GATE-LEVEL MINIMIZATION

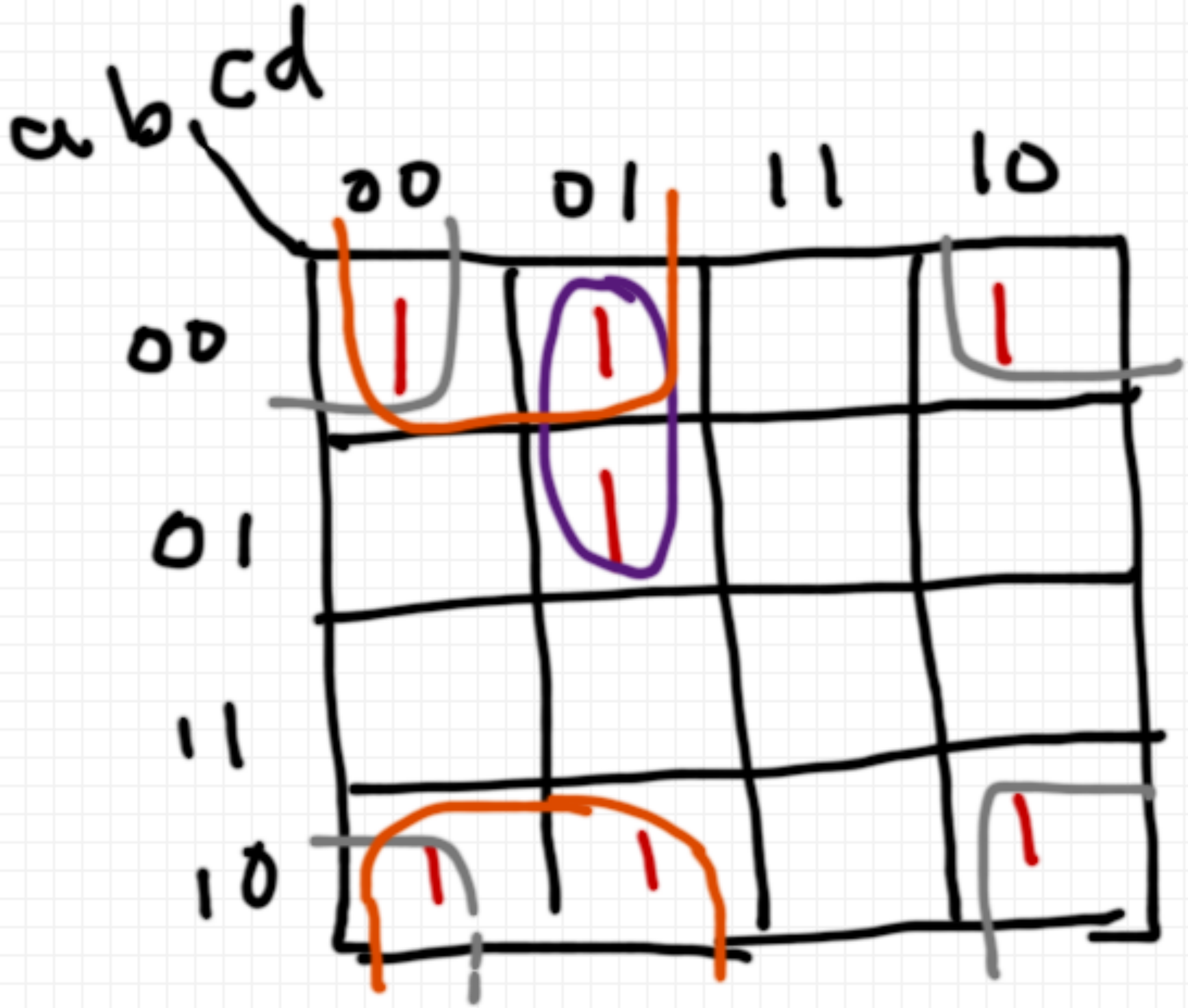
INEL 4205 - Spring 2012 - feb 21

$$\sum (0,1,2,5,8,9,10)$$

- Example 3-8: Simplify to a minimal expression using the:
  - 1's to produce a sum of products (AND-OR)
  - 0's to produce a complemented sum of products (AND-NOR)
  - 0's to produce a product of sums (OR-AND)
  - 1' to produce a complemented product of sums (OR-NAND)
  - implement first using NAND gates only
  - implement fourth using NOR gates only

