

Professor Brendan Morris, SEB 3216, [brendan.morris@unlv.edu](mailto:brendan.morris@unlv.edu)

## K-Map Examples

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Chapter 2.7

# Example 1: 3 Input

A	B	C	Y
0	0	0	0
0	0	1	1
0	1	0	1
0	1	1	0
1	0	0	1
1	0	1	0
1	1	0	1
1	1	1	0

# Example 2: 3 Input

A	B	C	Y
0	0	0	1
0	0	1	1
0	1	0	0
0	1	1	0
1	0	0	1
1	0	1	1
1	1	0	0
1	1	1	0

# Example 3: 4 Input

A	B	C	D	Y
0	0	0	0	1
0	0	0	1	0
0	0	1	0	1
0	0	1	1	0
0	1	0	0	0
0	1	0	1	0
0	1	1	0	0
0	1	1	1	0
1	0	0	0	0
1	0	0	1	1
1	0	1	0	0
1	0	1	1	1
1	1	0	0	0
1	1	0	1	1
1	1	1	0	0
1	1	1	1	1

# Example 4: Minterm Specification

- 4 variable (A,B,C,D) input
- $Y = \sum m(0,2,8,9,10,11)$ 
  - E.g.
  - $m_8 = A\bar{B}\bar{C}\bar{D} = 1000$
  - $A = 1, B = 0, C = 0, D = 0$

# Example 5: Minterm Specification

- 4 variable (A,B,C,D) input
- $Y = \sum m(1,3,6,9,11,12,13)$

# Example 6: Don't Cares

- 4 variable (A,B,C,D) input
- $Y =$   
 $\sum m(4,5,7,8,10,11,13,14) +$   
 $\sum d(0,1,2)$ 
  - $d$  term indicates do not care

# Example 7: Maxterm Specification

- 4 variable (A,B,C,D) input
- Maxterm expression for POS form
- $Y = \prod M(3,6,9,12,15) + \sum d(0,1,2)$



# Example 8: Equation Specification

- Use a K-map to simplify the following equation
- $Y = ABC + BCD + AC + BC$
- Note this is a 4-input problem
- Use expansion to find canonical minterms or
- Create full truth table
- Ex:
  - $ABC \rightarrow 1110$  and  $1111$  ( $D$  can be either 0 or 1)
  - $AC \rightarrow 1010, 1011, 1110, \text{ and } 1111$ 
    - 1<sup>st</sup> and 3<sup>rd</sup> bits turned on

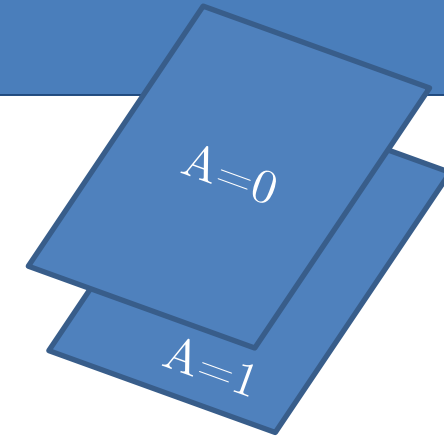
# Example 8: Equation Specification

- Use a K-map to simplify the following equation
- $Y = ABC + BCD + AC + BC$

A	B	C	D	Y
0	0	0	0	
0	0	0	1	
0	0	1	0	
0	0	1	1	
0	1	0	0	
0	1	0	1	
0	1	1	0	
0	1	1	1	
1	0	0	0	
1	0	0	1	
1	0	1	0	
1	0	1	1	
1	1	0	0	
1	1	0	1	
1	1	1	0	
1	1	1	1	

# Example 9: 5 Input

- 5-input function (A,B,C,D,E)
  - Create two 4-input K-maps and “stack”



A = 0    BC

DE	00	01	11	10
00	0	4	12	8
01	1	5	13	9
11	3	7	15	11
10	2	6	14	10

A = 1    BC

DE	00	01	11	10
00	16	20	28	24
01	17	21	29	25
11	19	23	31	27
10	18	22	30	26

- Draw bubbles within 4x4 and in between stack (above or below)
  - E.g. cell 5 and 21  $\rightarrow$  B'CD'E

# Example 9: 5 Input

- $Y = \sum m(0,1,2,3,8,9,16,17,20,21,24,25,28,29,30,31)$