Episode 6.02 - Two- and Four-Variable Karnaugh Maps

(Transcript URL: https://intermation.com/episode-6-02-two-and-four-variable-karnaugh-maps/)
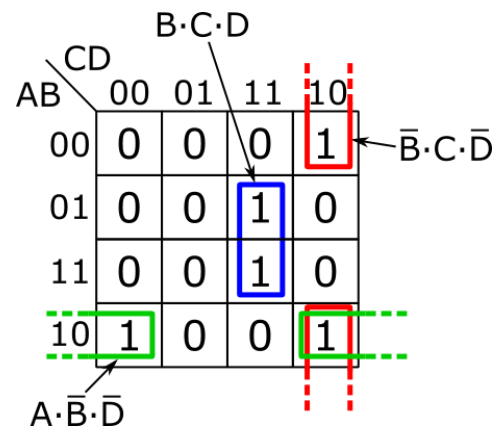
Show Description: To make the move to a four-variable Karnaugh map, we are going to double the number of columns found in the three-variable map. And what happens when we halve the three-variable map? We get a two-variable Karnaugh map!

Podcast Timestamp	Supporting Details
3:31	 | A	B	C	D	X
0	0	0	0	0
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	1
1	0	0	0	1
1	0	0	1	0
1	0	1	0	1
1	0	1	1	0
1	1	0	0	0
1	1	0	1	0
1	1	1	0	0
1	1	1	1	1	 Resulting simplified SOP expression: $X = B \cdot C \cdot D + \overline{B} \cdot C \cdot \overline{D} + A \cdot \overline{B} \cdot \overline{D}$

Podcast Timestamp	Supporting Details
10:10	

The supporting details consist of a grid of sixteen two-input Karnaugh maps with the following expressions:

$X = 0$

$X = 1$

$X = \overline{A} \cdot \overline{B}$

$X = \overline{A} \cdot B$

$X = A \cdot \overline{B}$

$X = A \cdot B$

$X = A$

$X = \overline{A}$

$X = B$

$X = \overline{B}$

$X = \overline{A} \cdot \overline{B} + A \cdot B$

$X = \overline{A} \cdot B + A \cdot \overline{B}$

$X = A + B$

$X = A + \overline{B}$

$X = \overline{A} + B$

$X = \overline{A} + \overline{B}$
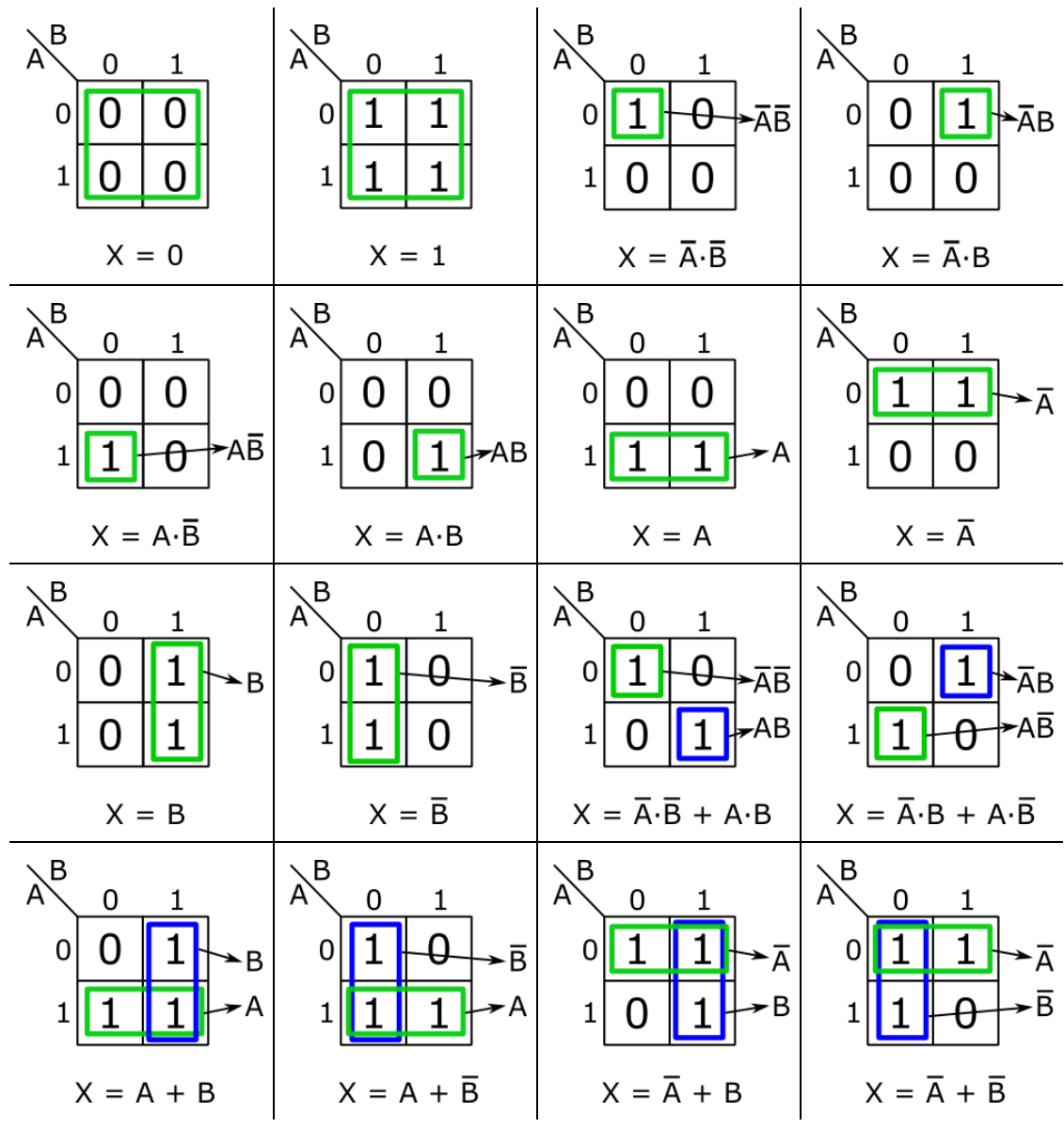
Sample Problems

For each of the truth tables shown below, transfer the output values to a 4-input Karnaugh map, identify each of the adjacent pairs, and generate the most simplified sum-of-products expression.*

A	B	C	D	X
0	0	0	0	1
0	0	0	1	0
0	0	1	0	0
0	0	1	1	0
0	1	0	0	1
0	1	0	1	0
0	1	1	0	1
0	1	1	1	0
1	0	0	0	0
1	0	0	1	1
1	0	1	0	1
1	0	1	1	1
1	1	0	0	0
1	1	0	1	0
1	1	1	0	0
1	1	1	1	0

A	B	C	D	X
0	0	0	0	1
0	0	0	1	0
0	0	1	0	0
0	0	1	1	0
0	1	0	0	0
0	1	0	1	1
0	1	1	0	1
0	1	1	1	1
1	0	0	0	1
1	0	0	1	0
1	0	1	0	0
1	0	1	1	0
1	1	0	0	0
1	1	0	1	0
1	1	1	0	0
1	1	1	1	1

A	B	C	D	X
0	0	0	0	0
0	0	0	1	1
0	0	1	0	1
0	0	1	1	0
0	1	0	0	0
0	1	0	1	0
0	1	1	0	1
0	1	1	1	1
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	0
1	1	1	0	0
1	1	1	1	0

* - Note that in later episodes, we will address Karnaugh maps where the ones cannot be paired, where redundant pairs can be eliminated, and where ones should be combined in groups larger than two. For this problem, simply identify the pairs.