$$f(a,b,c,d) = \sum(0,1,2,5,8,9,10)$$

1 como 1



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

(a)

$$f(a,b,c,d) = \sum(0,1,2,5,8,9,10)$$

0 como 1

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

$$(ab + cd + bd')' = f$$

(b)

$$f(a,b,c,d) = \sum(0,1,2,5,8,9,10)$$

0 como 0

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

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

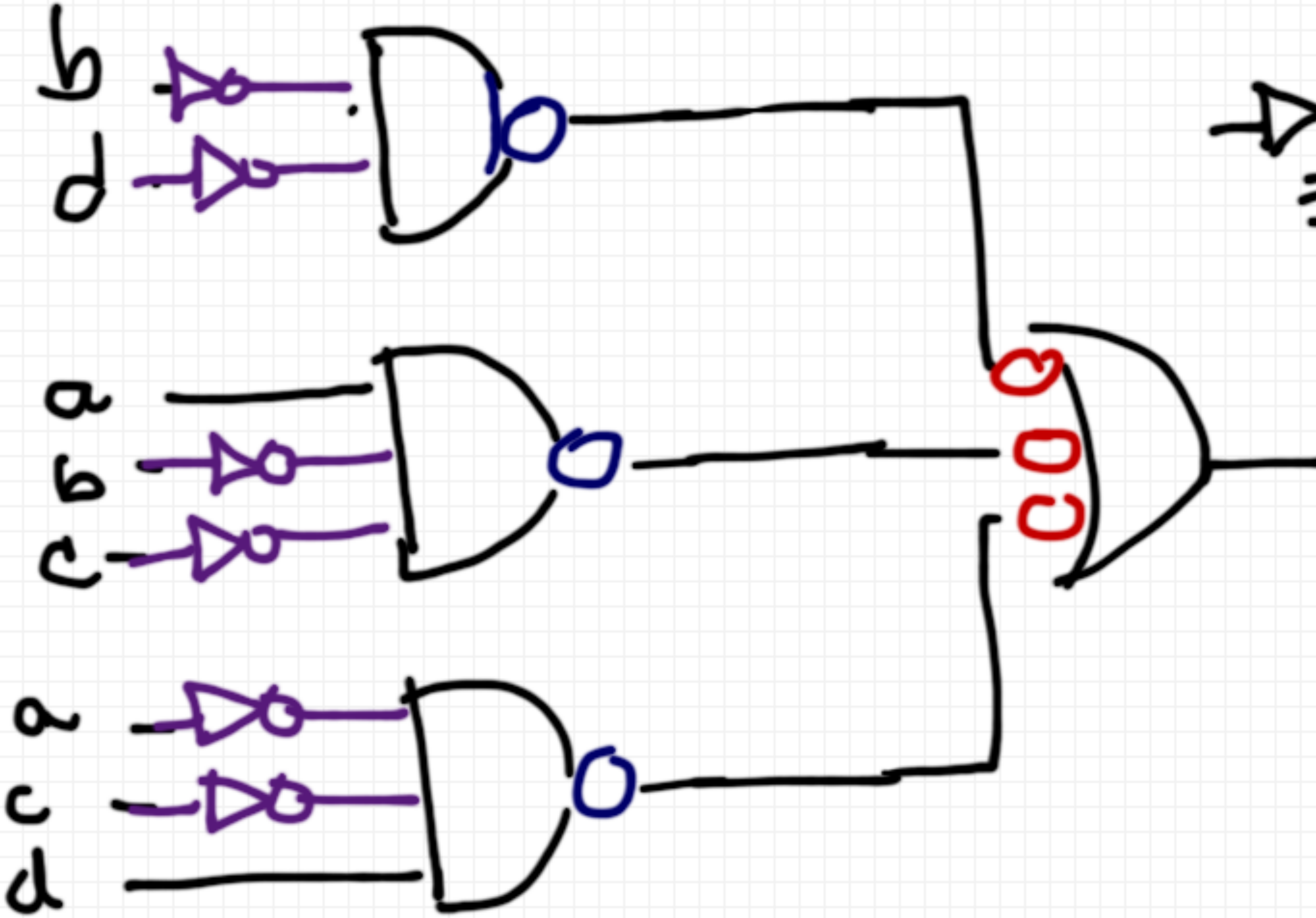
(c)

