CONTOUREDUCATION

Website: contoureducation.com.au | Phone: 1800 888 300
Email: hello@contoureducation.com.au

VCE Specialist Mathematics ½
Logic & Algorithms II [2.5]
Test Solutions

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. $A \rightarrow (A \wedge B)$ 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

|	True	False
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 $(p \to q) \land (\neg p \leftrightarrow q)$.

p	q	¬p	p → q	¬p ↔ q	(p→q)∧(¬p↔q)
T	T	F	T	F	F
T	F	F	F	T	F
F	T	T	T	T	T
F	F	T	T	F	F

Space for Personal Notes

Question 3 (2 marks)

The figure below shows a logic circuit and its incomplete truth table. Complete the below truth table.
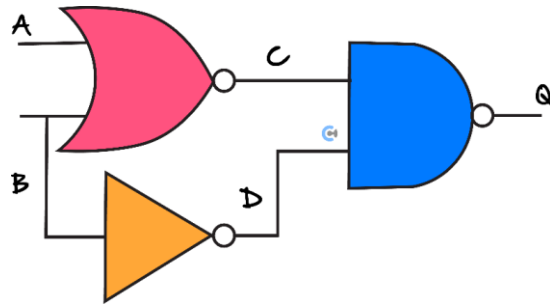
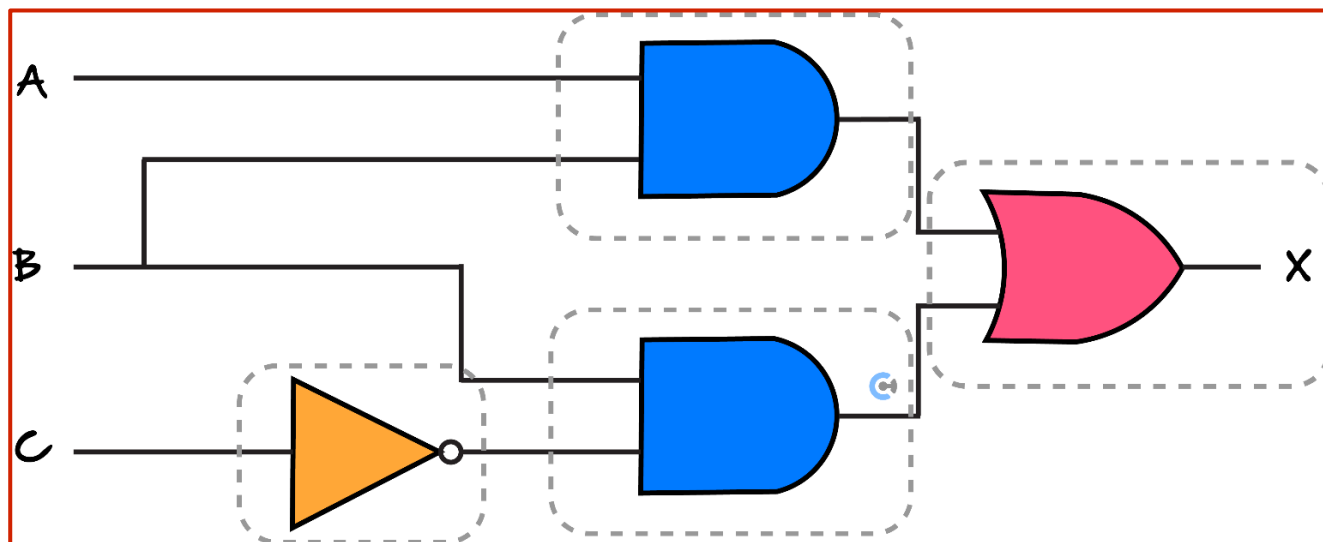| A	B	C	D	Q
0	0	1	1	0
0	1	0	0	1
1	0	0	1	1
1	1	0	0	1

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

A	B	C	X
0	0	0	0
0	0	1	0
0	1	0	1
0	1	1	0
1	0	0	0
1	0	1	0
1	1	0	1
1	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)

$$\overline{(\bar{x} + \bar{x})} = x$$

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

$$(\bar{a} + \bar{b})(\bar{a} + b) = \bar{a}\bar{a} + \bar{a}b + \bar{b}\bar{a} + \bar{b}b = \bar{a} + \bar{a}b + \bar{a}\bar{b} = \bar{a}(1 + b + \bar{b}) = \bar{a}$$

Space for Personal Notes

Question 6 (1 mark)

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

Given Boolean expression: $AC + ABC = AC (1 + B)$
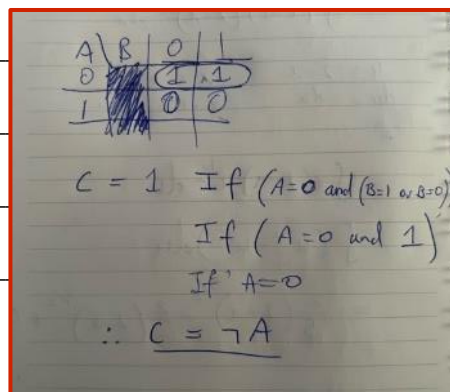Now, using the null law $1 + B = 1$, the above expression can be written as: $AC . 1 = AC$

Space for Personal Notes

Question 7 (5 marks)

Using the given truth tables, draw the corresponding K-Maps and determine the Boolean expression.
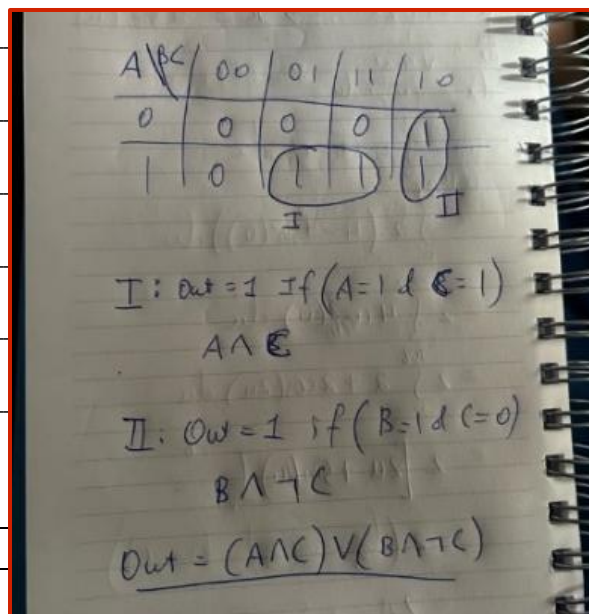
a. (2 marks)

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

Space for Personal Notes

CONTOUREDUCATION

VCE Specialist Mathematics ½

Free 1-on-1 Consults

What Are 1-on-1 Consults?

➤ **Who Runs Them?** Experienced Contour tutors (45 + raw scores and 99 + ATARs).
➤ **Who Can Join?** Fully enrolled Contour students.
➤ **When Are They?** 30-minute 1-on-1 help sessions, after-school weekdays, and all-day weekends.
➤ **What To Do?** Join on time, ask questions, re-learn concepts, or extend yourself!
➤ **Price?** Completely free!
➤ **One Active Booking Per Subject:** Must attend your current consultation before scheduling the next. :)

SAVE THE LINK, AND MAKE THE MOST OF THIS (FREE) SERVICE!

Booking Link

bit.ly/contour-specialist-consult-2025