-Map

a) $xy + yz + xy'z$

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

$F(x,y,z) = \Sigma(3,5,6,7)$

b) $C'D + ABC' + ABD' + A'B'D$

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

$F(A,B,C,D) = \Sigma(1,3,5,9,12,13,14)$

c) $wyz + w'x' + wxz'$

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

$F(w,x,y,z) = (0,1,2,3,11,12,14,15)$

d) $A'B + A'CD + B'CD + BC'D'$

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

$F(A,B,C,D) = (3,4,5,6,7,11,12)$

3.10 Simplify the following Boolean by first finding the essential prime implicants

a) $F(w,x,y,z) = \Sigma(0,2,4,5,6,7,8,10,13,15)$

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

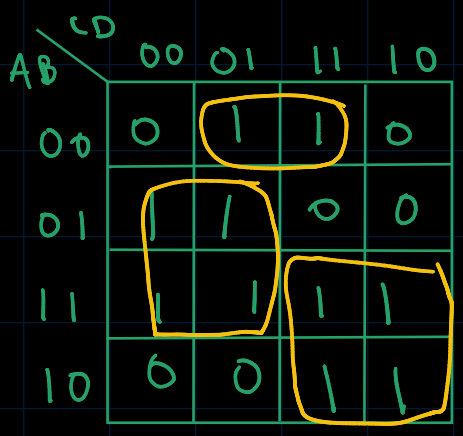
$F(w,x,y,z) = w'z' + xz + wxz'$

b) $F(A,B,C,D) = \Sigma(0,2,3,5,7,8,10,11,14,15)$

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

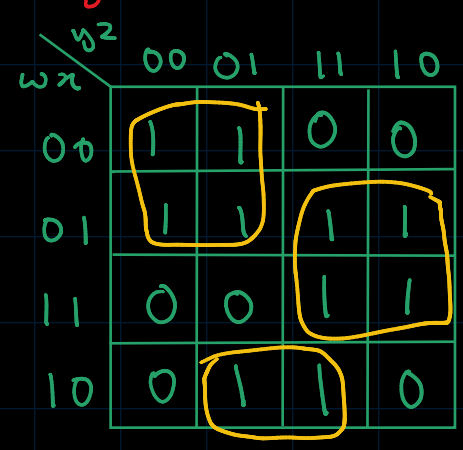
$F(A,B,C,D) = B'D' + CD + A'BD + AB'D' + AC$

