

Consider the Boolean function defined by the truth table below where A, B, and C are inputs, and Y is the sole output.

A	B	C	Y
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	X

(a) Without doing any logic minimization, write the expression for Y in Fully-Disjunctive Normal Form.

$$Y = (\neg A \wedge \neg B \wedge \neg C) \vee (\neg A \wedge B \wedge C) \vee (A \wedge \neg B \wedge \neg C) \vee (A \wedge B \wedge C)$$

Show supporting work below:

Y=1 for:

ABC

000 $(\neg A \wedge \neg B \wedge \neg C)$

011 $(\neg A \wedge B \wedge C)$

100 $(A \wedge \neg B \wedge \neg C)$

101 $(A \wedge \neg B \wedge C)$

(b) Use the function in (a), write the expression for $\neg Y$ in Fully-Disjunctive Normal Form.

$$\neg Y = (\neg A \wedge \neg B \wedge C) \vee (\neg A \wedge B \wedge \neg C) \vee (A \wedge B \wedge \neg C)$$

Show supporting work below:

Y=0 for:

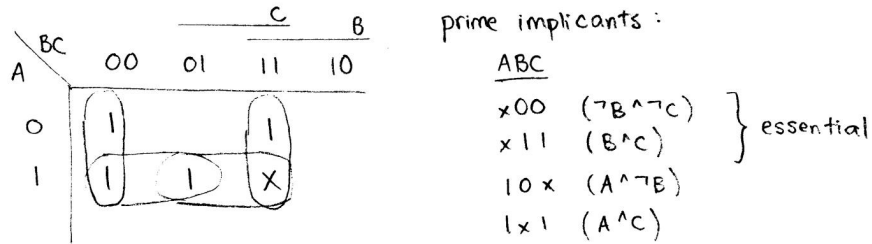
ABC

001 $(\neg A \wedge \neg B \wedge C)$

010 $(\neg A \wedge B \wedge \neg C)$

110 $(A \wedge B \wedge \neg C)$

(c) Draw the Karnaugh map of the truth table, circle the prime implicants, indicate which one(s) are essential (if any).



(d) Using the results in (c), repeat part (a) with a sum-of-product expression using the fewest number of terms and literals.

$$Y = (\neg B \wedge \neg C) \vee (B \wedge C) \vee (A \wedge \neg B)$$

(e) Show a combinational circuit that implements Y (with A, B, and C as inputs) using only inverters and NAND gates.

