

Boolean Logic

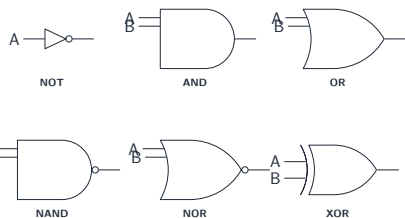
IGCSE Computer Science ■ Topic 10

IGCSE Computer Science



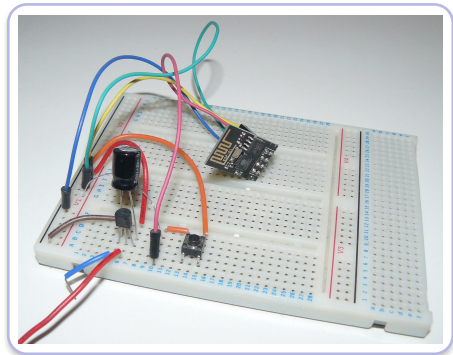
What we will cover

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



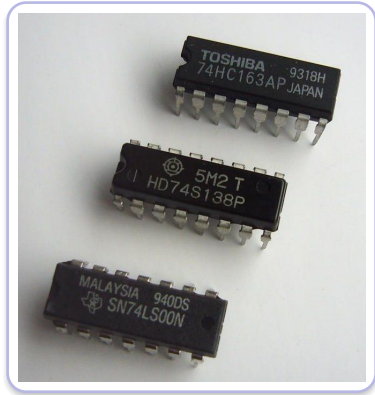
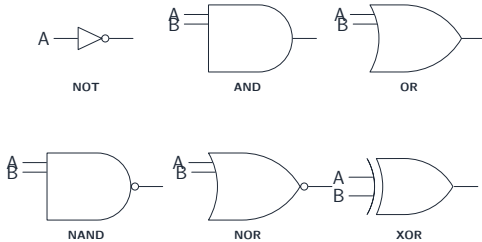
What is Boolean logic?

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

The six logic gates



chip

logic ic

Truth tables: AND and OR

A	B	$A \cdot B$
0	0	0
0	1	0
1	0	0
1	1	1

AND

AND: 1 only when both are 1

A	B	$A+B$
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.

Logic expressions

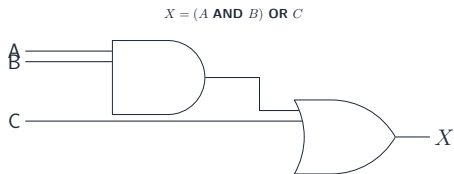
A **logic expression** 逻辑表达式 writes a circuit in words:

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

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.

Topic 10 – key takeaways

1 Two values

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

2 Six gates

NOT, AND, OR, NAND, NOR,
XOR

3 Truth table

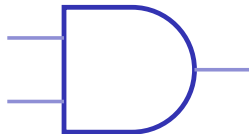
2^n rows for n inputs, in order

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