True Or False?

Computers may not be able to 'think' yet, but they can certainly follow the laws of logic

The CPU (Central Processing Unit) is often descibed as the heart of a computer. It's the place where all the computations and logical decision-making take place. But how are these decisions and calculations made?

To understand, we need to know the basics of binary arithmetic and be familiar with logic gates. In computers, these gates are simple electrical circuits able to make logical decisions and comparisons. This may sound more complicated than it is, and the principles can easily be illustrated using examples from everyday life.

There are three fundamental types of gate — the AND gate, the OR gate and the NOT gate. Capital letters are used when writing about gates to differentiate the words from the usual English 'and', 'or' and 'not'.

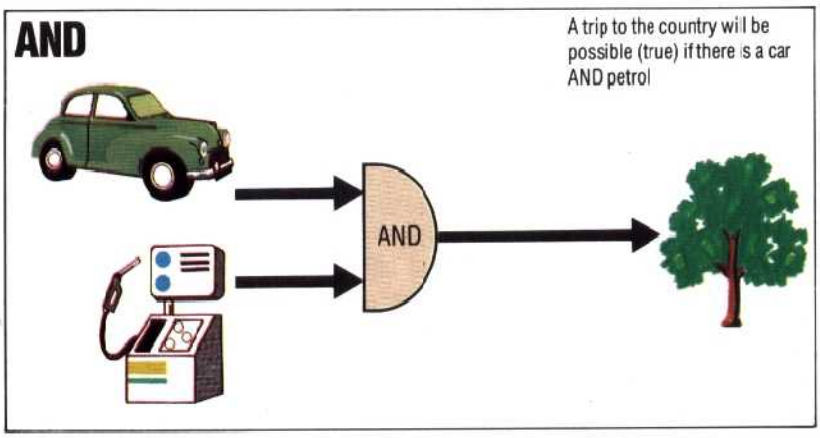
Logical Connections

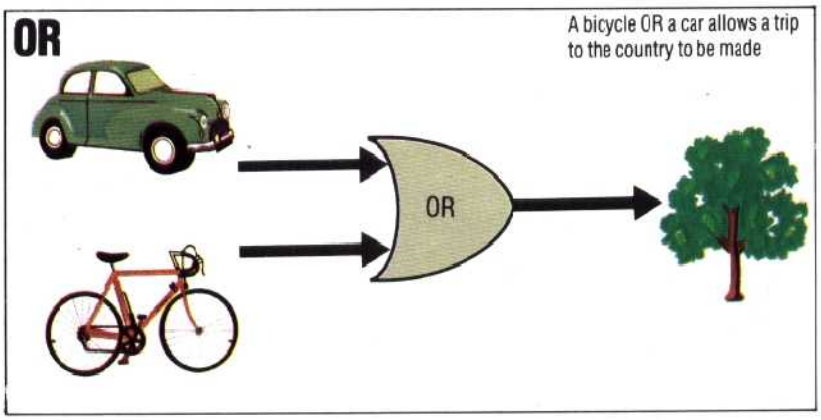
An AND gate is a circuit that gives a 'true' output if all the inputs are 'true'. Let's see what this means. Suppose you would like a trip to the country. If you have a car AND some petrol, you can have the trip. If you have some petrol but no car, you can't go. Similarly, a car but no petrol means no trip.

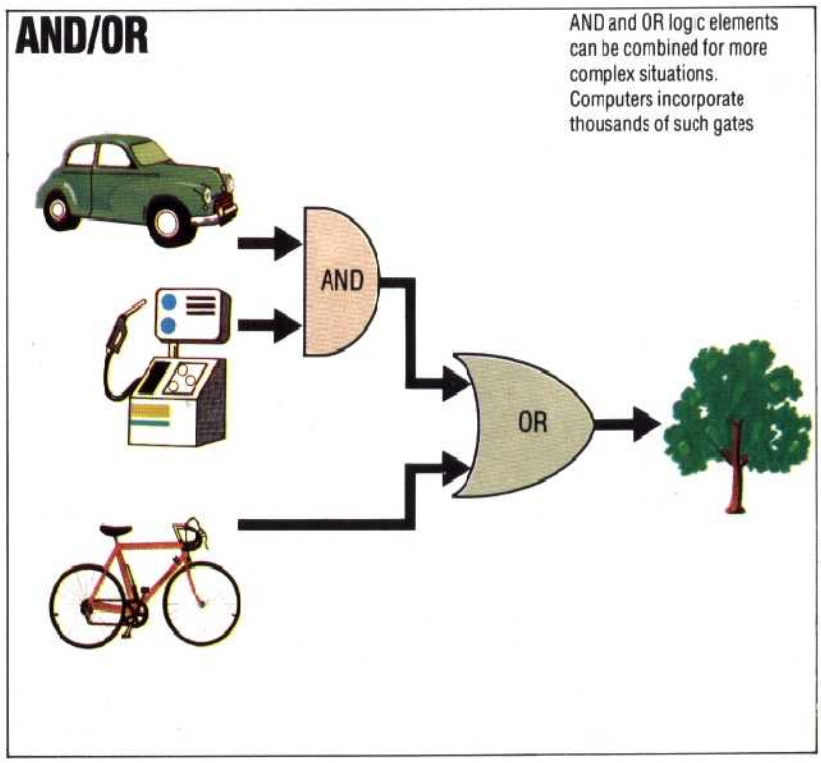
In this AND 'circuit', there are two input conditions and both need to be 'true'. To get the trip (the 'output') it must be true that you have a car AND it must be true that you have some petrol. Then the output becomes 'true' — it is true that you get the trip to the country. Later, we'll see how this logic diagram can be shown as a logic equation and also how it can be represented in a 'truth table'.

Imagine a slightly different situation. Somebody would like to take a trip to the country. The trip will be possible if they have either a car OR a bicycle (we'll assume the car has petrol this time). If they have a car, they can go. If they have a bike, they can go. It is only if neither of the input conditions is true that the trip becomes impossible — in computer jargon, the output becomes false (i.e. it is not true that he gets the trip to the country).

There is one more essential logic gate to consider, the NOT gate. This gate simply gives as an output the opposite of the input. If the input is true, the output will be false. If the input is false, the output will be true. Extending our metaphor of a trip to the country, whether by car or by bike, it must be false that there is a flat tyre to get a trip to the country. If the input (a flat tyre) is true, then the output (a trip) will be false.







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