Two differences between 3-variable Kmaps and 2-variable Kmaps

- Two variables, y and z, are grouped together.
- Column labels are not sequential. Column labels are 00, 01, 11, 01, respectively. Their decimal equivalents are 0, 1, 3, 2, respectively.

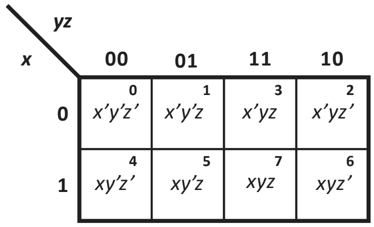
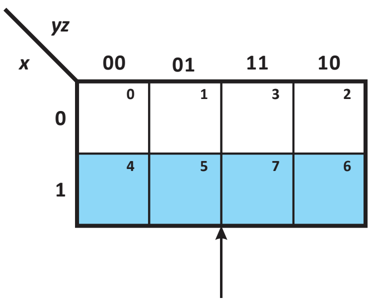
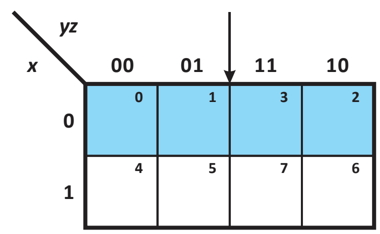


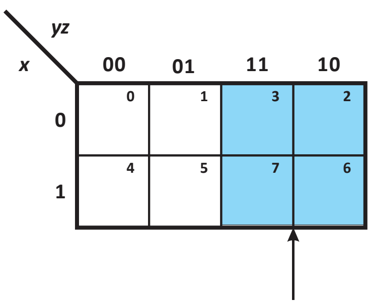
FIGURE 3.16 Minterms and Kmap Format for Three Variables



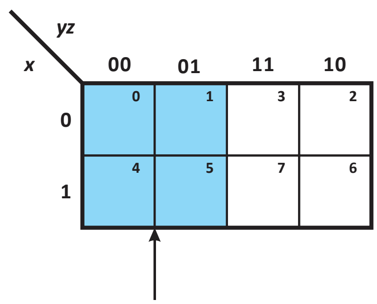
These minterms have ***x*** in common

These minterms have ***x′*** in common

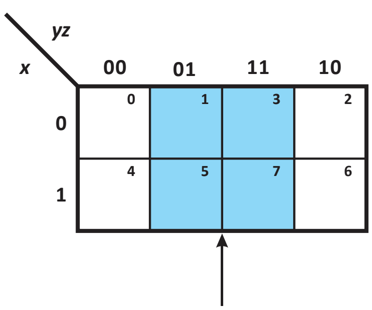




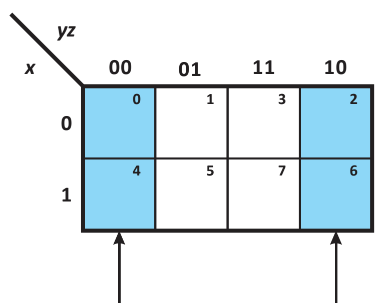
These minterms have ***y*** in common



These minterms have ***y′*** in common



These minterms have ***z*** in common



These minterms have ***z′*** in common

EXAMPLE 3.12 $F(x, y, z) = x'y'z + x'yz + xy'z + xyz$

SOLUTION: $F(x, y, z) = x'y'z + x'yz + xy'z + xyz = \sum(1,3,5,7)$

x \ yz	00	01	11	10
0	^{0} 0	^{1} 1	^{3} 1	^{2} 0
1	^{4} 0	^{5} 1	^{7} 1	^{6} 0

- Put 1s in all the cells whose minterms appear in the Boolean function $F(x, y, z) = x'y'z + x'yz + xy'z + xyz$
- Put 0s in the remaining cells

x \ yz	00	01	11	10
0	^{0} 0	^{1} 1	^{3} 1	^{2} 0
1	^{4} 0	^{5} 1	^{7} 1	^{6} 0

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

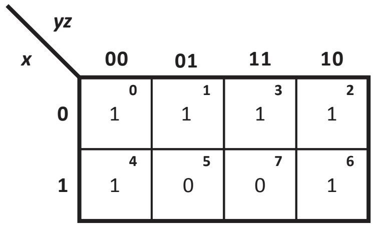
- Simplify by circling adjacent cells.
- We can see that $F(x, y, z) = z$ by reviewing the diagrams on the previous page.

