Sum and product notation

For reference, this section introduces the terminology used in some texts to describe the minterms and maxterms assigned to a Karnaugh map. Otherwise, there is no new material here.

Σ (sigma) indicates sum and lower case "m" indicates minterms. Σm indicates sum of minterms. The following example is revisited to illustrate our point. Instead of a Boolean equation description of unsimplified logic, we list the minterms.

$f(A,B,C,D) = \Sigma\, m(1, 2, 3, 4, 5, 7, 8, 9, 11, 12, 13, 15)$

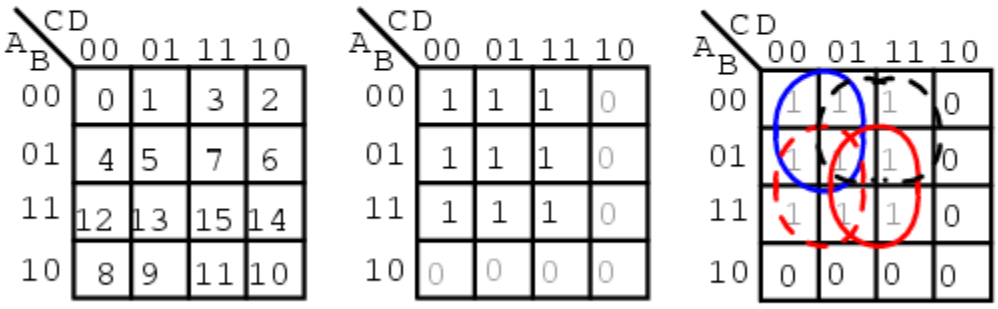
or

$f(A,B,C,D) = \Sigma(m_1,m_2,m_3,m_4,m_5,m_7,m_8,m_9,m_{11},m_{12},m_{13},m_{15})$

The numbers indicate cell location, or address, within a Karnaugh map as shown below right. This is certainly a compact means of describing a list of minterms or cells in a K-map.

$$\text{Out} = \overline{A}\,\overline{B}\,\overline{C}\,\overline{D} + \overline{A}\,\overline{B}\,\overline{C}\,D + \overline{A}\,\overline{B}CD + \overline{A}\,B\,\overline{C}\,\overline{D} + \overline{A}\,B\,\overline{C}\,D + \overline{A}\,BCD + A\,B\,\overline{C}\,\overline{D} + A\,B\,\overline{C}\,D + ABCD$$

$$f(A,B,C,D) = \sum m(0,1,3,4,5,7,12,13,15)$$



$$f(A,B,C,D) = \overline{A}\,\overline{C} + \overline{A}D + B\,\overline{C} + BD$$

The Sum-Of-Products solution is not affected by the new terminology. The minterms, **1**s, in the map have been grouped as usual and a Sum-OF-Products solution written.

Below, we show the terminology for describing a list of maxterms. Product is indicated by the Greek Π (pi), and upper case "M" indicates maxterms. ΠM indicates product of maxterms. The same example illustrates our point. The Boolean equation description of unsimplified logic, is replaced by a list of maxterms.

$f(A,B,C,D) = \Pi\ M(2, 6, 8, 9, 10, 11, 14)$

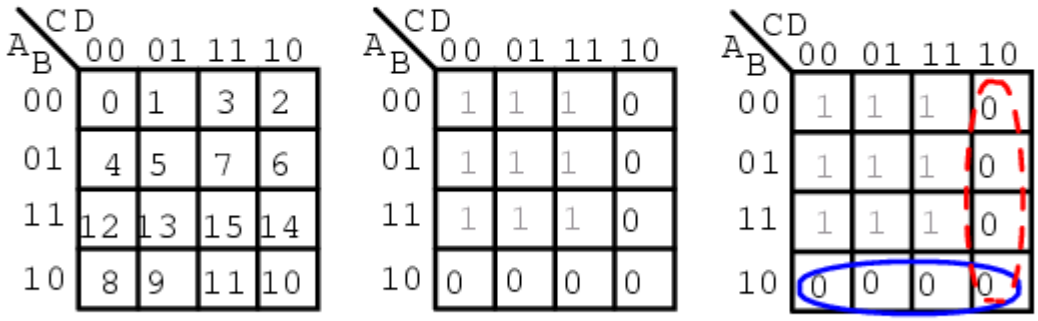
or

$f(A,B,C,D) = \Pi(M_2, M_6, M_8, M_9, M_{10}, M_{11}, M_{14})$

Once again, the numbers indicate K-map cell address locations. For maxterms this is the location of **0**s, as shown below. A Product-OF-Sums solution is completed in the usual manner.

$$Out = \overline{(\overline{A}+\overline{B}+\overline{C}+\overline{D})(\overline{A}+\overline{B}+\overline{C}+D)(\overline{A}+\overline{B}+\overline{C}+D)(\overline{A}+B+C+D)(\overline{A}+B+\overline{C+D})(\overline{A}+B+\overline{C+D})(\overline{A}+B+\overline{C}+D)}$$

$$f(A,B,C,D) = \prod M(2,6,8,9,10,11,14)$$



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

AB \ CD	00	01	11	10
00	1	1	1	0
01	1	1	1	0
11	1	1	1	0
10	0	0	0	0

AB \ CD	00	01	11	10
00	1	1	1	0
01	1	1	1	0
11	1	1	1	0
10	0	0	0	0

$$f(A,B,C,D) = \overline{(\overline{A}+B)}\,(\overline{C}+D)$$

Source: http://www.allaboutcircuits.com/vol_4/chpt_8/9.html