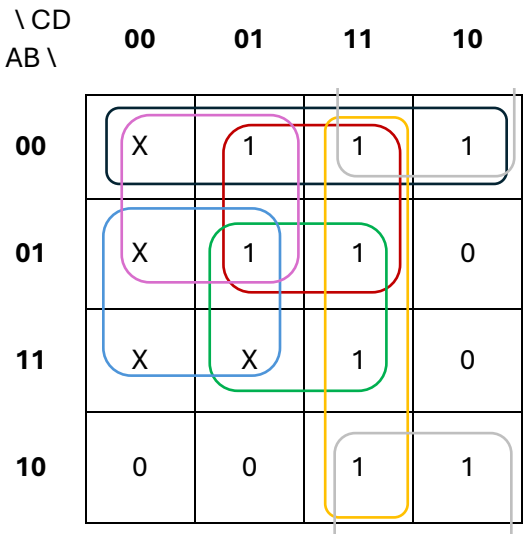
a) Using the truth table below, create a K-map and solve for a minimal sum-of-products expression.

A	B	C	D	Y
0	0	0	0	X
0	0	0	1	1
0	0	1	0	1
0	0	1	1	1
0	1	0	0	X
0	1	0	1	1
0	1	1	0	0
0	1	1	1	1
1	0	0	0	0
1	0	0	1	0
1	0	1	0	1
1	0	1	1	1
1	1	0	0	X
1	1	0	1	X
1	1	1	0	0
1	1	1	1	1

Here is a grid you can use if desired.



$$Y = \overline{B} \cdot C + B \cdot D + \overline{A} \cdot D$$

(there are many possibilities to cover what's left after the single essential prime implicant)

b) Regardless of whether or not you circled them in the K-map or used them in the SoP expression, are there any **non-essential prime implicants** (of 1s) in this function? If so, what are the expressions that represent them?

Only $\overline{B} \cdot C$ (outlined in grey above) is essential. The other six are non-essential.

$\overline{A} \cdot \overline{C}$

$B \cdot \overline{C}$

$\overline{A} \cdot D$

$B \cdot D$

$\overline{A} \cdot \overline{B}$

$C \cdot D$