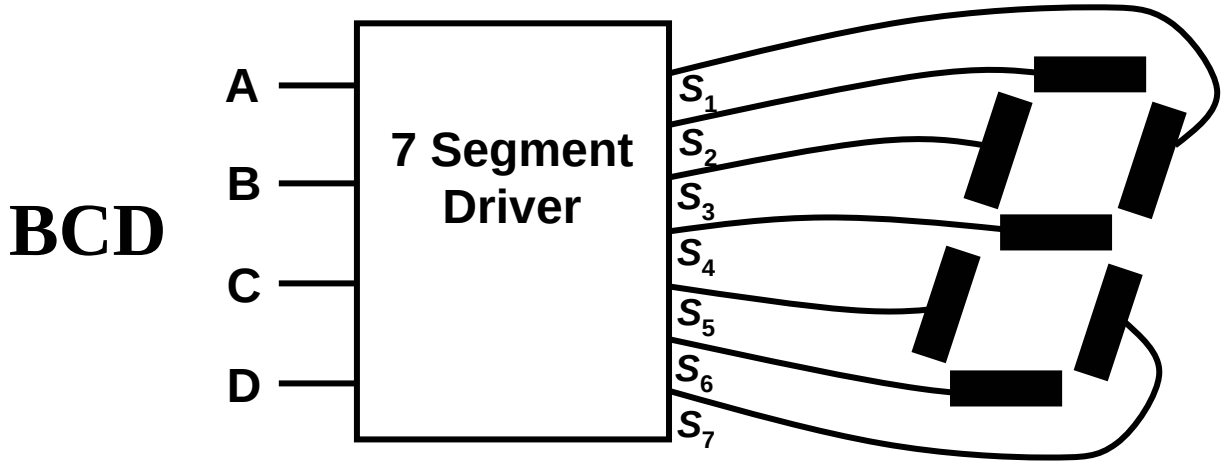
Don’t Care Values

Don’t care values result when certain assignments of values to variables never occur. For example,



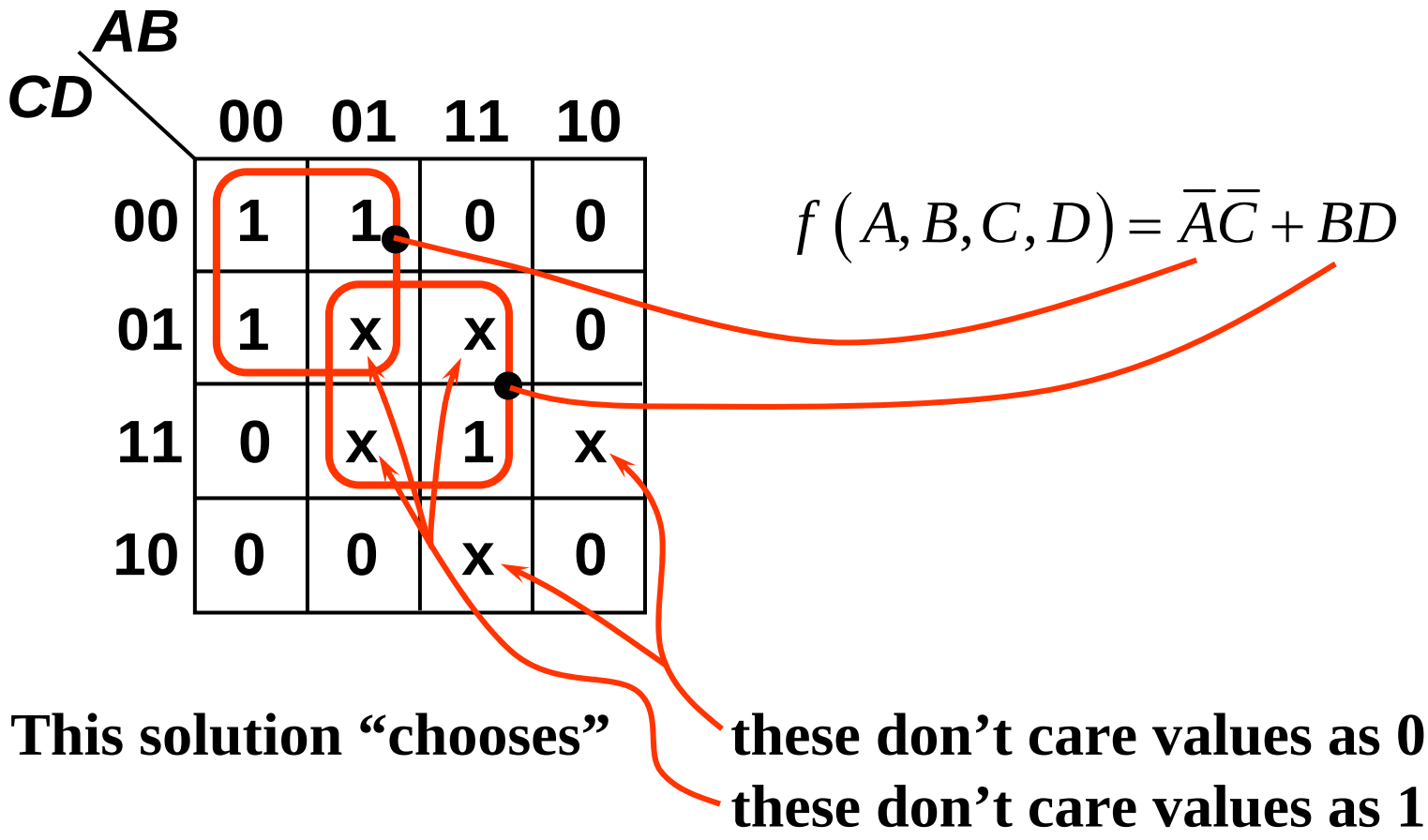
The designer can expect that the assignments *ABCD* = 1010, 1011, …, 1111 will never occur. Thus, S_1, S_2, …, and S_7 take on don’t care values for these assignments.

