Prime Implicants

For each Karnaugh maps below, circle the prime implicants. Then list each product term derived from the map indicating which are essential. You won't necessary need all lines. Finally, write the simplified expression.

Part A

	$\overline{B}$		B		
$\overline{A}$	1	1	1	1	$\overline{C}$
	0	0	1	0	C
A	1	1	1	0	
	0	1	1	0	$\overline{C}$
	$\overline{D}$	D		$\overline{D}$	

prime implicant — essential?

yes ☐ no ☐
_____ yes ☐ no ☐
_____ yes ☐ no ☐
_____ yes ☐ no ☐
_____ yes ☐ no ☐
_____ yes ☐ no ☐
_____ yes ☐ no ☐
_____ yes ☐ no ☐

$F_{(A,B,C,D)} =$ _____

Part B

	$\overline{B}$		B		
$\overline{A}$	1	1	0	1	$\overline{C}$
	1	0	1	1	C
A	1	0	0	1	
	1	1	0	1	$\overline{C}$
	$\overline{D}$	D		$\overline{D}$	

prime implicant — essential?

yes ☐ no ☐
_____ yes ☐ no ☐
_____ yes ☐ no ☐
_____ yes ☐ no ☐
_____ yes ☐ no ☐
_____ yes ☐ no ☐
_____ yes ☐ no ☐
_____ yes ☐ no ☐

$F_{(A,B,C,D)} =$ _____

Part C

	$\overline{B}$		B		
$\overline{A}$	0	0	0	1	$\overline{C}$
	0	1	1	1	C
A	1	0	0	1	
	0	0	0	1	$\overline{C}$
	$\overline{D}$	D		$\overline{D}$	

prime implicant — essential?

yes ☐ no ☐
_____ yes ☐ no ☐
_____ yes ☐ no ☐
_____ yes ☐ no ☐
_____ yes ☐ no ☐
_____ yes ☐ no ☐
_____ yes ☐ no ☐
_____ yes ☐ no ☐

$F_{(A,B,C,D)} =$ _____

Part D

	$\overline{B}$	$\overline{B}$	B	B	
$\overline{A}$	1	0	0	1	$\overline{C}$
	0	1	1	0	C
A	1	1	1	1	
	1	0	0	1	$\overline{C}$
	$\overline{D}$	D		$\overline{D}$	

prime implicant

essential?

yes☐ no☐ ___

yes☐ no☐ ___

yes☐ no☐ ___

yes☐ no☐ ___

yes☐ no☐ ___

yes☐ no☐ ___

yes☐ no☐ ___

$F_{(A,B,C,D)} =$ _____

Part E

	$\overline{B}$	$\overline{B}$	B	B	
$\overline{A}$	1	0	1	1	$\overline{C}$
	1	0	1	1	C
A	0	0	1	0	
	1	0	1	1	$\overline{C}$
	$\overline{D}$	D		$\overline{D}$	

prime implicant

essential?

yes☐ no☐ ___

yes☐ no☐ ___

yes☐ no☐ ___

yes☐ no☐ ___

yes☐ no☐ ___

yes☐ no☐ ___

yes☐ no☐ ___

$F_{(A,B,C,D)} =$ _____

Part F

	$\overline{B}$	$\overline{B}$	B	B	
$\overline{A}$	1	1	0	1	$\overline{C}$
	1	0	1	1	C
A	0	1	1	0	
	1	1	1	0	$\overline{C}$
	$\overline{D}$	D		$\overline{D}$	

prime implicant

essential?

yes☐ no☐ ___

yes☐ no☐ ___

yes☐ no☐ ___

yes☐ no☐ ___

yes☐ no☐ ___

yes☐ no☐ ___
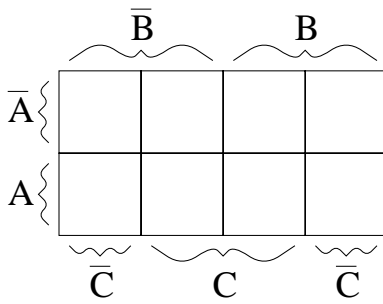
yes☐ no☐ ___

$F_{(A,B,C,D)}(SOP) =$ _____

$F_{(A,B,C,D)}(POS) =$ _____

Part G A four variable Karnaugh map contains all ones except for the entries $A\overline{B}CD$ and $ABCD$ which are zeros. What is the *simplified* logical expression in product of sums form?

$F_{(A,B,C,D)} =$ _____

Part H For the truth table below, complete the Karnaugh map below and identify the prime implicants. Then write the simplified expression. Be sure to factor out any common terms in your solution.

A	B	C	Out
0	0	0	1
1	0	0	1
0	1	0	0
1	1	0	1
0	0	1	1
1	0	1	0
0	1	1	0
1	1	1	0

prime implicant   essential?

_____   yes ☐   no ☐

_____   yes ☐   no ☐

_____   yes ☐   no ☐

$F_{(A,B,C,D)} =$ _____