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.

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

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 ¬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).

		C	C, B	B
A \ BC	00	01	11	10
0	1		1	
1	1	1	X	

prime implicants :

ABC		
x00	$(\neg B \wedge \neg C)$	essential
x11	$(B \wedge C)$	essential
10x	$(A \wedge \neg B)$	
1x1	$(A \wedge C)$	

(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.