Minimizing an Expression with Don't Cares

Two Approaches

1. **Find the minimal circuit for each assignment of values to the don't cares (choose each don't care as 0 or 1). If there are *k* don't cares, there are 2^k functions (not practical for large *d*).**
2. **Enter don't cares into Karnaugh Map and select the fewest largest circles.**

Example of Approach #2

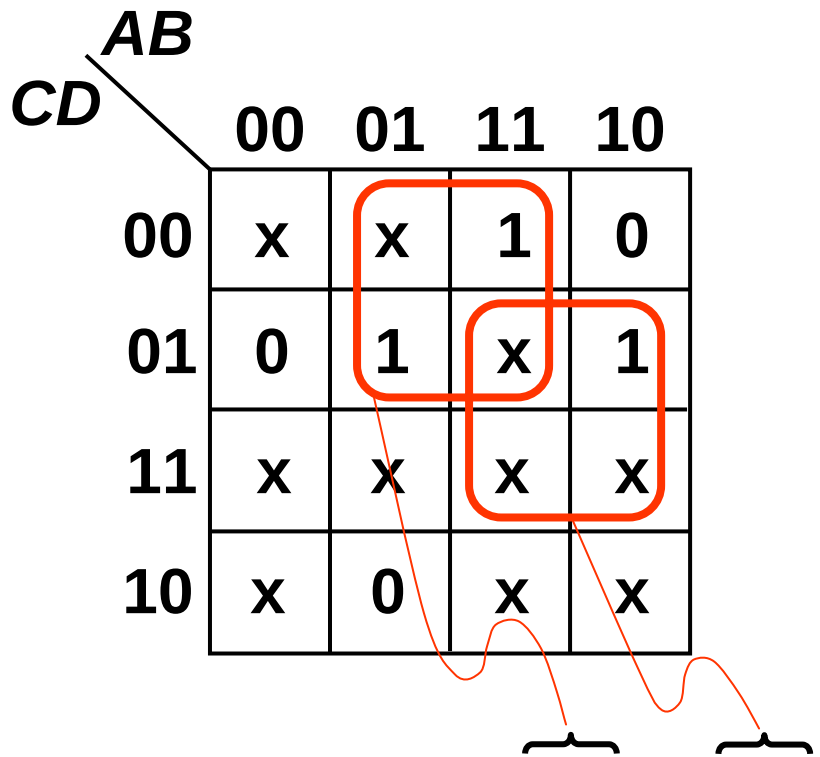


Two Problems

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

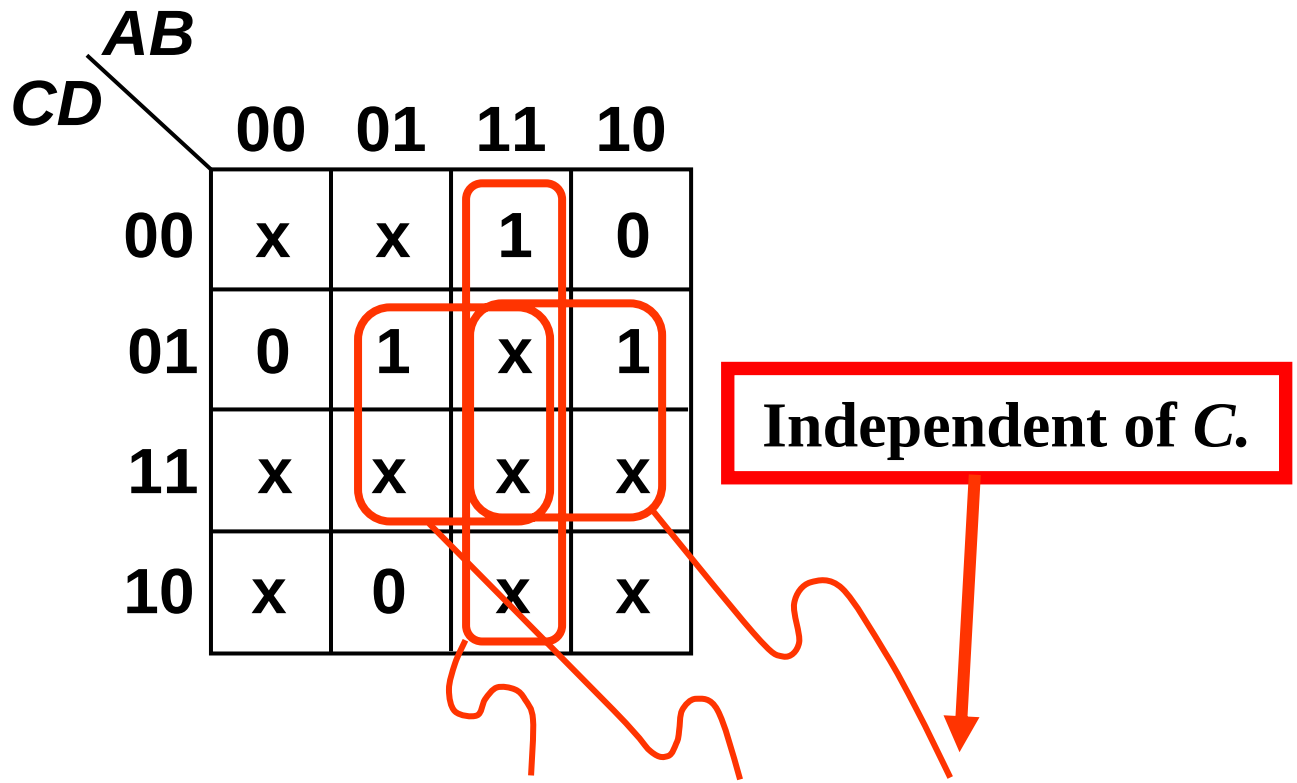
1. **Minimize number of product terms**
2. **Minimize number of dependent variables.**

Minimize number of product terms



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

Minimize number of dependent variables



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

Minimizing a Circuit with Don't Cares

Two Problems

1. **Minimizing the number of product terms allows for smaller AND-OR circuits. Our example minimized to 4 variables and 2 product terms. It is useful in ordinary circuits.**

2. **Minimizing the number of dependent variables allows for smaller memory. Our example minimized to 3 variables, so that it is useful for FPGA design.**