Computer Logic

Difference between analogue and digital?

Analogue devices measure the value of a physically continuous quantity. Thus, a thermometer senses the surrounding air temperature, which is a physical continuous quantity. Digital devices count a number of physical, discontinuous (separate, discrete) quantities. Thus, abacus is a digital device because the number of beads on a wire is counted. A nurse will count the number of heart beats when taking a patient's pulse.

A perfect example is that of an analogue radio tuner and a digital radio tuner. Since the analogue one is continuous you can never be sure that you are perfectly tuned while a digital tuner is very accurate.

Analogue Radio Tuner

Two-state Devices

Computers are digital, electronic machines. The electronic circuits are two-state or bistable which means that only two states are possible, 'on' or 'off' – either 5 volts or 0 volts. Two-state devices are used in computers because they are cheap, quick, and reliable and take up only small amounts of space and energy. For this reason, the binary number system, which uses the two digits 0 and 1, is most suited to computers. In fact, the digits 0 and 1 represent the two states possible in 2-state devices used in computers.

All programs and data are ultimately recognised as just patterns of 0's and 1's by the digital computer.

The Binary Number System

In our everyday arithmetic, we make use of numbers in what is called the decimal or the denary number system. Every number system in maths has a radix, or base, i.e. the number of individual digits including zero which that system can use. In the decimal system, the ten digits used are 0,1,2,3,4,5,6,7,8 and 9.

Since computers make use of two-state devices, it is clear that the binary number system with only two digits, zero and one, is the ideal number system to represent the two-state electronic devices and, as a result, people studying computers have to become aware of binary arithmetic.

Number Systems

Decimal - The decimal number system used in everyday life employs the base 10 system. The 10 symbols used in decimal are 0, 1, 2, 3, 4, 5, 6, 7, 8 and 9.

Binary - The binary system uses the base 2. The 2 symbols used in binary are 0 and 1. Therefore any number must be represented using 0s and 1s only.

Hexadecimal - The hexadecimal number system is also used and the 16 symbols of this system are 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, A, B, C, D, E and F. The base of this system is 16 where A, B, C, D, E and F correspond to the decimal numbers 10, 11, 12, 13, 14 and 15.

Units of Storage

As we have already mentioned, the binary system is the most suitable for computer electronics. Consequently, all data stored in memory uses binary logic, where each binary digit or bit can be set to 0 or 1.

A byte is a group of 8 bits which are used to represent a character. The following are the units of storage used:

Kilobytes or KB	-	1 kbyte	=	1024 bytes
Megabytes or MB	-	1 Mbyte	=	1024 Kbytes
Gigabytes or GB	-	1 Gbyte	=	1024 Mbytes
Terabytes or TB	-	1 Tbyte	=	1024 Gbytes

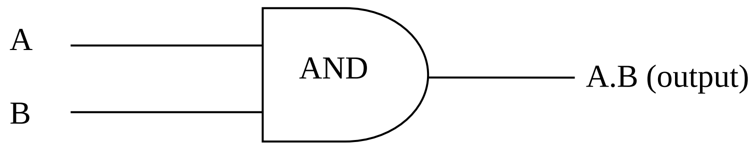
LOGIC GATES and TRUTH TABLES

Gates permit certain operations to be performed on a computer for example, the data stored in main memory. Gates are electronic circuits that produce an output depending upon the input presented to them. The input is always in binary unit.

There are several types of gates but we will have a look at three of them: AND, OR, NOT

AND Gate

An And gate has an output of 1 if all inputs are 1, otherwise 0 is output.

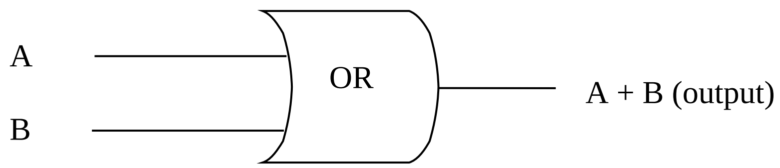


Truth Table

Input		*Output*
A	**B**	**A AND B**
0	0	0
0	1	0
1	0	0
1	1	1

OR Gate

An OR gate has an output of 1 if any of the inputs are 1, otherwise 0 is output.

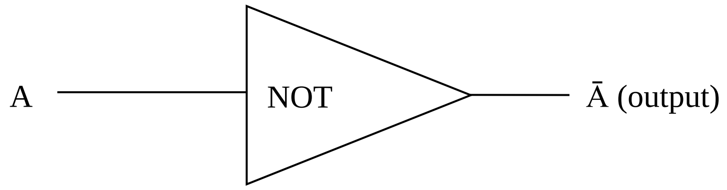


Truth Table

Input		*Output*
A	**B**	**A OR B**
0	0	0
0	1	1
1	0	1
1	1	1

NOT Gate

A NOT gate has one input and one output. It has the effect of reversing the input signal and is sometimes called an inverter. Every 0 becomes a 1 and every 1 becomes a 0.



Truth Table

Input	*Output*
A	**NOT A**
0	1
1	0