0 1 . 1 Using the rules of Boolean algebra, simplify the following expression.

$$\overline{\overline{A \cdot (\overline{B} + 0)} \cdot \overline{\overline{A} \cdot (B + B)}}$$

You **must** show your working.

[4 marks]

Answer

0 2 . 1 De Morgan's laws can be applied to enable a combination of logic gates to be replaced by a single gate that produces the same output.

What single gate could replace the combination of gates in the expression $\overline{\overline{A} \cdot \overline{B}}$?

[1 mark

0 2 . 2 Using the rules and identities of Boolean Algebra, simplify the following Boolean expression.

$$A \cdot (A + C) \cdot \overline{A} + \overline{\overline{A} \cdot \overline{A} \cdot B}$$

[4 marks]

0 3 . 1 Using the rules and identities of Boolean algebra, simplify the following Boolean expression.

$$\overline{A + B \cdot \overline{\overline{B}} + C \cdot A}$$

You **must** show your working.

[4 marks]

Answer

| 0 | 4 |. | 1 | Complete the truth table below.

A	**B**	$\overline{\textbf{B}}$	$\left(\textbf{A}+\overline{\textbf{B}}\right)$	$\left(\textbf{A}+\overline{\textbf{B}}\right)\cdot\textbf{B}$
0	0			
0	1			
1	0			
1	1			

Using the final column, give a simplified Boolean expression for

$$\left(A+\overline{B}\right)\cdot B$$

[3 marks]

Answer _____

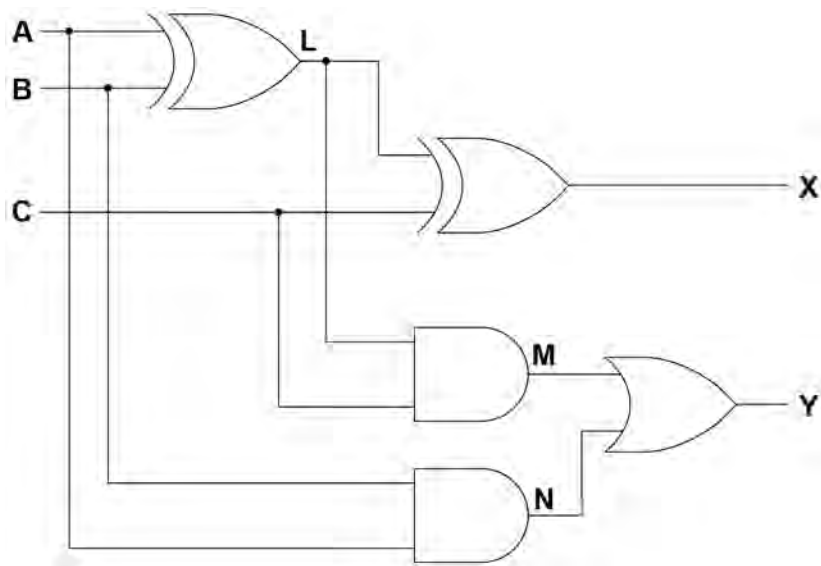**0 4 . 2** Using the rules and identities of Boolean algebra, simplify the following Boolean expression.

$$\left(A+\bar{B}\right)\cdot\left(\overline{\bar{A}+B}\right)$$

[4 marks]

Answer

0 5 . 1   **Figure 3** shows a circuit diagram.

Figure 3

Complete the truth table below for the circuit shown in **Figure 3**.

[3 marks]

A	B	C	L	M	N	X	Y
0	0	0		0		0	
0	0	1		0		1	
0	1	0		0		1	
0	1	1		1		0	
1	0	0		0		1	
1	0	1		1		0	
1	1	0		0		0	
1	1	1		0		1	

0 5 . 2 Using **Figure 3**, write a Boolean expression for output **Y** in terms of inputs **A**, **B** and **C**.

[2 marks]

Y = _____

0 5 . 3 Using the rules of Boolean algebra, simplify the following expression.

$$\overline{\overline{A} + \overline{B}} + B \cdot \overline{A} \cdot \left(\overline{C} + C \right)$$

You **must** show your working.

[4 marks]

0 6 . 1 Using the rules of Boolean algebra, simplify the following expression.

$$\overline{W} \cdot X \cdot Z + W \cdot Z + X \cdot Y \cdot \overline{Z} + \overline{W} \cdot X \cdot Y \cdot 1$$

You **must** show your working.

[4 marks]

Final answer

0 7 This question is about the `CheckIfGameOver` method in the `Dastan` class.

0 7 . 1 Explain why the first selection structure is needed.

[1 mark]

---

0 7 . 2 **Figure 6** shows a pseudo-code representation of part of the `CheckIfGameOver` method.

Figure 6

```
NOT (Player1HasMirza AND Player2HasMirza)
```

Rewrite the code in **Figure 6** so that it has the same functionality but uses `OR` and `NOT` Boolean operations only, instead of the `AND` and `NOT` Boolean operations.

[1 mark]

---

0 8 . 1 Identities are often applied to help simplify Boolean expressions. One such identity is:

$$A . \overline{A} = 0$$

Without using a truth table, explain why this identity is true.

[2 marks]

0 8 . 2 Using the rules of Boolean algebra, simplify the following Boolean expression.

$$\overline{\overline{\overline{B . A . \overline{B}}}} + A . B$$

You **must** show your working.

[4 marks]

Answer _____

0 9 . 1   Using the rules of Boolean algebra, simplify the following Boolean expression.

$$\overline{\overline{A \cdot (A + 1)} \cdot \overline{B}} \cdot \overline{\overline{A} + \overline{B + 0}}$$

You **must** show your working.

[4 marks]

Answer _____

1 0 . 1 Using the rules of Boolean algebra, simplify the following Boolean expression.

$$\overline{A + B \cdot C + B \cdot \overline{C}} + C \cdot (A + \overline{A} \cdot (B + 1))$$

You **must** show your working.

[4 marks]

Working

Answer

1 1 . 1 Using the rules of Boolean algebra, simplify the following Boolean expression.

$$A \cdot \overline{B} + B \cdot (\overline{\overline{A} + (\overline{B} \cdot C)})$$

You **must** show your working.

[4 marks]

Working

Answer

1 2 . 1 Using the rules of Boolean algebra, simplify the following Boolean expression.

$$\overline{A}\cdot\left(B\cdot C\cdot D+B\cdot C\cdot\overline{D}+B\right)+\overline{\overline{A}+B}$$

You **must** show your working.

[4 marks]

Working

Answer