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VCE Specialist Mathematics ½

Logic & Algorithms II [2.5]

Test

22 Marks. 1 Minute Reading. 18 Minutes Writing

Results:

Test Questions	_____ / 22

Section A: Test Questions (22 Marks)

Question 1 (4 marks)

Tick whether the following statements are **true** or **false**.

	True	False
a. A **tautology** is an assertion of propositional logic that is false in all situations; that is, it is false for all possible values of its variables.		
b. $A \longrightarrow (A \wedge B)$ is not a contradiction.		
c. The truth table for $\neg (p \vee q)$ is: p | q | $p \vee q$ | $\sim (p \vee q)$ T | T | T | F T | F | F | T F | T | F | T F | F | F | T		
d. p and q are both true propositions and r is a false proposition. What is the truth value of $q \wedge (\sim r)$?		
e. The logical connective 'implies' ($\Rightarrow$) is false only when the first statement is true and the second statement is false.		
f. According to the properties of Boolean algebra, $1'1'$ (the complement of 1) is equal to 1.		
g. In a logic switching circuit, an 'OR' gate represented by switches in parallel will output 1 if at least one switch is closed.		
h. The absorption property in Boolean algebra can be expressed as $x \wedge (x \vee y) = x$.		

Space for Personal Notes

Question 2 (2 marks)

Construct the truth table for $(p \rightarrow q) \wedge (\neg p \leftrightarrow q)$.

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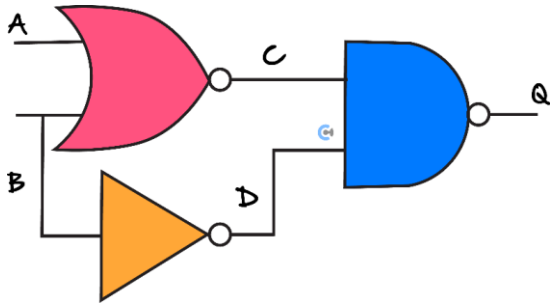
Question 3 (2 marks)

The figure below shows a logic circuit and its incomplete truth table. Complete the below truth table.



A	B	C	D	Q
	0			
	1			
	0			
	1			

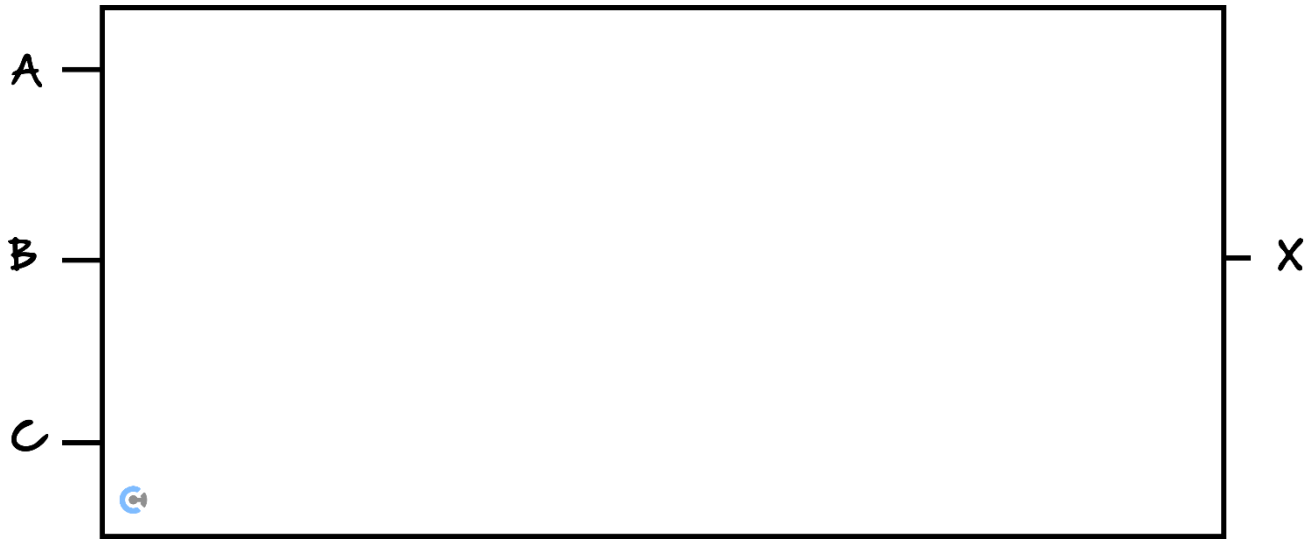
Space for Personal Notes

Question 4 (5 marks)

For this logic statement,

$$X = 1 \ if \ ((A \ is \ 1 \ AND \ B \ is \ 1) \ OR \ (B \ is \ 1 \ AND \ C \ is \ not \ 1))$$

a. Draw the logical circuit. (2 marks)



b. Complete the truth table for the given logic statement. (3 marks)

A	***B***	***C***	**Working space**	***X***
0	0	0		
0	0	1		
0	1	0		
0	1	1		
1	0	0		
1	0	1		
1	1	0		
1	1	1		

Space for Personal Notes

Question 5 (3 marks)

Simplify each expression by algebraic manipulation and by using the laws of Boolean algebra.

a. $\overline{(\bar{x} + \bar{x})} =$ (1 mark)

_____

_____

b. $(\bar{a} + \bar{b})(\bar{a} + b) =$ (2 marks)

_____

_____

_____

_____

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Question 6 (1 mark)

Show that $AC + ABC = AC$ where $A, B, C \in \{0,1\}$.

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Question 7 (5 marks)

Using the given truth tables, draw the corresponding K-Maps and determine the Boolean expression.

a. (2 marks)

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

b. (3 marks)

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

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