

Boolean Logic

IGCSE Computer Science ■ Topic 10

IGCSE Computer Science



Boolean Logic

What we will cover

- 1 What is Boolean logic?
- 2 The six logic gates
- 3 Truth tables
- 4 Logic expressions
- 5 Logic circuits
- 6 Recap

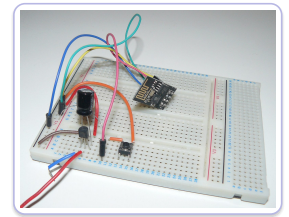
1 Gates

Boolean Logic

└─ Gates

What is Boolean logic?

Boolean logic 布尔逻辑 works with just two values: **TRUE (1)** and **FALSE (0)**. A **logic gate** 逻辑门 takes one or more inputs and gives one output. A **truth table** 真值表 lists the output for *every* combination of inputs.



Breadboard

Boolean Logic

└─ Gates

The six logic gates

- **NOT** – invert
- **AND** – 1 only if all inputs are 1
- **OR** – 1 if any input is 1
- **NAND** / **NOR** – universal (any circuit from these)
- **XOR** – 1 if the inputs differ

Boolean Logic

└─ Gates

Truth tables: AND and OR

A	B	A AND B
0	0	0
0	1	0
1	0	0
1	1	1

AND

AND: 1 only when both are 1

A	B	A OR B
0	0	0
0	1	1
1	0	1
1	1	1

OR

Build a truth table row by row: with n inputs there are 2^n rows – 2 inputs give 4, 3 inputs give 8. List them in binary-counting order so you miss none.

2 Expressions and circuits

Logic expressions

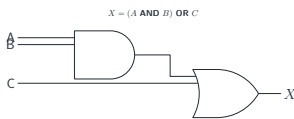
A **logic expression** 逻辑表达式 writes a circuit in words:

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

Work it out **inside the brackets first**, then combine.

Precedence: NOT binds tightest, then AND, then OR. Use brackets to be sure – an examiner reads exactly what you wrote.

Logic circuits



A **logic circuit** 逻辑电路 draws the gates joined by wires. To build its truth table, work **left to right**: find each gate's output, feed it into the next.

Circuit → expression → truth table are three views of the **same** logic – an exam may give you any one and ask for another.

3 Recap

Topic 10 – key takeaways

1 **Two values**

TRUE (1) and FALSE (0), through gates

3 **Truth table**

2^n rows for n inputs, in order

2 **Six gates**

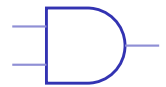
NOT, AND, OR, NAND, NOR, XOR

4 **Three views**

circuit, expression, table – same logic

Check yourself

- 1 When is an AND gate's output 1?
- 2 How many rows for 3 inputs?
- 3 Which gate outputs 1 when inputs differ?
- 4 Which operator binds tightest?



Answers 1. when both inputs are 1 2. 8 3. XOR 4. NOT