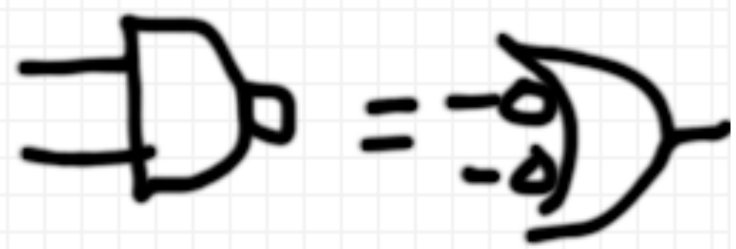
$$f(a,b,c,d) = \sum(0,1,2,5,8,9,10)$$

1s como $\emptyset$

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

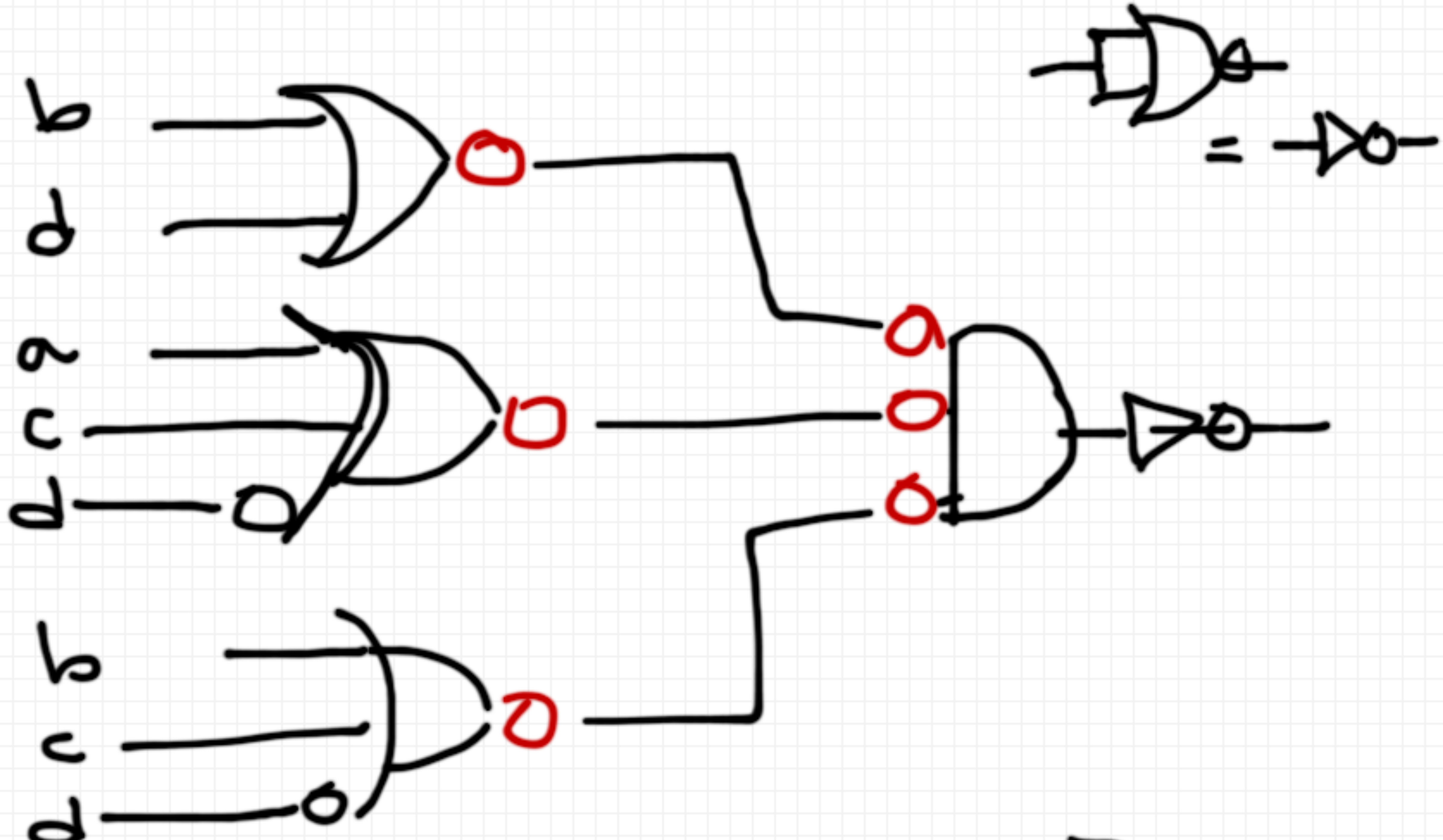