c) $F(A,B,C,D) = \Sigma(1,3,4,5,10,11,12,13,14,15)$



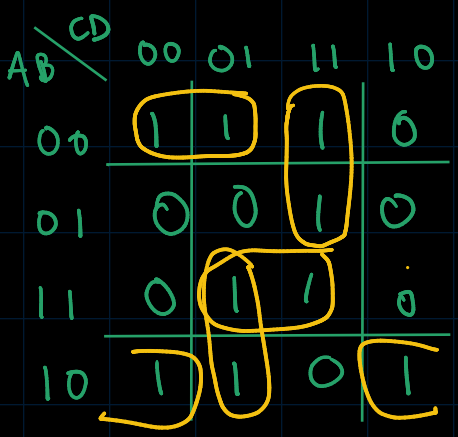
$F(A,B,C,D) = ABD + BC' + AC$

d) $F(w,x,y,z) = \Sigma(0,1,4,5,6,7,9,11,14,15)$



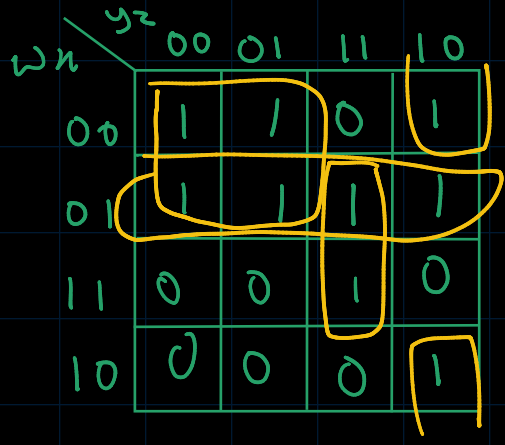
$F(w,x,y,z) = w'y' + xy + wx'z$

e) $F(A,B,C,D) = \Sigma(0,1,7,8,9,10,13,15)$



$F(A,B,C,D) = A'B'C' + A'CD + ABD + AC'D + AB'D'$

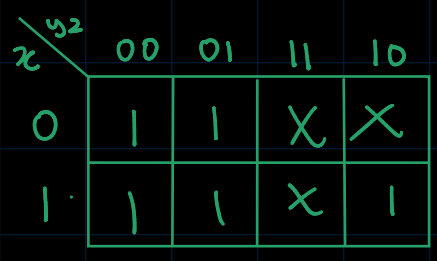
f) $F(w,x,y,z) = \Sigma(0,1,2,4,5,6,7,10,15)$



$F(w,x,y,z) = w'y' + w'x + xyz + x'y'z'$

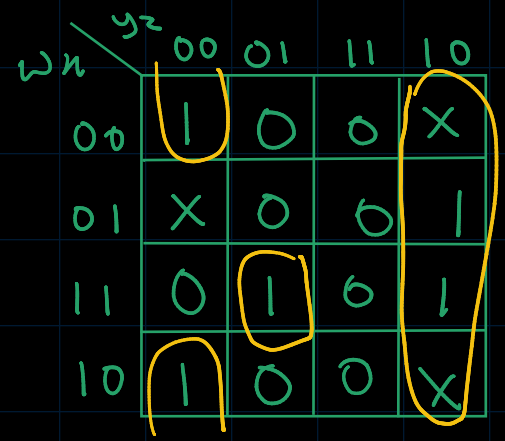
3.15 Simplify the following Boolean functions F, together with don't-care conditions d, and then express the simplified function in sum-of-minterms form:

a) $F(x,y,z) = \Sigma(0,1,4,5,6)$
$d(x,y,z) = \Sigma(2,3,7)$



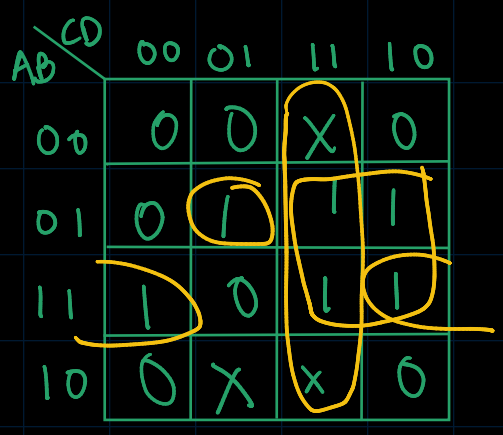
$F(x,y,z) = (0,1,2,3,4,5,6,7)$

b) $F(A,B,C,D) = \Sigma(0,6,8,13,14)$
$d(A,B,C,D) = \Sigma(2,4,10)$



$F(A,B,C,D) = B'D' + CD' + ABC'D$
$F(A,B,C,D) = (0,2,6,8,10,13,14)$

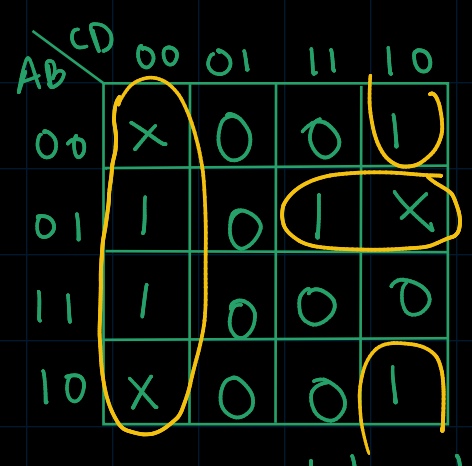
c) $F(A,B,C,D) = \Sigma(5,6,7,12,14,15)$
$d(A,B,C,D) = \Sigma(3,9,11)$