We can verify the simplification algebraically (and laboriously) as follows.

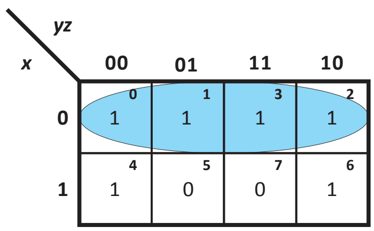
$F(x, y, z)$	$=$	$x'y'z + x'yz + xy'z + xyz$	Original expression
	$=$	$x'(y'z + yz) + x(y'z + yz)$	Distributive Law (OR Form) applied twice
	$=$	$(x' + x)(y'z + yz)$	Distributive Law (OR Form)
	$=$	$(1)(y'z + yz)$	Inverse Law (OR Form)
	$=$	$(y'z + yz)$	Identity Law (AND Form)
	$=$	$(y' + y)z$	Distributive Law (OR Form)
	$=$	$(1)z$	Inverse Law (OR Form)
	$=$	z	Identity Law (AND Form)

EXAMPLE 3.13 $F(x,y,z) = x'y'z' + x'y'z + x'yz + x'yz' + xy'z' + xyz'$

SOLUTION: $F(x,y,z) = x'y'z' + x'y'z + x'yz + x'yz' + xy'z' + xyz' = \sum(0,1,3,2,4,6)$

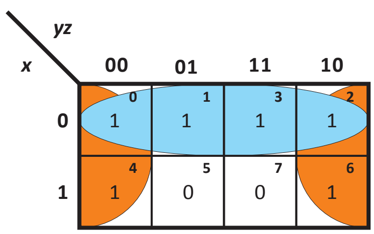


- Put 1s in all the cells whose minterms appear in the Boolean function $F(x,y,z) = xx'y'z' + x'y'z + x'yz + x'yz' + xy'z' + xyz'$
- Put 0s in the remaining cells



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

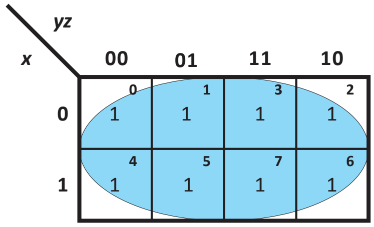
- Identify the first implicant



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

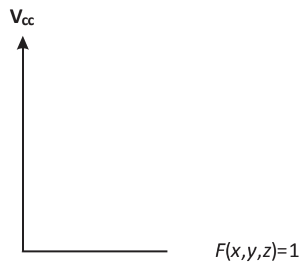
- Identify the second implicant by circling as many cells as possible.
- To simplify, you may circle cells that are included in other implicants.

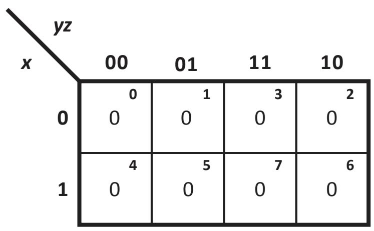
EXAMPLE 3.14 Suppose we have a Kmap with all 1s:



$F(x, y, z) = 1$

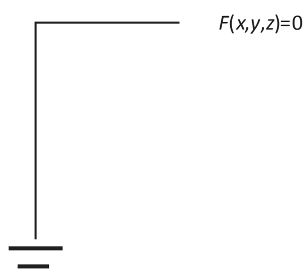
V_{cc}: Power (V – Volts)





$F(x, y, z) = 0$

Ground



In class exercise: Draw the truth table, Kmap, and minimize the Boolean function $F(x, y, z) = x'y'z' + x'yz + xy'z' + xyz$

Solution: $F(x,y,z) = x'y'z' + x'yz + xy'z' + xyz = \sum(0,3,4,7)$

m_i	x	y	z	F
m_0	0	0	0	1
m_1	0	0	1	0
m_2	0	1	0	0
m_3	0	1	1	1
m_4	1	0	0	1
m_5	1	0	1	0
m_6	1	1	0	0
m_7	1	1	1	1

x \ yz	00	01	11	10
0	^{0} 1	^{1} 0	^{3} 1	^{2} 0
1	^{4} 1	^{5} 0	^{7} 1	^{6} 0

x \ yz	00	01	11	10
0	^{0} 1	^{1} 0	^{3} 1	^{2} 0
1	^{4} 1	^{5} 0	^{7} 1	^{6} 0

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