Karnaugh Maps (2)

Lecture 12

COE211-Digital Logic Design

الفصل الدراسي الأول Fall2020-1442

جامعة طيبة فرع ينبع ـ كلية علوم وهندسة الحاسبات – شطر الطالبات

د. فاطمة الحربي

Simplest SOP Expressions

- To find the simplest possible *sum of products* (SOP) expression from a K-map, you need to obtain:
  - minimum number of literals per product term; and
  - minimum number of product terms

- This is achieved in K-map using:

  - *bigger groupings* of minterms ([prime implicants](#)) where possible; and

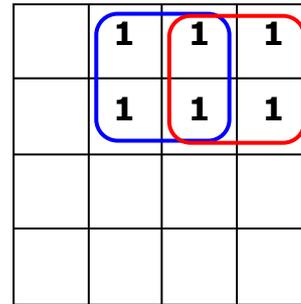 - *no redundant groupings* (look for [essential prime implicants](#))

  Implicant : a product term that could be used to cover minterms of the function.

Prime Implicant

- A prime implicant is a product term obtained by combining the maximum possible number of minterms from adjacent squares in the map.

- Use bigger groupings (prime implicants) where possible.

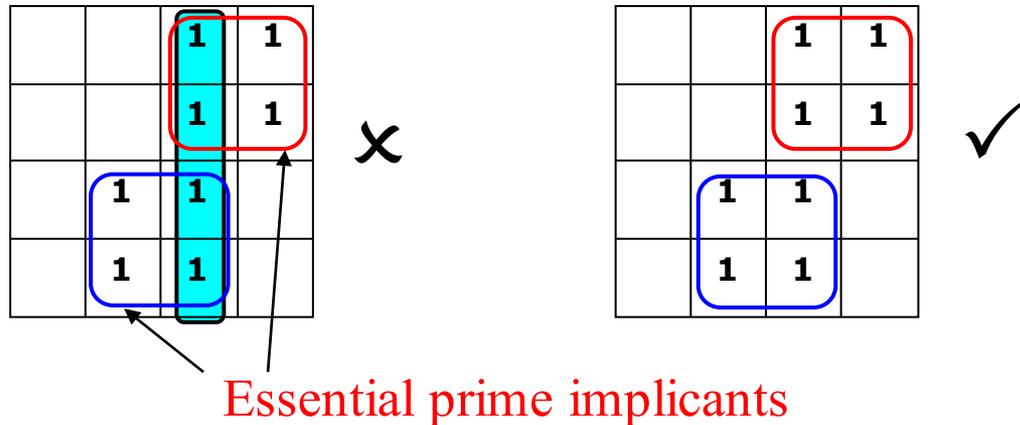**– تصميم المنطق الرقمي Digital Logic Design - COE211 – Lecture_12**
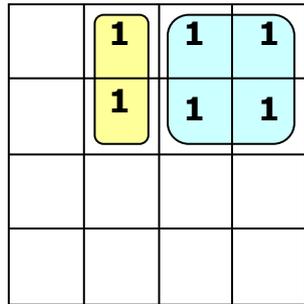
Essential Prime Implicant

- No redundant groups:

Essential prime implicants

- An essential prime implicant is a prime implicant that includes at least one minterm that is not covered by any other prime implicant.
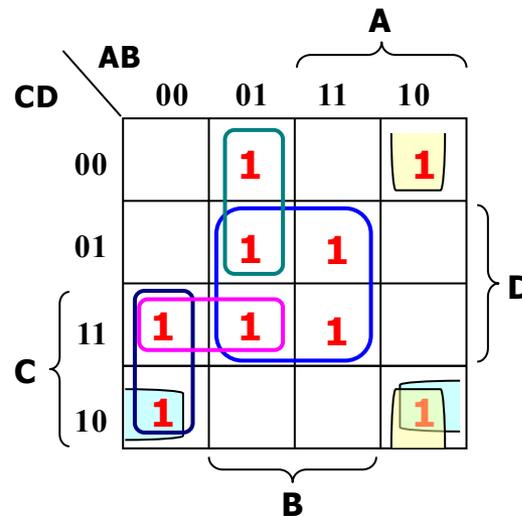
Algorithm

1. Circle all prime implicants on the K-map.

2. Identify and select all essential prime implicants for the cover.

3. Select a minimum subset of the remaining prime implicants to complete the cover, that is, to cover those minterms not covered by the essential prime implicants.
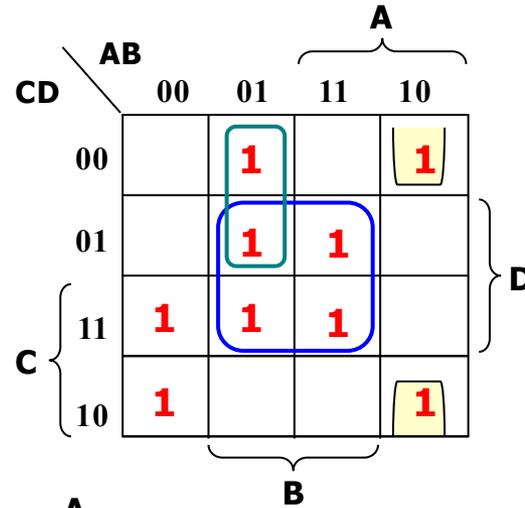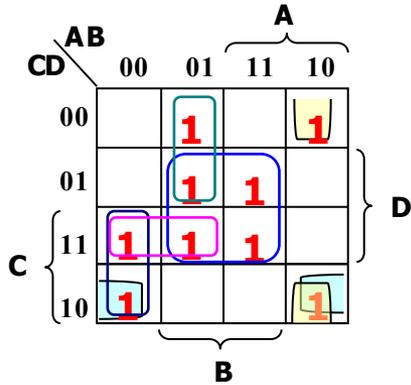
Example 1 (1)

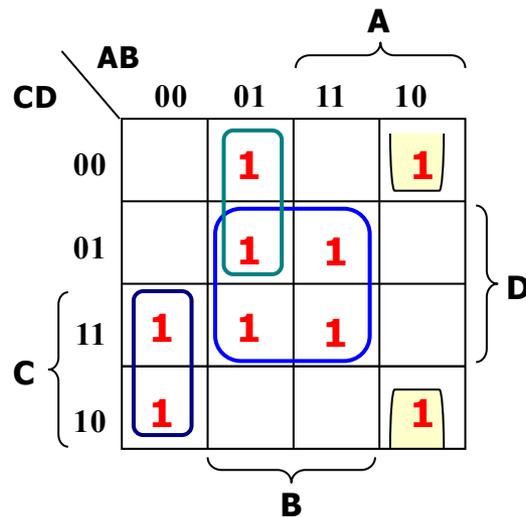- Example:

$$f(A,B,C,D) = \sum m(2,3,4,5,7,8,10,13,15)$$

All prime implicants

Example 1 (2)

Essential prime implicants

Minimum cover

Example 1 (3)

$$f(A,B,C,D) = BD + A'B'C + AB'D' + A'BC'$$

Simplest POS Expressions

- Simplified POS expression can be obtained by grouping the maxterms (i.e., 0s) of given function.

Example 2 (1)

- Example:

    Given F=∑m(0,1,2,3,5,7,8,9,10,11) → we first draw the K-map, then group the maxterms together:

Example 2 (2)

- This gives the SOP of F' to be:

  F' = BD' + AB

- To get POS of F, we have:

  F = (BD' + AB)'

  = (BD')'(AB)'   DeMorgan

  = (B'+D)(A'+B')   DeMorgan