1.4.3 Karnaugh Maps Questions

1. Fez has created a logic circuit. The expression he has created for the logic circuit is:

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

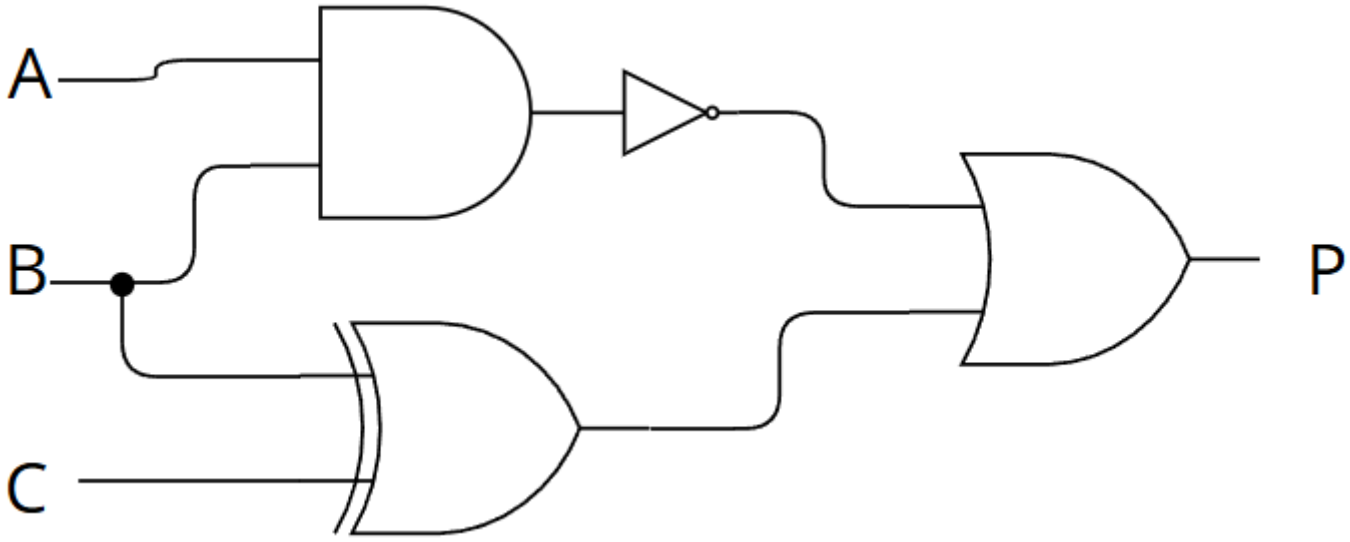
C\AB	00	01	11	10
0				
1				

What is the simplified expression?

_____

_____ **[4]**

2. A computer scientist has created the following logic circuit



Give the Boolean expression that represents the logic circuit shown above. Do not attempt to simplify the expression.

_____

_____

_____

_____ **[2]**

3. (a) Complete the truth table for the logic circuit shown above.

A	B	C	P

[3]

(b) The following Karnaugh map represents another logic circuit.

CD\AB	00	01	11	10
00	1	1	1	1
01	0	0	1	1
11	0	0	0	0
10	1	1	0	0

Use this Karnaugh map to find the simplified expression for this circuit.
You should highlight the map as appropriate and write the expression here.

[4]

4. (a) Complete the Karnaugh map below for Boolean expression $(A \wedge \neg B) \vee (D \wedge \neg C)$

CD\AB	00	01	11	10
00				
01				
11				
10				

[3]

(b) Use the Karnaugh map to see if a simplified expression can be found.

_____

_____ **[2]**

END OF QUESTION PAPER

Mark scheme

<table>
<tr><th colspan="3">Question</th><th>Answer/Indicative content</th><th>Marks</th><th>Guidance</th></tr>
<tr><td>1</td><td></td><td></td><td>
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<tr><td>C\AB</td><td>00</td><td>01</td><td>11</td><td>10</td><td></td></tr>
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<tr><td>1</td><td>1</td><td>1</td><td>1</td><td>1</td><td></td></tr>
</table>
1 mark per bullet up to a maximum of 4 marks:
• 1 mark for filling in the table correctly
• 1 mark for the group shown in red
• 1 mark for the group shown in blue
• 1 mark for the simplified expression A∨C
</td><td>4</td><td></td></tr>
<tr><td>2</td><td></td><td></td><td>
• ¬(A ∧ B)
• v (B v C)
</td><td>2</td><td></td></tr>
<tr><td>3</td><td>a</td><td></td><td>
<table>
<tr><th>A</th><th>B</th><th>C</th><th>P</th><th>Marking Guidance</th></tr>
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<tr><td>10</td><td>1</td><td>1</td><td>0</td><td>0</td></tr>
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• Correct highlighting on K-map as shown above
• (A ∧ ¬D)
• (A ∧ ¬C)
• Expressions joined with v // OR
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Left column filled as (A ∧ ¬B)
2nd row filled as (D ∧ ¬C)
Other cells filled as zero or left blank

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<tr><td>CD\AB</td><td>00</td><td>01</td><td>11</td><td>10</td></tr>
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Karnaugh map used to highlight 1s on the map
Expression cannot be simplified.

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