$F(A,B,C,D) = AB\bar{D} + A'BC'D + CD + BC$

$F(A,B,C,D) = \Sigma(3,5,6,7,11,12,14,15)$

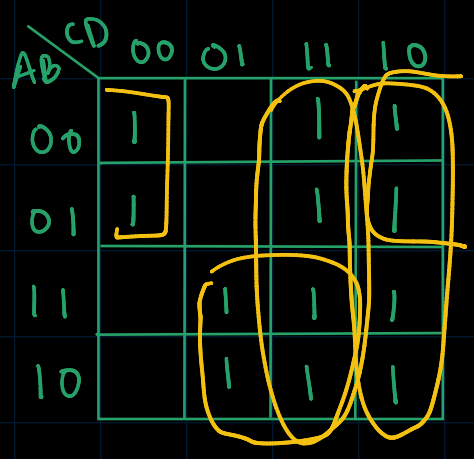
d) $F(A,B,C,D) = \Sigma(4,12,7,2,10)$
$d(A,B,C,D) = \Sigma(0,6,8)$



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

3.16 Simplify the following functions and implement them with two-level NAND circuit gates.

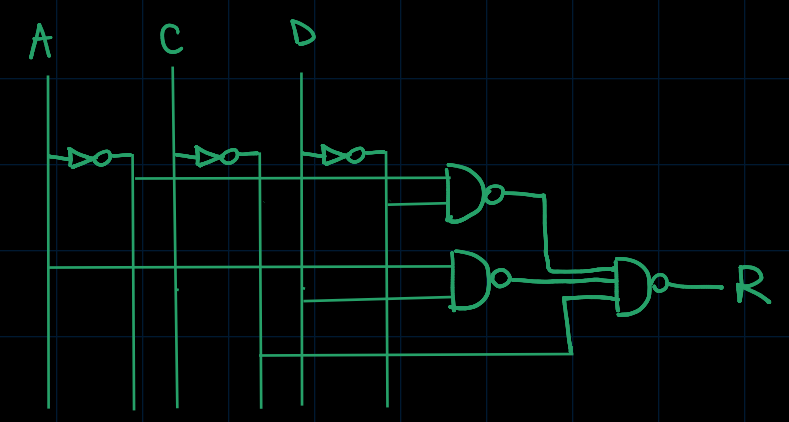
a) $F(A,B,C,D) = AC'D + A'C + ABC + AB'C + A'C'D'$



