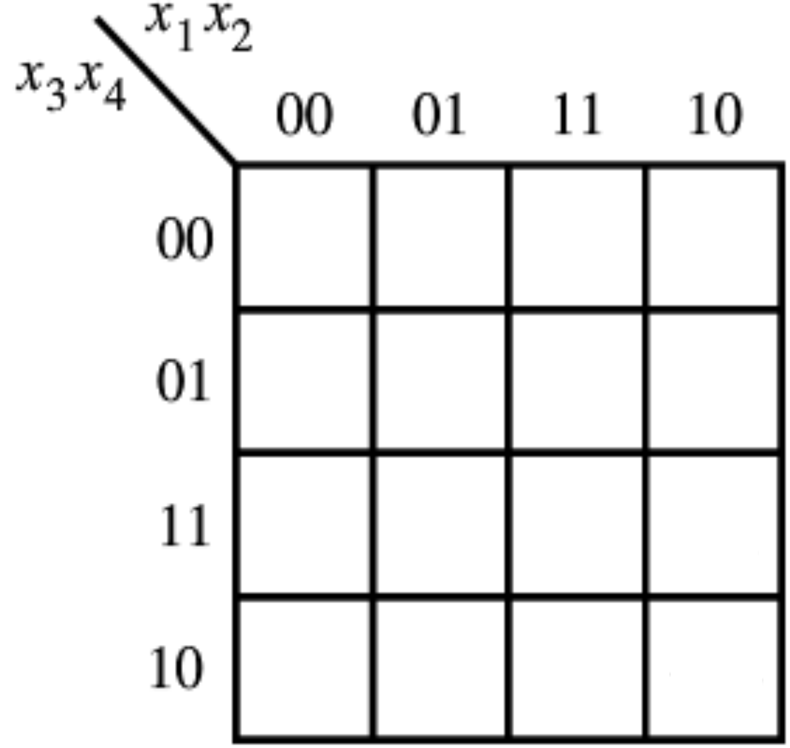
Chapter 3 cont

Where we left off

- 4 variable maps.



5 Variable Maps

NOT in your Book

Basically use 2 4-variable maps AND label each with the 5th variable.

$F = z + z'(v'w + xy)$

Get the Sum of Products

$F = z + v'wz' + xyz'$ distribution

Two ways to attack this

create the truth table then the K-Map

or just fill in the K-Map

$F = z + v'wz' + xyz'$

v	w	x	y	z	F	v	w	x	y	z	F
0	0	0	0	0		1	0	0	0	0	
0	0	0	0	1		1	0	0	0	1	
0	0	0	1	0		1	0	0	1	0	
0	0	0	1	1		1	0	0	1	1	
0	0	1	0	0		1	0	1	0	0	
0	0	1	0	1		1	0	1	0	1	
0	0	1	1	0		1	0	1	1	0	
0	0	1	1	1		1	0	1	1	1	
0	1	0	0	0		1	1	0	0	0	
0	1	0	0	1		1	1	0	0	1	
0	1	0	1	0		1	1	0	1	0	
0	1	0	1	1		1	1	0	1	1	
0	1	1	0	0		1	1	1	0	0	
0	1	1	0	1		1	1	1	0	1	
0	1	1	1	0		1	1	1	1	0	
0	1	1	1	1		1	1	1	1	1	

$F = z + v'wz' + xyz'$

v	w	x	y	z	F	v	w	x	y	z	F
0	0	0	0	0	0	1	0	0	0	0	0
0	0	0	0	1	1	1	0	0	0	1	1
0	0	0	1	0	0	1	0	0	1	0	0
0	0	0	1	1	1	1	0	0	1	1	1
0	0	1	0	0	0	1	0	1	0	0	0
0	0	1	0	1	1	1	0	1	0	1	1
0	0	1	1	0	1	1	0	1	1	0	1
0	0	1	1	1	1	1	0	1	1	1	1
0	1	0	0	0	1	1	1	0	0	0	0
0	1	0	0	1	1	1	1	0	0	1	1
0	1	0	1	0	1	1	1	0	1	0	0
0	1	0	1	1	1	1	1	0	1	1	1
0	1	1	0	0	1	1	1	1	0	0	0
0	1	1	0	1	1	1	1	1	0	1	1
0	1	1	1	0	1	1	1	1	1	0	1
0	1	1	1	1	1	1	1	1	1	1	1

