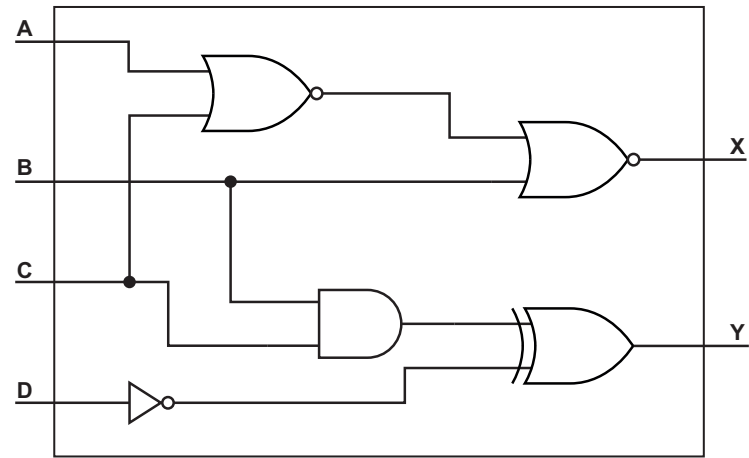


4 (a) Write the logic expressions for the following logic circuit.



X =

Y =

[2]

(b) Complete the truth table for the logic expression:

$X = (A \text{ OR } B) \text{ XOR } (B \text{ OR } C) \text{ XOR } (\text{NOT } A \text{ NAND } C)$

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		

[2]

9 Describe the differences between a monitoring system and a control system.

.....

.....

.....

.....

.....

..... [3]

10 An architect needs a model of a building.

(a) Explain how the model will be printed using a 3D printer.

.....

.....

.....

.....

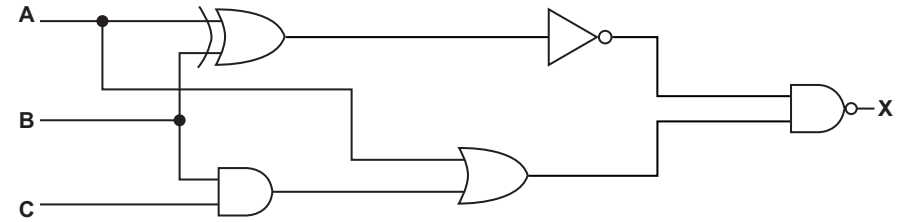
..... [3]

(b) State why a 3D printer needs a buffer.

.....

..... [1]

9 (a) Consider the following logic circuit:



Write the logic expression for the logic circuit. Do **not** simplify the expression.

X = [2]

(b) Consider the following logic expression:

$$X = \text{NOT } ((A \text{ NAND } B) \text{ XOR } (\text{NOT } A \text{ OR } \text{NOT } C))$$

A truth table for the logic expression is given:

Row number	A	B	C	X
1	0	0	0	1
2	0	0	1	0
3	0	1	0	1
4	0	1	1	0
5	1	0	0	1
6	1	0	1	0
7	1	1	0	1
8	1	1	1	1

There are **three** errors in the truth table.

Identify the **three** errors in the truth table by writing the row numbers with an incorrect output.

Error 1 Row number

Error 2 Row number

Error 3 Row number

- 11** An automated system opens doors when a person is detected within 2 metres. The system closes the doors when there is no longer a person within 2 metres.

Identify whether the automated system is an example of a monitoring system or a control system.

Justify your choice.

Monitoring or Control.....

Justification

.....

.....

.....

.....

..... [3]

- 3** A car has an automatic braking system.

A sensor is used to measure the distance to objects that are in front of the car.

The car automatically brakes if an object is too close to the front of the car or the distance between the car and the object is decreasing too quickly. The closer the object is to the front of the car, the harder the car brakes so that the car slows down more quickly.

Explain the reasons why the automatic braking system of the car is a control system.

.....

.....

.....

.....

.....

..... [3]

- 1 (a)** Tick (✓) **one** box to identify the correct logic statement for this truth table.

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

☐

NOT (A AND B AND C)

☐

(A XOR B) NOR C

☐

(A OR B OR C) NOR C

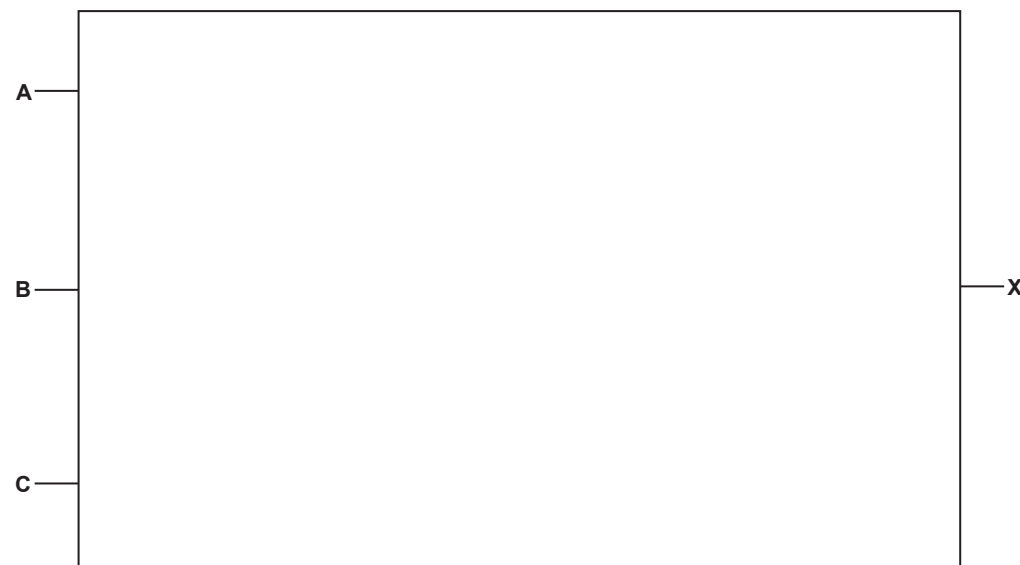
☐

NOT A AND NOT B AND NOT C

[1]

- (b)** Draw a logic circuit for the logic expression:

$$X = \text{NOT} (\text{NOT } A \text{ AND } (\text{NOT } B \text{ XOR } C))$$



[2]

9 A road bridge has a weight limit and a height limit for vehicles. For example, a vehicle must weigh less than 10 000 kg and must have a height of less than 3 m.

The bridge has a warning system. If a vehicle is approaching the bridge and it exceeds one or both limits, a sign displays a warning telling the driver of the vehicle to stop.

(a) The bridge warning system uses sensors to detect if a vehicle exceeds the limits.

Complete the table by identifying **two** different sensors that could be used by the system **and** describe how each sensor is used by the system.

Sensor	Use in bridge warning system
.....	
.....	

[2]

(b) Explain whether the bridge warning system is an example of a monitoring system or of a control system.

.....
.....
.....
.....

[2]