DON'T-CARE CONDITIONS

- In some applications the function is not specified for certain combinations of the variables.
  - Eg: the four-bit binary code for the decimal digits has six combinations that are not used and consequently are considered to be unspecified.
- Functions that have unspecified outputs for some input combinations are called *incompletely specified functions*
- *In most applications,* we simply don't care what value is assumed by the function for the unspecified minterms.
  - For this reason, the unspecified minterms of a function are called *don't-care conditions .*
- *These don't-care conditions can be used on a map to provide* further simplification of the Boolean expression.

DON'T-CARE CONDITIONS

- A don't-care minterm is a combination of variables whose logical value is not specified.
- To distinguish the don't-care condition from 1's and 0's, an X is used.
- Thus, an X inside a square in the map indicates that we don't care whether the value of 0 or 1 is assigned to *F for the particular minterm.*
- In choosing adjacent squares in K-map to simplify the function in a map, the don't-care minterms may be assumed to be either 0 or 1.
  - When simplifying the function, we can choose to include each don't-care minterm with either the 1's or the 0's, depending on which combination gives the simplest expression.

DON'T-CARE CONDITIONS

- **Simplify the Boolean function**

  F (w, x, y, z) =∑ (1, 3, 7, 11, 15)

  which has the don't-care conditions

  d (w, x, y, z) =∑ (0, 2, 5)

Map 1:

  - Don't-care minterms 0 and 2 are included
    - *F = yz + w'x'*

Map 2:

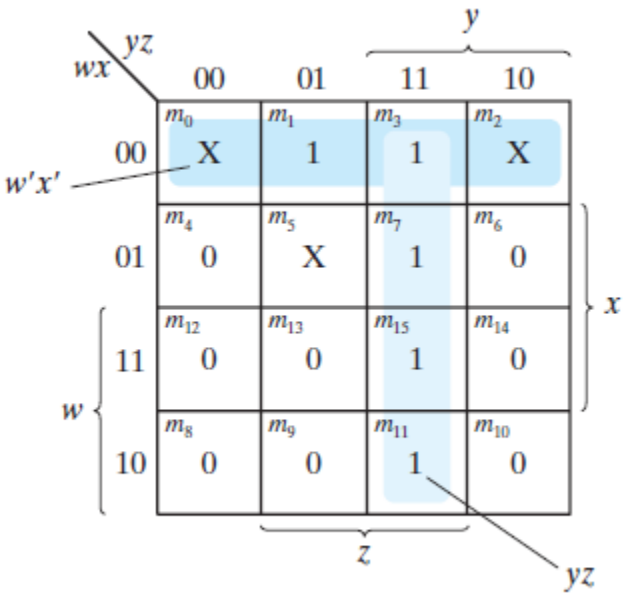
  - Don't-care minterm 5 is included
    - *F = yz + w'z*

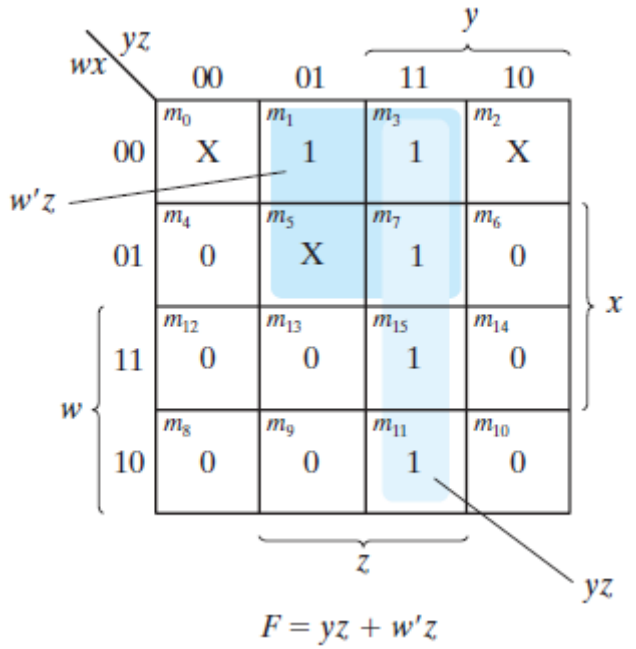
- *F (w, x, y, z) = yz + w'x' = ∑(0, 1, 2, 3, 7, 11, 15)*

  F (w, x, y, z) = yz + w'z = ∑(1, 3, 5, 7, 11, 15)

  - Both expressions include minterms 1, 3, 7, 11, and 15 that make the function *F equal* to 1.

- The two expressions represent two functions that are not algebraically equal
  - Both cover the specified minterms of the function, but each covers different don't-care minterms.
  - As far as the *incompletely specified function* is concerned, either expression is acceptable because the only difference is in the value of *F for the* don't care minterms.





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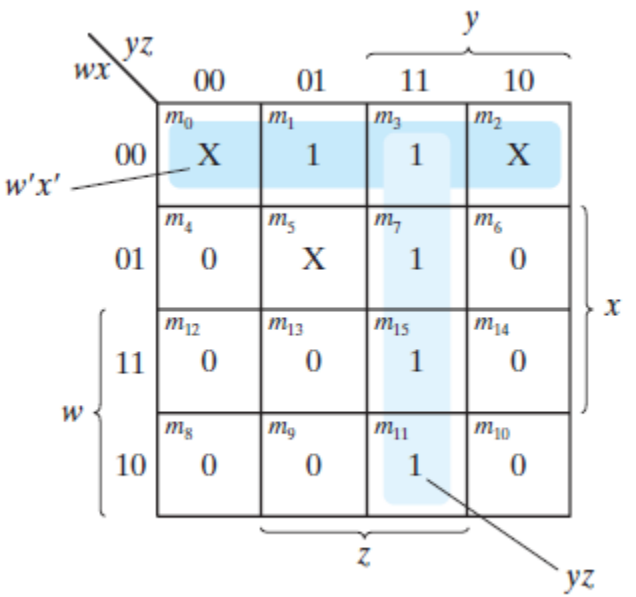
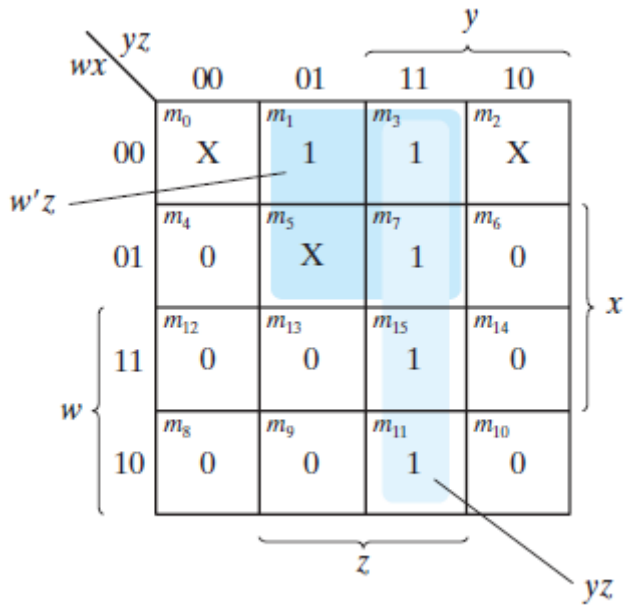
– simplified expression in product-of-sums form:

- *F (w, x, y, z) = z(w' + y) =∑ (1, 3, 5, 7, 11, 15)*
  - In this case, we include minterms 0 and 2 with the 0's



$F = yz + w'x'$



$F = yz + w'z$