

# EE 200- Digital Logic Circuit Design

## 3.4 Product-of-Sums Simplification

## 3.5 Don't-Care Conditions

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# Introduction

- Can you give an example of don't-care condition



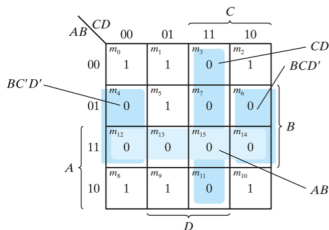
# Lecture Outline

- 1 The Map Method
  - Product-of-Sums Simplification
  - Don't-Care Conditions



# Product-of-Sums Simplification

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

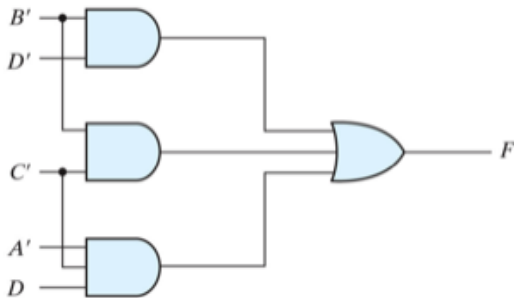


- $F' = AB + CD + BD'$
- Using DeMorgan's  $F = (A' + B')(C' + D')(B' + D)$



# Product-of-Sums Simplification

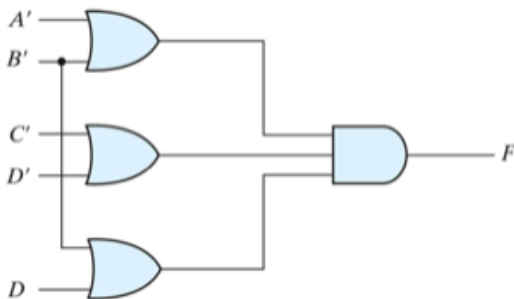
- $F = B'D' + B'C' + A'C'D$





# Product-of-Sums Simplification

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





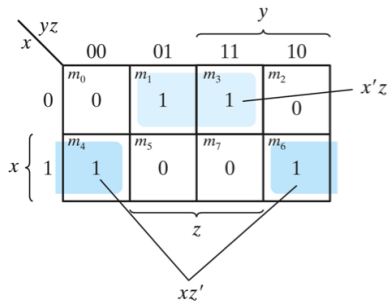
# Product-of-Sums Simplification

<b><i>x</i></b>	<b><i>y</i></b>	<b><i>z</i></b>	<b><i>F</i></b>
0	0	0	0
0	0	1	1
0	1	0	0
0	1	1	1
1	0	0	1
1	0	1	0
1	1	0	1
1	1	1	0

- $F = m_1 + m_3 + m_4 + m_6$



# Product-of-Sums Simplification



- $F = x'z + xz'$
- $F' = xz + x'z'$
- $(F')' = F = (x' + z')(x + z)$





# Product-of-Sums Simplification

- What if the function was given as product of maxterms?
- $F = (A' + B' + C')(B + D)$
- $F' = ABC + B'D'$
- Mark  $F'$  minterms' squares with 0's and the remaining squares with 1's.



## Don't-Care Conditions

- Simplify  $F(w, x, y, z) = \sum(1, 3, 7, 11, 15)$  with don't-care conditions  $d(w, x, y, z) = \sum(0, 2, 5)$

		yz		y			
				00	01	11	10
wx	w'x'	00	$m_0$	$m_1$	$m_3$	$m_2$	
		X	1	1	X		
		01	$m_4$	$m_5$	$m_7$	$m_6$	x
		0	X	1	0		
		11	$m_{12}$	$m_{13}$	$m_{15}$	$m_{14}$	}
		0	0	1	0		
w		10	$m_8$	$m_9$	$m_{11}$	$m_{10}$	
			0	0	1	0	
				z			

- $F = yz + w'x'$



# Don't-Care Conditions

$wx \backslash yz$	00	01	11	10
00	$m_0$ X	$m_1$ 1	$m_3$ 1	$m_2$ X
01	$m_4$ 0	$m_5$ X	$m_7$ 1	$m_6$ 0
11	$m_{12}$ 0	$m_{13}$ 0	$m_{15}$ 1	$m_{14}$ 0
10	$m_8$ 0	$m_9$ 0	$m_{11}$ 1	$m_{10}$ 0

- $F = yz + w'z$



# Summary

- 1 The Map Method
  - Product-of-Sums Simplification
  - Don't-Care Conditions



# Next Lecture

- NAND and NOR Implementation.