$$\left[(b+d)(a+c+d')(b+c)\right]'$$





de Morgan

$b'd' + ab'c' + a'c'd$



$$\left[\overline{(b+d)(a+c+d')(b+c+d')}\right]$$

Textbook solution

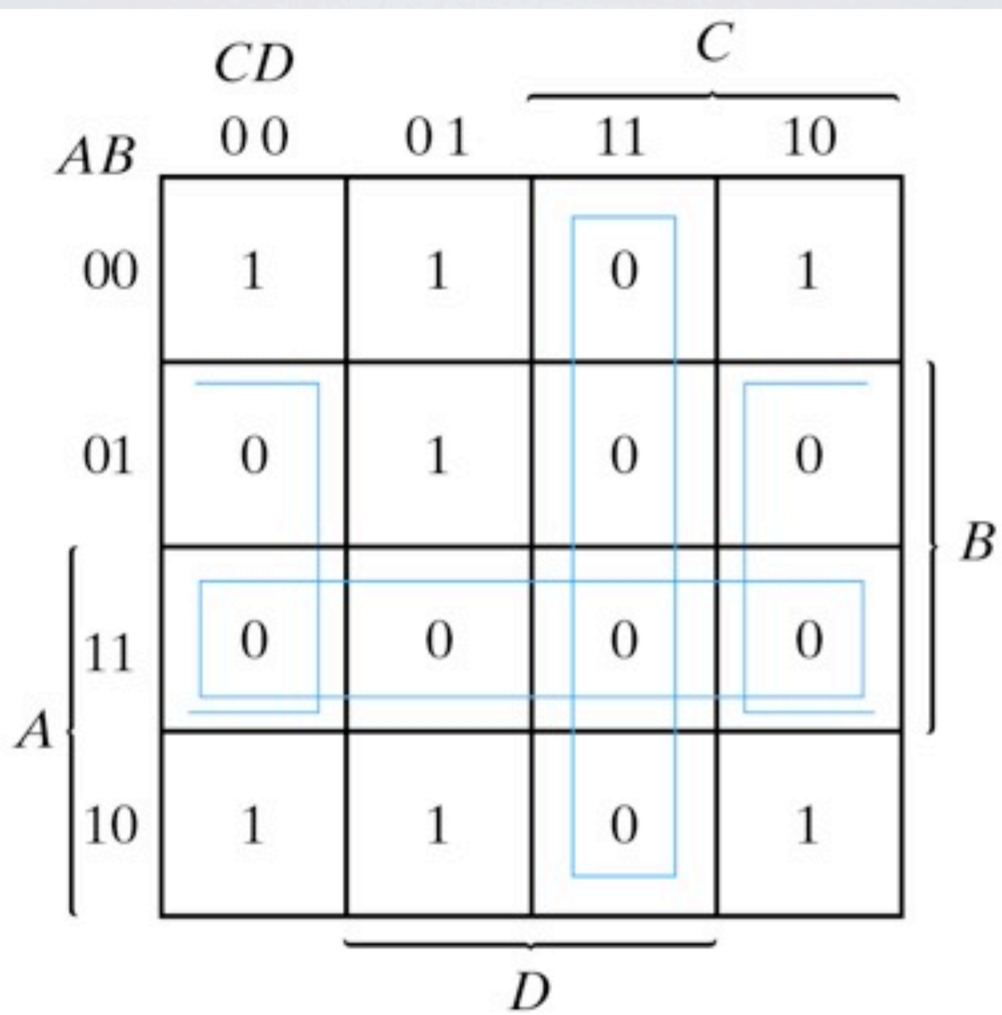
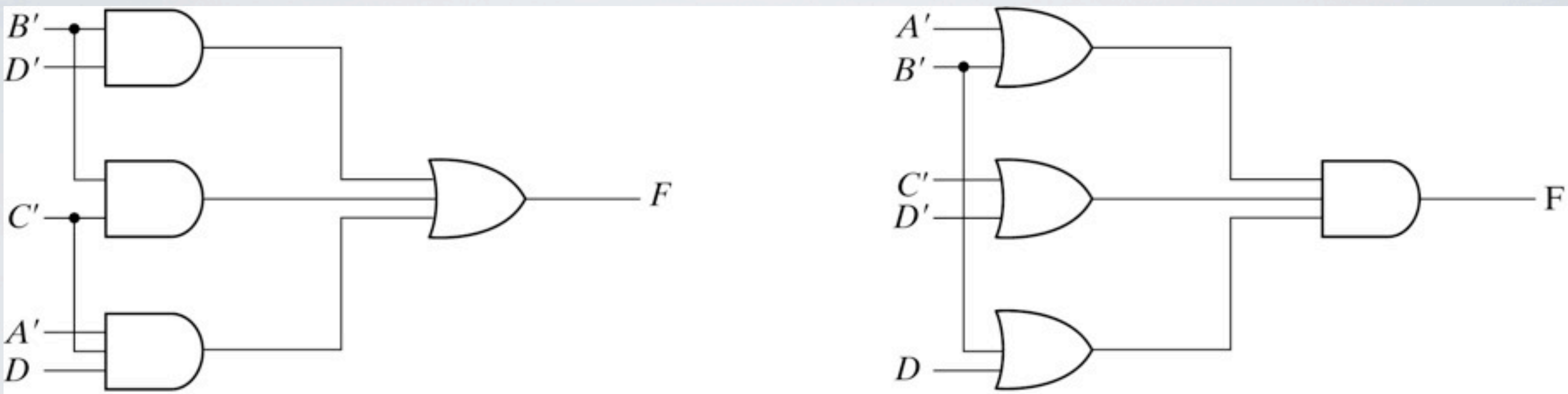