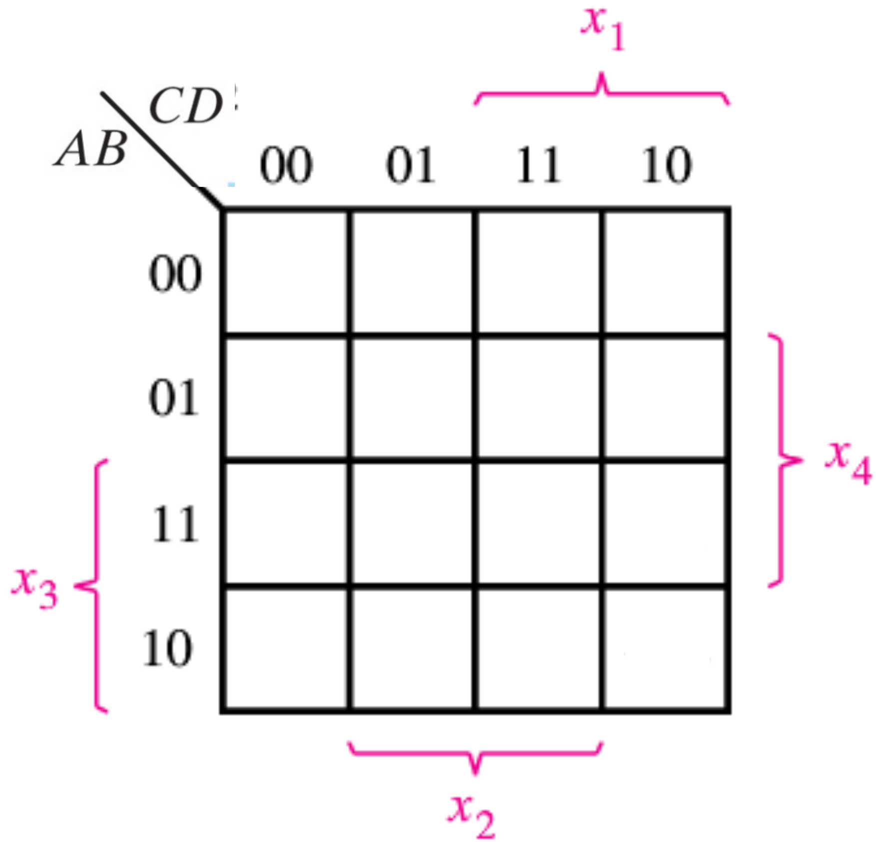
$$F = z + z'(v'w + xy)$$

	00	01	11	10
00				
01				
11				
10				

	00	01	11	10
00				
01				
11				
10				

Product of Sums

F(A, B, C, D) = ∑(0, 1, 2, 5, 8, 9, 10)



$F(A, B, C, D) = \sum(0, 1, 2, 5, 8, 9, 10)$

Product of Sums

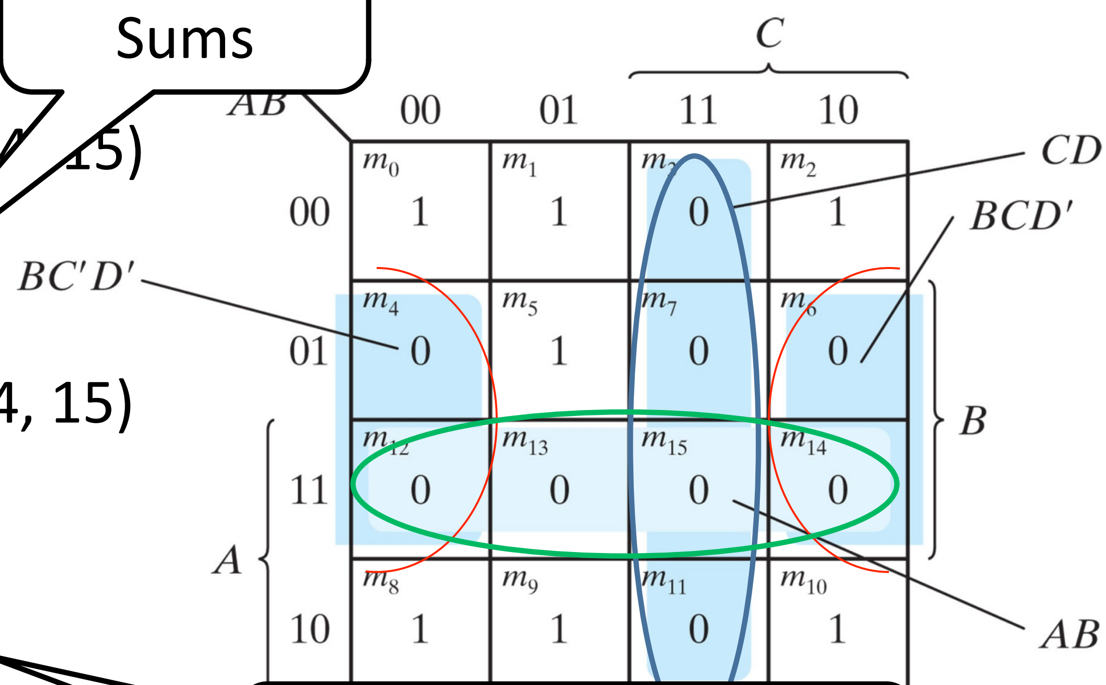
$F' = \sum(3, 4, 6, 7, 11, 12, 13, 14, 15)$