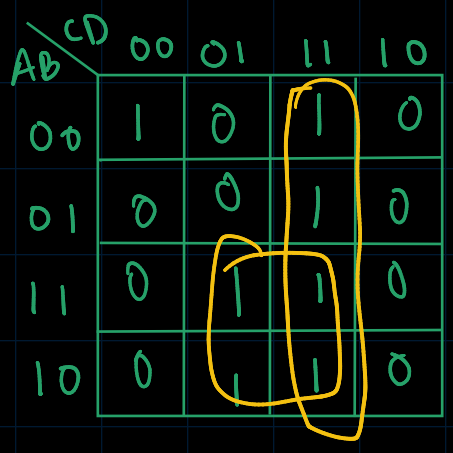
$F(A,B,C,D) = A'D' + C + AD$

$[A'D' + C + AD]'$

$= (A'D')'(C')(AD)'$



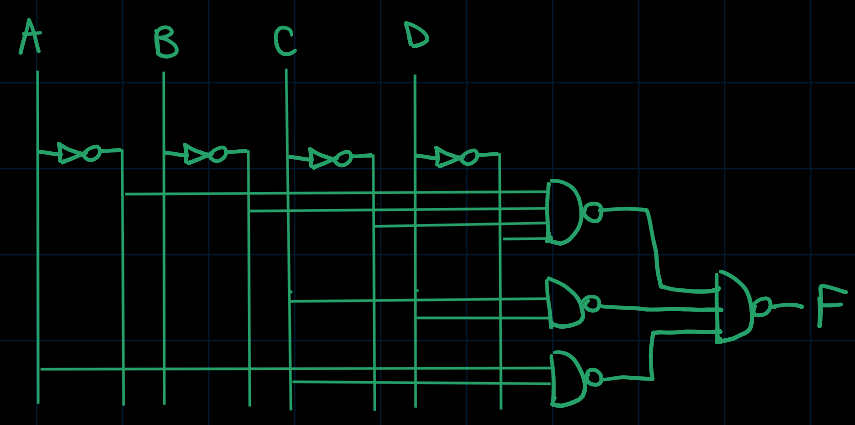
b) $F(A,B,C,D) = A'B'C'D' + CD + AC'D$



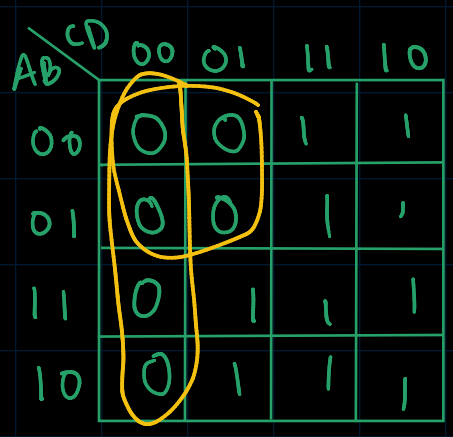
$F(A,B,C,D) = A'B'C'D' + CD + AC$

$[A'B'C'D' + CD + AC]'$

$(A'B'C'D')'(CD)'(AC)'$



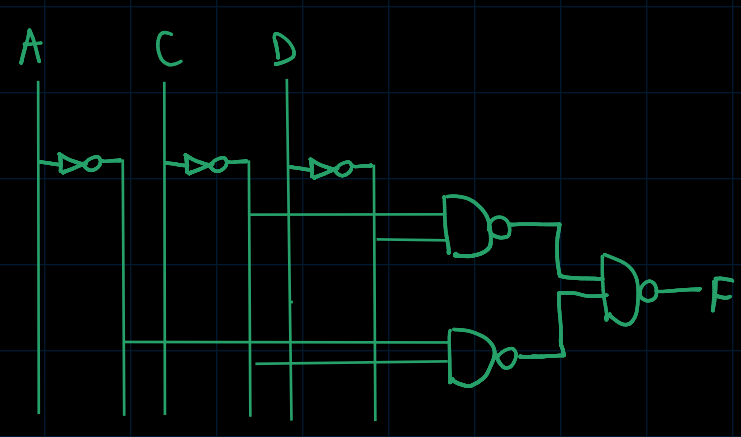
c) $F(A,B,C,D) = (A'+C'+D')(A'+C')(C'+D')$



