Binary arithmetic

1. Addition
2. Subtraction
3. Multiplication
4. Division

See also: <https://ryanstutorials.net/binary-tutorial/binary-arithmetic.php>

**Addition**

**Adding unsigned numbers**

Adding [unsigned numbers](https://www.swarthmore.edu/NatSci/echeeve1/Ref/BinaryMath/NumSys.html#posint) in binary is quite easy. Recall that with 4 bit numbers we can represent numbers from 0 to 15. Addition is done exactly like adding decimal numbers, except that you have only two digits (0 and 1). The only number facts to remember are that

0+0 = 0, with no carry,
1+0 = 1, with no carry,
0+1 = 1, with no carry,
1+1 = 0, and you carry a 1.

so to add the numbers 0610=01102 and 0710=01112 (answer=1310=11012) we can write out the calculation (the results of any carry is shown along the top row, in italics).

|  |  |
| --- | --- |
| **Decimal** | **Unsigned Binary** |
|  *1*  (carry) 06 +07 13 |   *110* (carry) 0110 +0111 1101 |

**Subtraction**

Binary Subtraction

**Subtraction and Borrow**, these two words will be used very frequently for the binary subtraction. There are four rules of binary subtraction.



Example − Subtraction



**Multiplication**

**Multiplying unsigned numbers**

Multiplying [unsigned numbers](https://www.swarthmore.edu/NatSci/echeeve1/Ref/BinaryMath/NumSys.html#posint) in binary is quite easy. Recall that with 4 bit numbers we can represent numbers from 0 to 15. Multiplication can be performed done exactly as with decimal numbers, except that you have only two digits (0 and 1). The only number facts to remember are that 0\*1=0, and 1\*1=1 (this is the same as a logical "and").

Multiplication is different than addition in that multiplication of an n bit number by an m bit number results in an n+m bit number. Let's take a look at an example where n=m=4 and the result is 8 bits

|  |  |
| --- | --- |
| **Decimal** | **Binary** |
|  10 x6 60 |  1010 x0110 0000 1010 1010 +0000  0111100  |

Binary Division

Binary division is similar to decimal division. It is called as the long division procedure.

Example − Division

