Binary Numbers

There are a variety of schemes to associate binary bits with numbers.

The association of a binary number with an unsigned integer is straightforward. However, one could, by your convention, have the binary point anywhere in the binary word rather than at the right.

Negative numbers are usually represented by the two's complement scheme. Here the left hand bit is the sign bit and the negative of a number is formed by complementing the bits and adding one. Ordinary arithmetic works and one ignores any carry (unless checking for overflow).

A number of analog to digital and digital to analog converters use offset two's complement which is the same as two's complement with the left hand (sign) bit complemented.

Gray codes are often used for shaft encoders, etc. so that a small amount of jitter makes a difference of only one number. However arithmetic is so difficult with Gray codes, that one usually converts
gray codes to unsigned integers before doing any addition or subtraction.

Floating point is a form used to realize a large dynamic range with a smaller number of bits than would be required with two's complement.

More information on binary number systems is provided by Altera's

*Application Note 83.*

If clicking on the application note is unsuccessful then go to

[www.altera.com](http://www.altera.com)

and navigate to AN 83.