Definitions

Each appearance of a variable, either uncomplemented or complemented, is called a *literal*.

For example: $x_1 \bar{x}_2 x_3$ had 3 literals, while $x_1 \bar{x}_3 \bar{x}_4 x_5$ has 4 literals.

A product term that implies $f = 1$ is called an *implicant* of that funciton.

How many implicants does the following function have?

$$f = \bar{x}_1 \bar{x}_2 \bar{x}_3 + \bar{x}_1 x_2 \bar{x}_3 + \bar{x}_1 \bar{x}_2 x_3 + \bar{x}_1 x_2 x_3 + x_1 x_2 x_3$$

$$f = \bar{x}_1 \bar{x}_2 \bar{x}_3 + \bar{x}_1 x_2 \bar{x}_3 + \bar{x}_1 \bar{x}_2 x_3 + \bar{x}_1 x_2 x_3 + x_1 x_2 x_3$$

x_3 \ $x_1 x_2$	00	01	11	10
0	1	1		
1	1	1	1	

x_3 \ $x_1 x_2$	00	01	11	10
0	1	1		
1	1	1	1	

x_3 \ $x_1 x_2$	00	01	11	10
0	1	1		
1	1	1	1	

Implicants may be combined to form implicants with fewer literals.

A *prime implicant* is an implicant that cannot be combined further to result in fewer literals. It is not possible to eliminate any additional literals from a prime implicant (and still have a valid implicant).

If a prime implicant includes at least one minterm for which $f = 1$ that is *not* included in any other prime implicants, then it is called an *essential prime implicant.*

A collection of implicants that accounts for all valuations for which $f = 1$ is called a *cover* of that function.

Most functions have a number of different covers.

The objective of minization is to obtain a *minimal cover.*

$x_1 x_2$

x_3	00	01	11	10
0	1	1		
1	1	1	1	

$x_1 x_2$

x_3	00	01	11	10
0	1	1		
1	1	1	1	

$x_1 x_2$

x_3	00	01	11	10
0	1	1		
1	1	1	1	

$x_1 x_2$

x_3	00	01	11	10
0	1	1		
1	1	1	1	

Procedure for Finding a Minimal Sum on a K-Map:

1. On the K-map, encircle all the 1-cells with loops, each of which contains 2^N 1-cells, where N is a nonnegative number. Choose N as large as possible.

   These loops are called $prime-implicant\ loops\,(PIL's)$.

   Some 1-cells may be contained in only one PIL, these cells are called $distinguished\ 1-cells$.

   PIL's that contain distinguished 1-cells are called $essential\ prime\ implicant\ loops\,(EPIL's)$.

2. Determine the set of all EPIL's.

3. If the set of all EPILs covers all valuations for which $f=1$, then this cover is a minimal cost cover; otherwise, select additional non-EPIL's to complete a minimal cost cover.

   Guidelines: Use as small number of loops as possible, and use as large a loop as possible.