

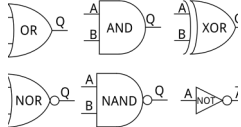



# Y9—Logic

## Important ideas

	Logic is a way of thinking. Logic is about solving problems by using a step-by-step approach.
	The CPU (Central Processing Unit) of a computer is a logic machine. Software directs the CPU to use different types of logic at different times. This is called processing.
	CPUs are made of millions of logic gates. There are different types of logic gate that do different logic tasks. A computer works by combining logic gates.
	There is a language of logic. This is called Boolean logic (after George Boole).

## Important vocabulary

Logic	A way of processing information
Central Processing Unit	The control unit of a computer
Boolean Logic	The language of logic—eg True and False
Logic gate	The tiny switches found inside microchips (CPUs)
Truth Table	This is a simple way of showing the outputs of logic gates or systems
Algorithm	A set of rules to follow— the end point is a solution to a problem.
Semiconductor	This is a type of material that can selectively conduct electricity
Electrons	A flow of electrons causes a current (which transfers energy).

## Overview of topic

Truth tables always show us how a logic gate (or sequences of gates) works.

**NOT** gate truth tables have 1 input and 2 possible output states (the symbol has one input and one output).

**AND** gate truth tables have 2 inputs and 4 possible output states

**AND** gate

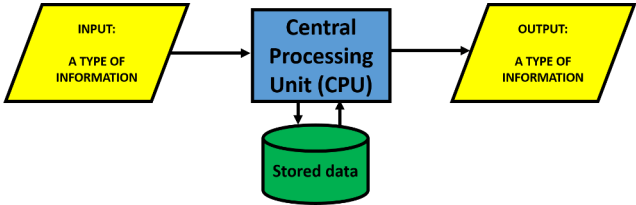
Truth table:

INPUT A	INPUT B	OUTPUT
TRUE(1)	TRUE(1)	TRUE(1)
FALSE(0)	FALSE(0)	FALSE(0)
TRUE(1)	FALSE(0)	FALSE(0)
FALSE(0)	TRUE(1)	FALSE(0)



**OR** gate truth tables have 2 inputs and 4 possible output states (three are TRUE and one is FALSE)

## How it connects...



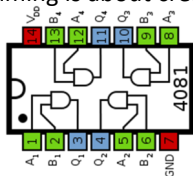
The most important part of a computer is the CPU. The CPU is made up of logic gates. These gates are usually embedded in a microchip. The simplest microchips (Integrated Circuits or ICs) have a small number of logic gates. Modern CPUs have billions of logic gates.

CPUs follow algorithms. These are step by step instructions written by the user (software). Programming is about creating the algorithms for a CPU to follow.

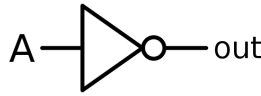
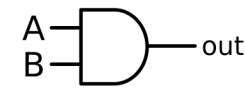

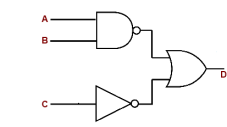
Logic gates are binary systems.

They are ON/OFF.




Binary systems can only use 2 states (ON/OFF or TRUE/FALSE or 1 or 0). This means that computers can only follow algorithms that give binary choices.



## Important examples

	This is a <b>NOT</b> logic gate. It always reverses the INPUT. This is used as an <b>INVERTER</b> (eg nightlight)
	This is an <b>AND</b> logic gate. It will only give an output if both inputs are <b>TRUE (ON)</b> . It is used to combine.
	This is an <b>OR</b> logic gate. It gives an output if any of the inputs are <b>TRUE</b> . It is a linking gate
	Logic gates can be linked into sequences to carry out tasks. You work out the outputs using truth tables.

## I must be able to...

<b>Explain what logic means in terms of computers</b>	This is the step-by-step process used to solve problems. It works by following algorithms. CPUs contain logic gates that follow simple rules. The programming algorithms direct the CPU to carry out tasks –OUTPUTS
<b>Recognise the symbols for logic gates</b>	NOT  AND  OR 
<b>Create truth tables for logic gates and sequences of logic gates</b>	<ul style="list-style-type: none"> <li>NOT gates (1 INPUT and 1 OUTPUT) - reverses logic of single input</li> <li>AND gates (2 INPUTS and 1 OUTPUT) - combines logic of two inputs.</li> </ul>
<b>Solve logic problems</b>	1. Look for patterns or links 2. Create a rule (a logic rule) 3. Test the rule (put in data) 4. Discard rules that don't work! 5. Check that rule works every time.