$F' = AB + CD + BD'$

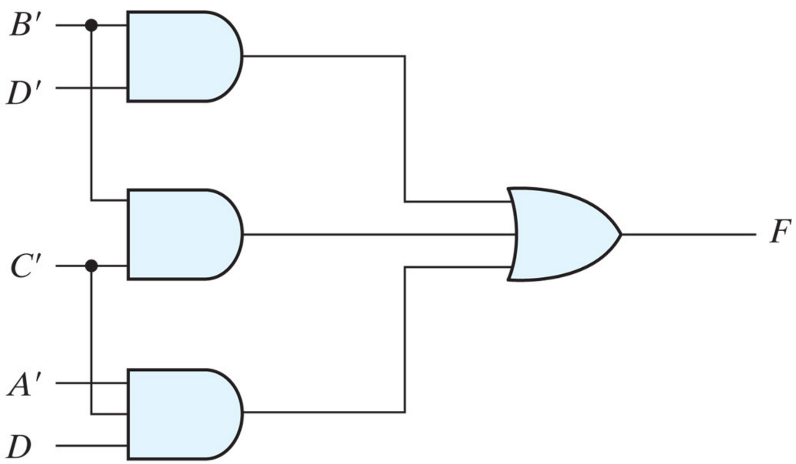
$F = (A + B)(C + D)(B + D')$

$F = \Pi(3, 4, 6, 7, 11, 12, 13, 14, 15)$

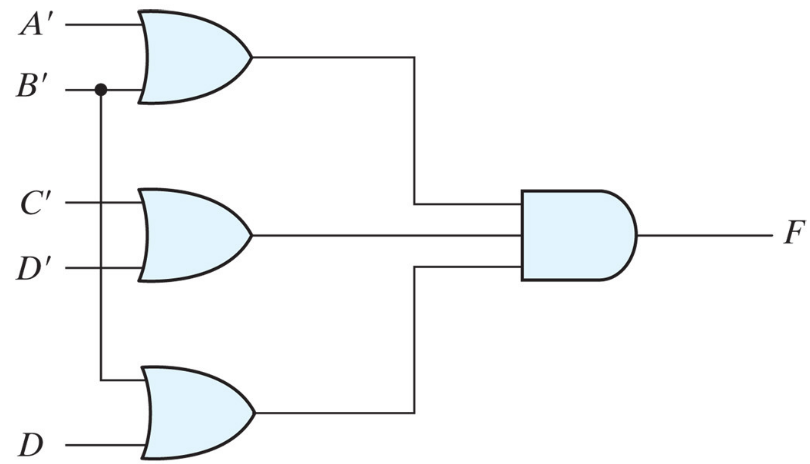
$F = (A+B+C'+D')(A+B'+C+D)$
$(A+B'+C'+D)(A+B'+C'+D')$
$(A'+B+C'+D')(A'+B'+C+D)$
$(A'+B'+C+D')(A'+B'+C'+D)$
$(A'+B'+C'+D')$



Product of Maxterms



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



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

Don’t Cares

- *Incompletely specified functions*
  - A function which has an output which is unspecified for a given set of inputs.

- Don’t care conditions
  - The unspecified minterms of a function.

