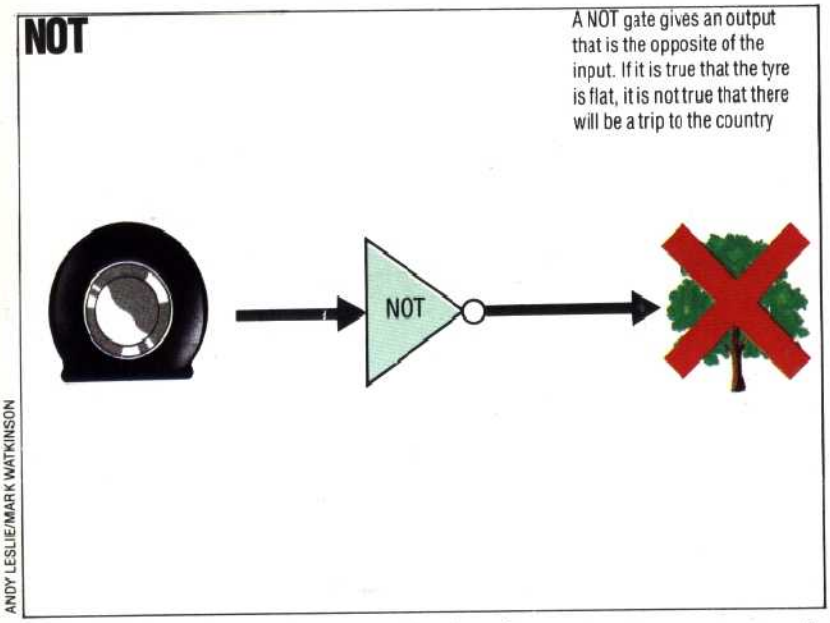


ANDY LESLIE/MARK WATKINSON

These logic elements can be combined and we have illustrated this using the trip to the country example. Combinations of AND, OR and NOT allow all decisions based on conventional logic to be made. It is interesting to work out the logic decisions (gates) needed for other problems. Try working out what would be required for a garden barbecue, for example. It can become quite complicated. To have the barbecue in the garden (the true output) we would need various input conditions: money OR a cheque book OR a credit card (to buy the food and drink) AND a free evening AND fine weather AND a grill AND charcoal.

Truth Tables

The symbols we have used in the illustrations are the same as those used in computer circuit diagrams. To see just how easily logical decisions can be implemented using electrical circuits, let's look at the 'truth table' for the AND illustration. If we use the letter c to represent the 'having a car' input condition and the letter p for the 'having petrol' input condition, we can represent the 'having a trip to the country' output condition using a t. We can then use T to stand for true and F to stand for false. The truth table shows all possible combinations of input conditions and the effect of using AND on the output. It looks like this:

CAR	F	T	F	T	(c)
PETROL	F	F	T	T	(p)
TRIP	F	F	F	T	(t)

The truth table for 2-input AND

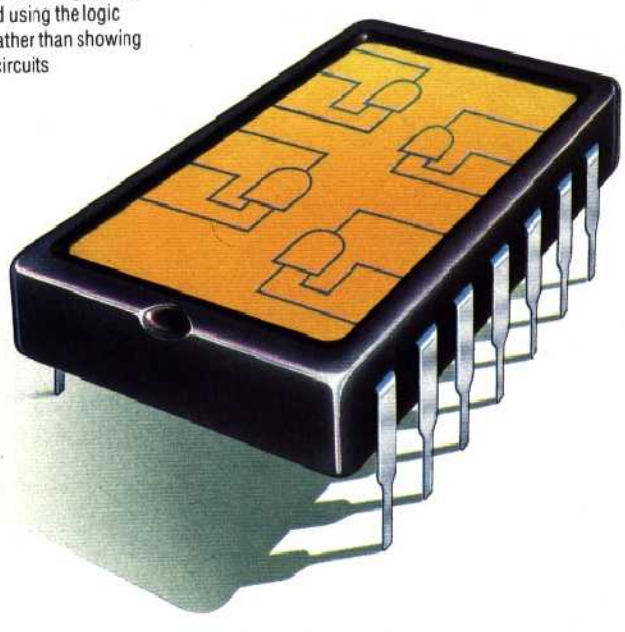
CAR	0	1	0	1	(c)
PETROL	0	0	1	1	(p)
TRIP	0	0	0	1	(t)

The same truth table using 0 and 1 for False and True

In computers we use the binary digits zero and one to stand for false and true respectively. The computer interprets a plus voltage as one and a zero voltage as a zero. An AND circuit can easily be made using transistors so that if both inputs are plus voltages, the output will also be a plus voltage. If either or both of the inputs is a voltage of zero, the output from the circuit will also be a zero.

An electronic OR circuit gives a positive voltage output if either or both of the inputs is positive. If both the inputs are zero, the output will also be zero. In a NOT circuit, the input is simply reversed: if the input is positive, the output will be zero; if the input is zero, the output will be positive.

The 7408 Chip
Large silicon chips often contain thousands of gates to perform AND, OR and NOT logic. The small 7408 chip illustrated contains all the transistors and circuitry for four AND gates. The gates are represented using the logic symbols, rather than showing the actual circuits



TONY LODGE