Fig. 3-14 Map for Example 3-8; $F(A, B, C, D) = \Sigma(0, 1, 2, 5, 8, 9, 10)$
$= B'D' + B'C' + A'C'D = (A' + B')(C' + D')(B' + D)$



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

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

Fig. 3-15 Gate Implementation of the Function of Example 3-8

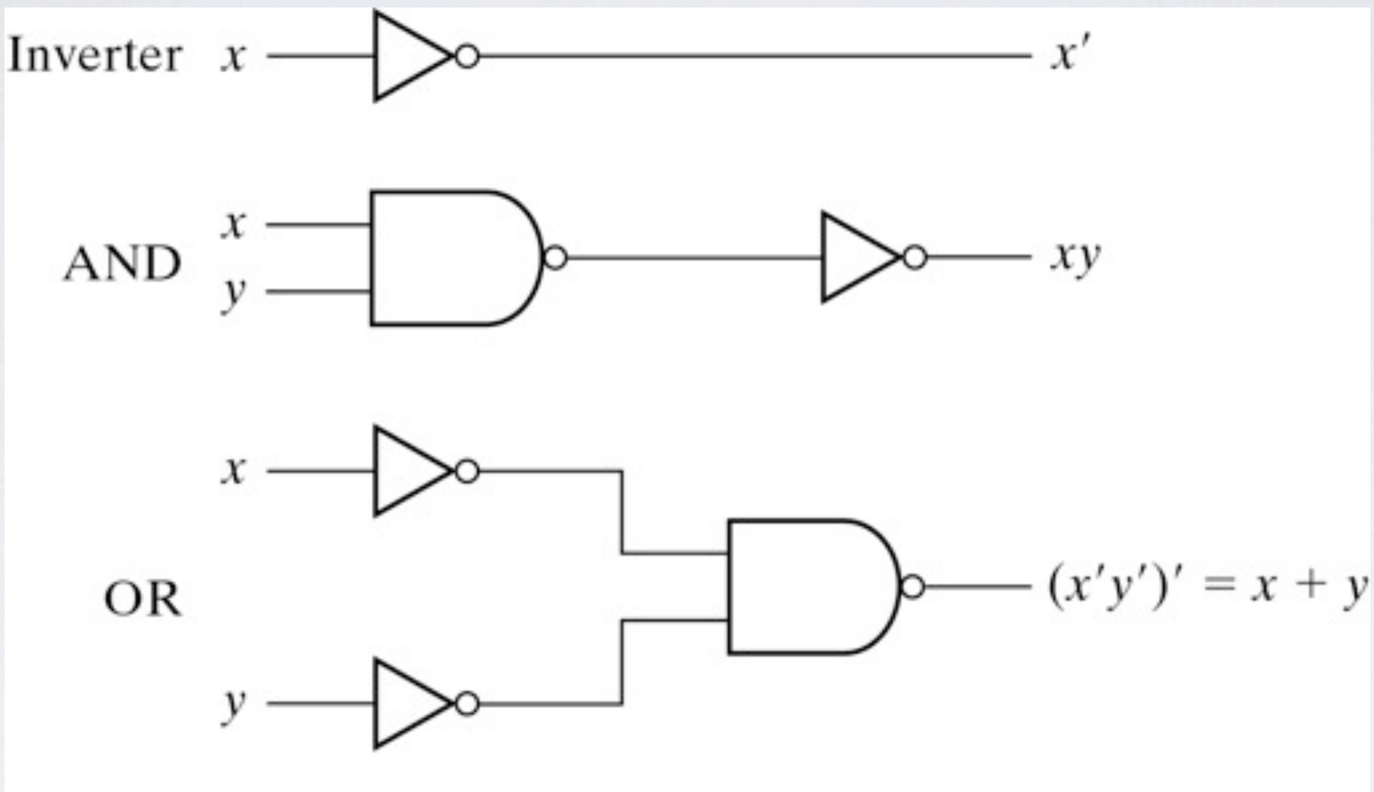


Fig. 3-18 Logic Operations with NAND Gates

