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Computation Structures 1: Digital Circuits

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WE4.4

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Video explanation of solution is provided below the problem.

For the following problems, please use the following conventions when entering boolean expressions.

- $\bar{X}$: enter as not(X).

- X AND Y: enter as XY.

- X AND $\bar{Y}$: enter as Xnot(Y).

- X OR Y: enter as X + Y.

- $\bar{X}\bar{Y}$: enter as not(X)not(Y).

- Recall that $\overline{XY} = \bar{X} + \bar{Y}$ (not $\bar{X}\bar{Y}$).

- Extra white spaces are ignored.

- Lower or upper case letters are treated the same.

- Sum of products expression refers to an expression of the form ABC + not(A)not(B)C, where each term is a product term and ORing them together makes a sum of products expression. Note that within a product term negation can only be applied to a single variable at a time. In other words not(A)not(B) is acceptable but not(AB) is not.

Karnaugh Maps

1/1 point (ungraded)

Given the following truth table for function F, use a karnaugh map to determine the minimum sum of products expression for F. Use not(X) to express $\overline{X}$ in your answer.
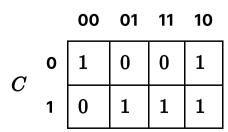
A	B	C	F
0	0	0	1
0	0	1	0
0	1	0	0
0	1	1	1
1	0	0	1
1	0	1	1
1	1	0	0
1	1	1	1

not(b)not(c) + anot(b) + bc   ✔

Explanation

The Karnaugh Map for this function is shown here.

AB

		00	01	11	10
C	0	1	0	0	1
	1	0	1	1	1

There are two ways to group all of these 1's into the smallest number of groupings that cover all the 1's. Both schemes begin by covering the bottom two middle 1's. This grouping produces the term BC. The next grouping which occurs in both solutions is the two 1's in the top row. Those can be merged into one group by wrapping around the edge of the karnaugh map. This grouping produces the term $\bar{B}\bar{C}$. The remaining one in the bottom right corner can be covered by two possible groupings. You can either merge the two 1's in the rightmost column, or you can merge the two 1's on the bottom right. The first option results in the term $A\bar{B}$, the secor

[Calculator]

results in the term AC. So one minimal sum of products expression for F is:
$F = BC + \bar{B}\bar{C} + A\bar{B}$.
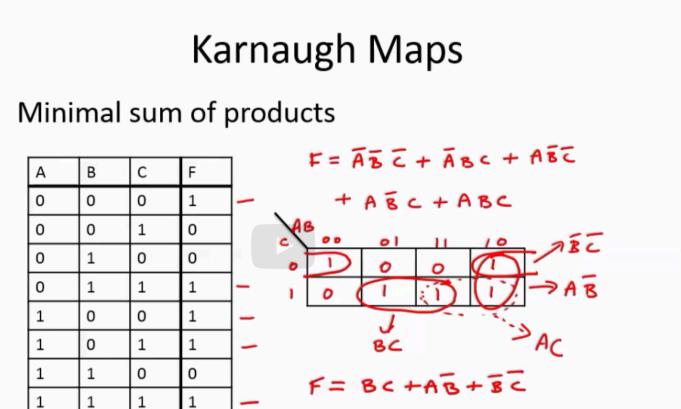The second one is:
$F = BC + \bar{B}\bar{C} + AC$.

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ⓘ   Answers are displayed within the problem

Karnaugh Maps

▶   3:30 / 3:38   ▸ 1.0x   🔊   ✕   CC   ❝

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