$$F(w, x, y, z) = \Sigma(1, 3, 7, 11, 15)$$
$$d(w, x, y, z) = \Sigma(0, 2, 5)$$

	00	01	11	10
00				
01				
11				
10				

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

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

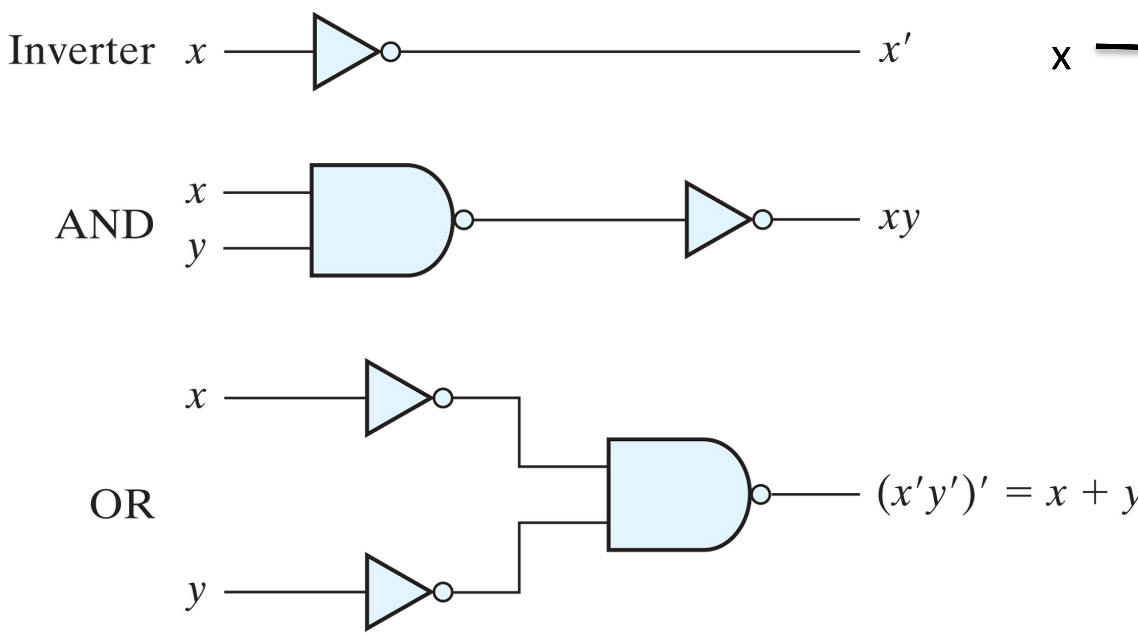
$$F(A, B, C, D) = \Sigma(3, 7, 11, 13, 14, 15)$$

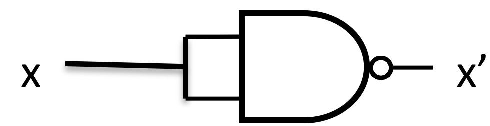
- $F(A, B, C, D) = \Pi(1, 3, 5, 7, 13, 15)$

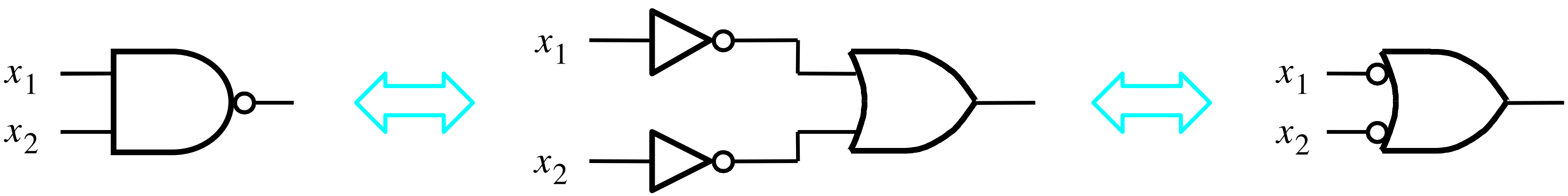
NAND and NOR implementations

- Digital circuits are generally built using NAND and NOR.
- Why? Because they're easier to make.
- The basic gates used in all IC digital logic circuits

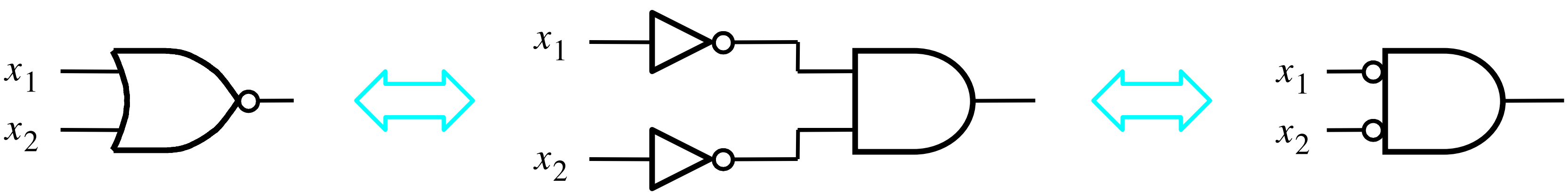
The 3 basic functions (NOR, AND, and OR) from a NAND.







(a) $\overline{x_1 x_2} = \bar{x}_1 + \bar{x}_2$



(b) $\overline{x_1 + x_2} = \bar{x}_1 \bar{x}_2$