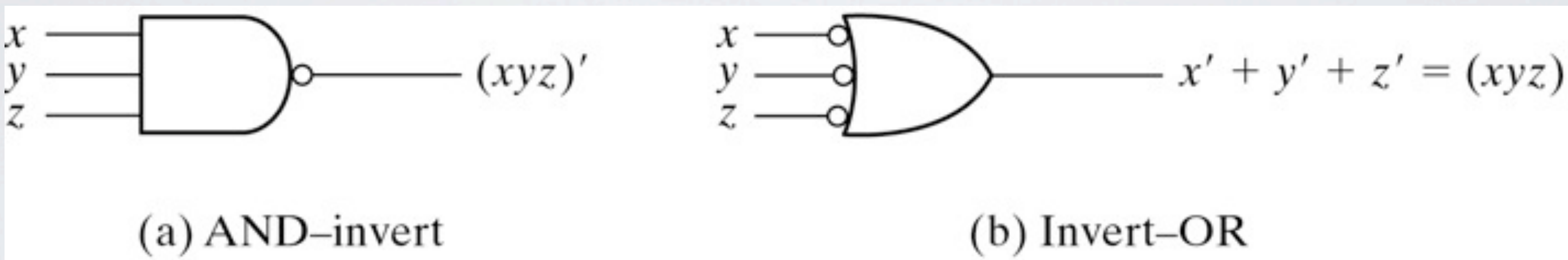


Fig. 3-19 Two Graphic Symbols for NAND Gate

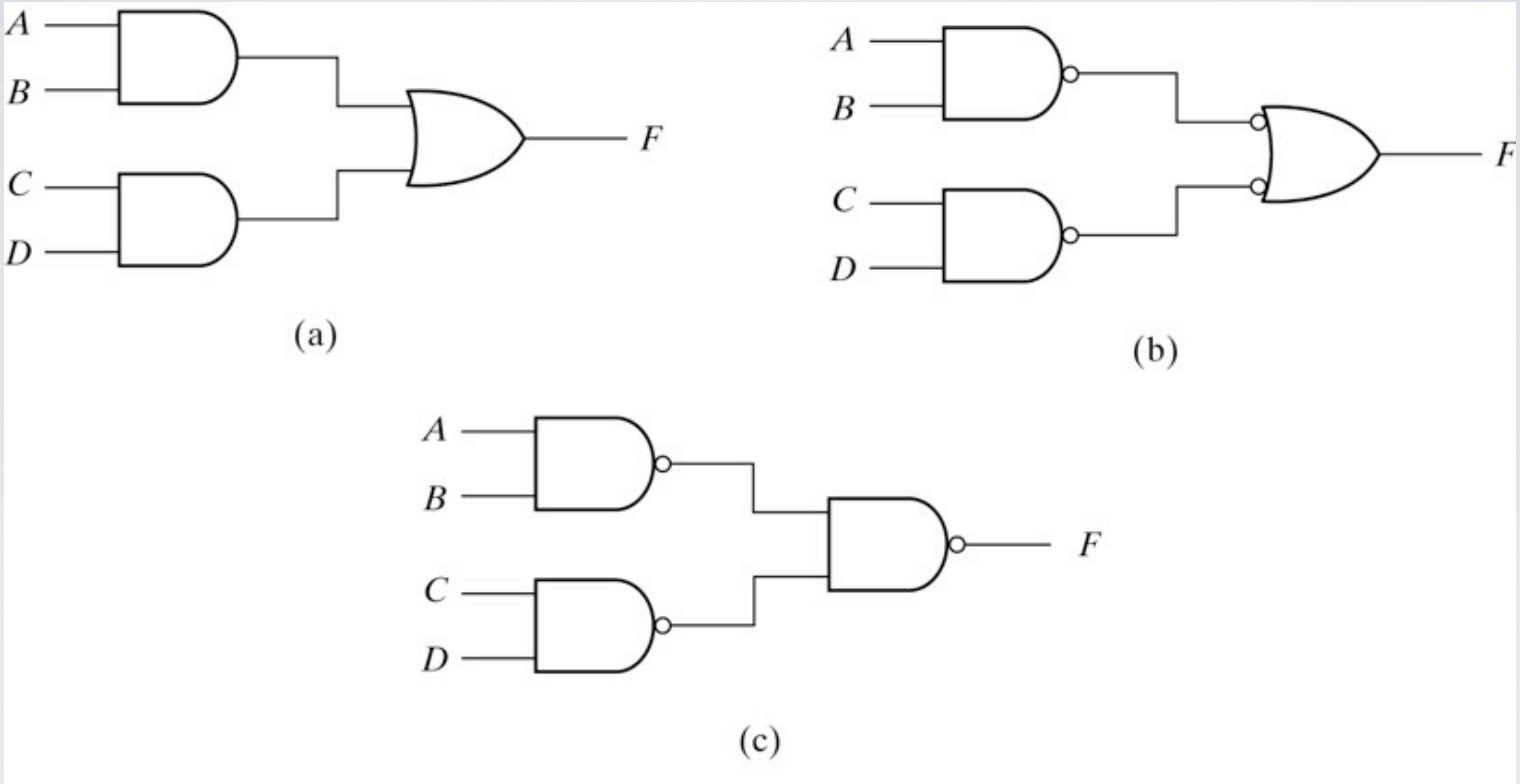


Fig. 3-20 Three Ways to Implement $F = AB + CD$