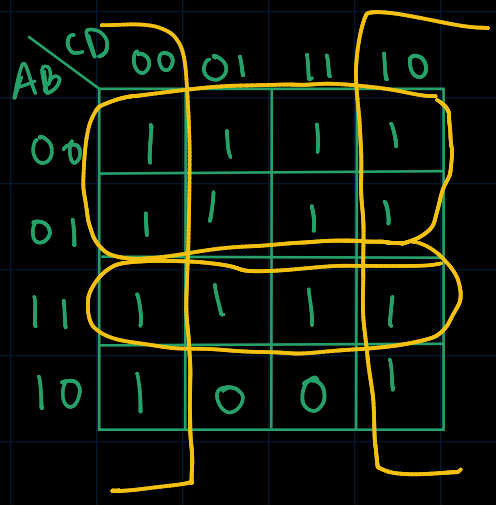
$F(A,B,C,D) = C'D' + A'C'$

$= [C'D' + A'C']'$

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



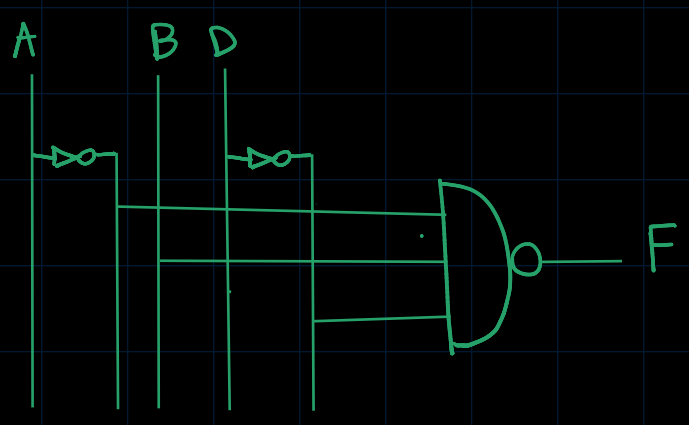
d) $F(A,B,C,D) = A' + B + D' + BC$



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

$[D' + A' + B]'$

$(D')'(A')'B'$



3.18 Draw (a) a logic diagram using only two-input NOR gates to implement the following function:

$$F(A,B,C,D) = (A \oplus B)'(C \oplus D)$$

and (b) repeat (a) for a NAND logic diagram

$F(A,B,C,D) = (A \oplus B)'(C \oplus D)$

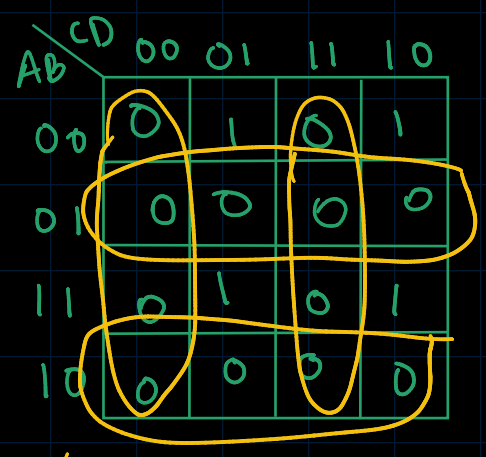
$= (AB' + A'B')(C'D + CD')$

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

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

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

$= A'B'C'D + A'B'CD' + ABC'D + ABCD'$



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

$= [C'D' + CD + A'B + AB']'$

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

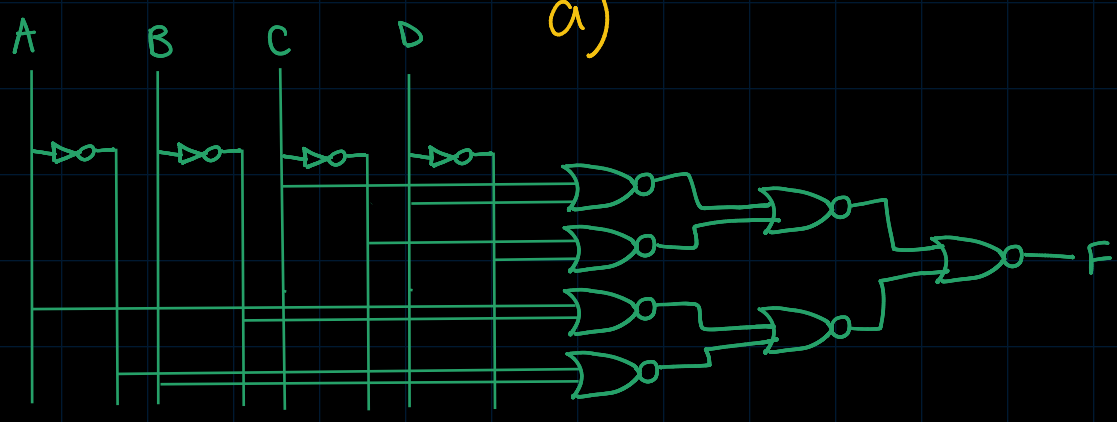
$= [(C + D)(C' + D')(A + B')(A' + B)]'$

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

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

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

a)



b)

$(C'D')'(CD')\ (A'B)'(AB')'$