

CSCI 2150 – Karnaugh Map Homework

Name: _____

1. Complete the truth table to the right with the values for the sum-of-products expression $A \cdot \bar{B} \cdot C + A \cdot \bar{C}$.

A	B	C	X
0	0	0	0
0	0	1	0
0	1	0	0
0	1	1	0
1	0	0	1
1	0	1	1
1	1	0	1
1	1	1	0

If we can figure out where each of the products generates a 1 in the truth table, then we can "OR" them together to get the final truth table. First, $A \cdot \bar{B} \cdot C$ is equal to one when $A = 1$, $\bar{B} = 1$ ($B = 0$), and $C = 1$. There is only one row in the truth table where this happens, i.e., the 1 - 0 - 1 row.

The product $A \cdot \bar{C}$ outputs a 1 when $A = 1$ and $C = 0$. B can be either a 0 or a 1. This gives us 1's in two rows: 1 - 0 - 0 and 1 - 1 - 0. The final truth table is presented to the right.

2. Create a Karnaugh map from the truth table below and draw the appropriate rectangles.

A	B	C	X
0	0	0	0
0	0	1	1
0	1	0	1
0	1	1	0
1	0	0	X
1	0	1	0
1	1	0	1
1	1	1	1

The Karnaugh map to the right is a direct translation of the truth table. Note that there is no reason to include the X since it doesn't allow us to create larger or fewer rectangles.

		C	
		0	1
AB	00	0	1
	01	1	0
	11	1	1
	10	X	0

3. Derive the minimum SOP expression from the Karnaugh map below. Be sure to show all steps.

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

Red rectangle

A	B	C	D
1	0	0	0
1	0	0	1
1	0	1	1
1	0	1	0

A drops out. Since C and D drop out. Since B=0, it should be inverted in the product. Since A=1, it isn't inverted.

Blue rectangle

A	B	C	D
0	1	0	0
1	1	0	0

A drops out. Since B=1, it isn't inverted. Since C=0 and D=0, they are inverted.

$$B \cdot \bar{C} \cdot \bar{D}$$

Green rectangle

A	B	C	D
0	0	1	1
0	0	1	0
1	0	1	1
1	0	1	0

A and D drop out. Since C=1, it isn't inverted. Since B=0, it is inverted.

The final answer is:

$$A \cdot \bar{B}$$

$$\bar{B} \cdot C$$

$$A \cdot \bar{B} + B \cdot \bar{C} \cdot \bar{D} + \bar{B} \cdot C$$