

Quiz #1

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Do not start working until instructed to do so.

1. You must answer in the **space provided** for answers after every question. We will ignore answers written anywhere else in the booklet. **All pages in this booklet must be accounted** for otherwise it will not be graded.
2. This quiz is closed book/notes.
3. You may not use any electronic device.

Following table to be filled by course staff only

	Maximum Score	Your Score
TOTAL	20	

Consider the Boolean function below.

$$Y = \neg((\neg c \vee a) \wedge b) \wedge (\neg c \vee a \vee b)$$

(a) Complete the truth table.

	A	B	C	Y	$\neg Y$
$\neg 0 \wedge 1$	0	0	0	1	0
$\wedge 0$	0	0	1	0	1
$\neg 1 \wedge 1$	0	1	0	0	1
$\neg 0 \wedge 1$	0	1	1	1	0
$\neg 1 \wedge 1$	1	0	0	1	0
$1 \wedge 1$	1	0	1	1	0
$\wedge 1$	1	1	0	0	1
$\neg 1 \wedge 1$	1	1	1	0	1

Show supporting work below:

$$Y = (\overline{A\bar{B}C}) \wedge (\overline{A\bar{B}C\bar{e}}) \wedge (\overline{A\bar{B}C\bar{e}}) \wedge (\overline{A\bar{B}C})$$

$$= (A\bar{B}C\bar{e}) \wedge (A\bar{B}C\bar{e}) \wedge (A\bar{B}C\bar{e}) \wedge (A\bar{B}C\bar{e})$$

(b) Write the expression for Y in Fully-Conjunctive Normal Form.

$$Y = (\overline{A\bar{B}C}) \wedge (\overline{A\bar{B}C\bar{e}}) \wedge (\overline{A\bar{B}C\bar{e}}) \wedge (\overline{A\bar{B}C})$$

$$= (A\bar{B}C\bar{e}) \wedge (A\bar{B}C\bar{e}) \wedge (A\bar{B}C\bar{e}) \wedge (A\bar{B}C\bar{e})$$

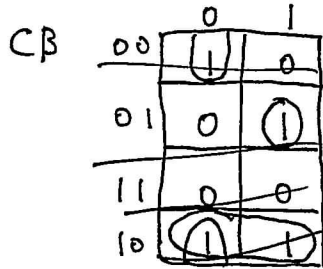
Show supporting work below:

(c) Write the expression for $\neg Y$ in Fully-Disjunctive Normal Form.

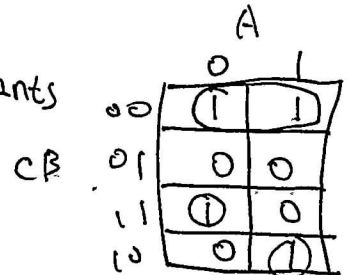
$$\neg Y = (\overline{A\bar{B}C}) \vee (\overline{A\bar{B}C\bar{e}}) \vee (\overline{A\bar{B}C\bar{e}}) \vee (\overline{A\bar{B}C})$$

Show supporting work below:

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

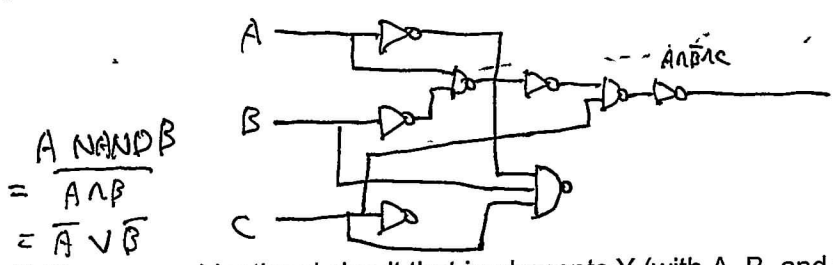


They are all essential prime implicants

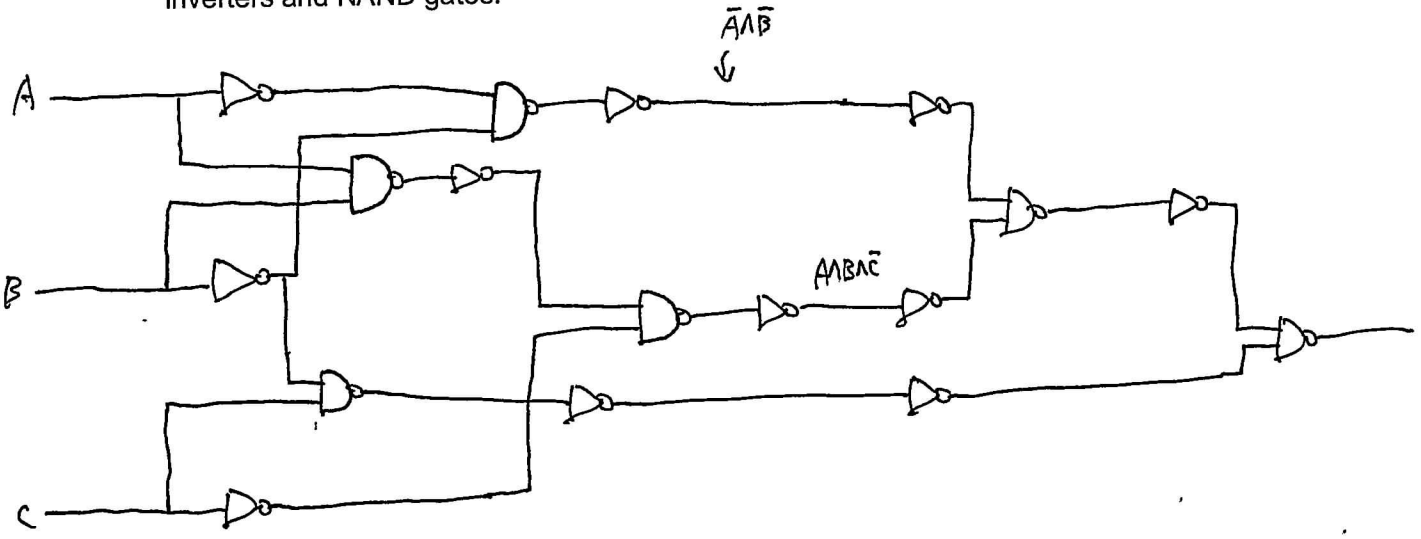


(e) Using the results in (d), write the sum-of-product expression using the fewest number of terms and literals.

$$Y = \cancel{(AAB\bar{A}\bar{C})} \vee \cancel{(A\bar{A}B\bar{B})} \vee \cancel{(B\bar{A}C)} \vee (A\bar{B}\bar{A}C) \vee (\bar{B}\bar{A}\bar{C}) \vee (A\bar{A}B\bar{A}C)$$



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



C ↑ this is wrong. See the back

$$(A\bar{B}AC) \vee (B\bar{A}C) \vee (A\bar{A}BAC)$$