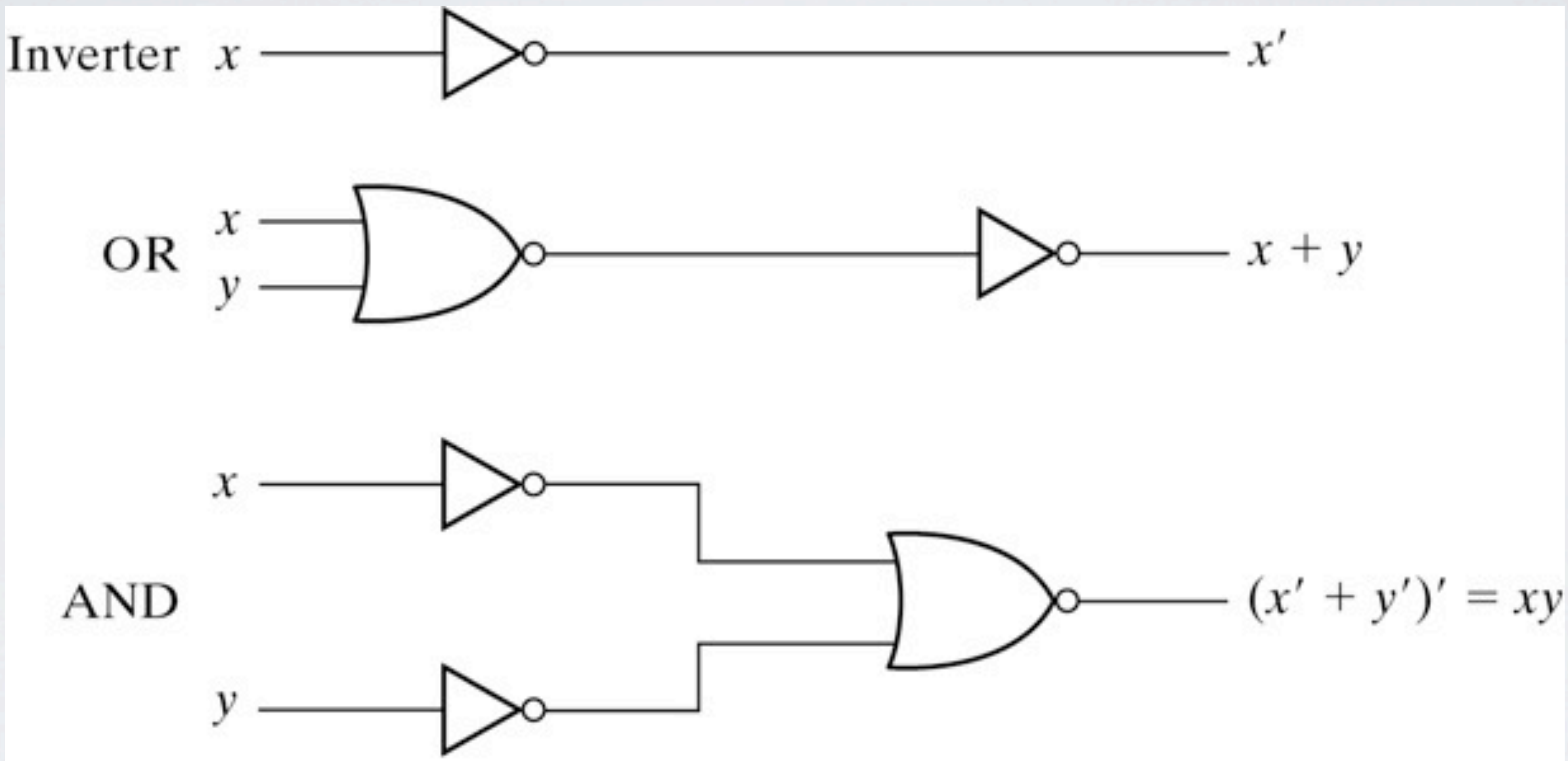


Fig. 3-24 Logic Operations with NOR Gates

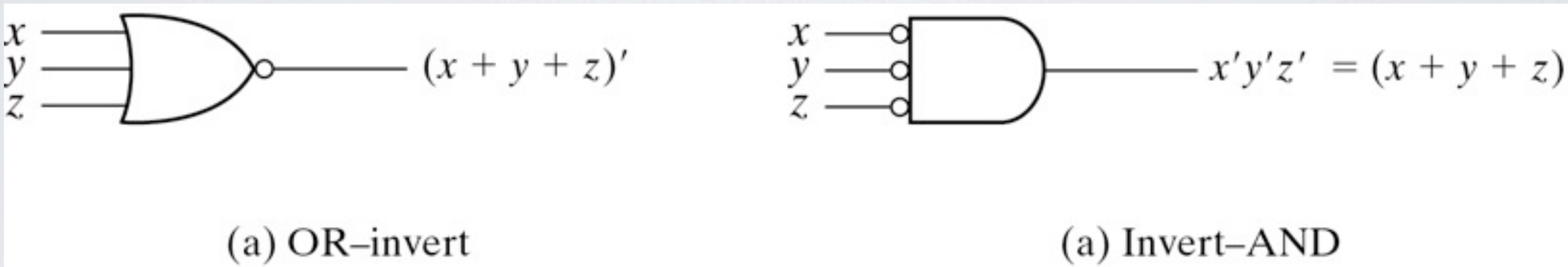


Fig. 3-25 Two Graphic Symbols for NOR Gate