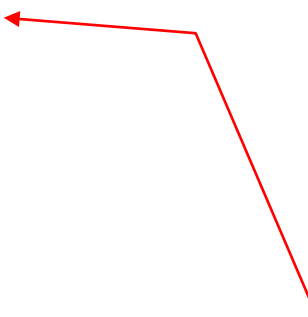


DIGITAL MATH

Adding · Subtracting · Multiplying ·
Dividing
Other Number Systems

ADDING

$$\begin{array}{r} 1 \\ 9_{10} \\ +1 \\ \hline 10 \end{array}$$



9 IS THE HIGHEST CHARACTER IN OUR NUMBER SYSTEM. IF WE WANT TO ADD ONE WE HAVE RESET THE COLUMN TO ZERO AND CARRY A 1. THAT ONE REPRESENTS A "10" BECAUSE WE ARE IN THE DECIMAL NUMBER SYSTEM

ADDING

For BINARY you *CARRY/BORROW* **2**
(or 10_2)

For OCTAL you *CARRY/BORROW* **8**

For HEXADECIMAL you
CARRY/BORROW **16**

ADDING

BINARY

$$\begin{array}{r} 1 \ 1 \ 1 \ 1 \\ 1101_2 \\ +0111 \\ \hline 10100 \end{array}$$

OCTAL

$$\begin{array}{r} 1 \ 1 \\ 675_8 \\ +077 \\ \hline 774 \end{array}$$

HEXADECIMAL

$$\begin{array}{r} 1 \ 1 \\ AF_{16} \\ +FA \\ \hline 1A9 \end{array}$$

SUBTRACTING

BORROW METHOD

In our number system (base 10) when subtracting, we sometimes have to borrow from the column to the left and bring over 10.

When subtracting in other number systems, when borrowing, you bring over an amount equal to the radix (base) of that system.

SUBTRACTING

BORROW METHOD

BINAR

| |
|---|
| $\begin{array}{r} 010 \\ \cancel{101} \\ - 11 \\ \hline 10 \end{array}$ |
|---|

In binary, when you borrow, you borrow 2 (10_2) instead of 10 decimal.

In binary, $10_2 - 1_2 = 1_2$

SUBTRACTING

BORROW METHOD

OCTA

$$\begin{array}{r} 76 \\ -57 \\ \hline 17 \end{array}$$

Diagram illustrating the borrowing process in octal subtraction. A diagonal line is drawn from the 6 in the first column to the 5 in the second column. Above the 6 is the number 6, and above the 5 is the number 14, indicating that 8 (the octal value of 10) is borrowed from the first column to be added to the 6 in the second column.

In octal, when you borrow, you borrow 8 instead of 10. The 8 is then added to 6 to give 14. Then 7 is subtracted from 14 to give 7. The 7 in the second column is reduced by 1 to become 6 and the 5 is then subtracted to give you 1.

SUBTRACTING

BORROW METHOD

HEXADECIMAL

$$\begin{array}{r} \\ \cancel{A}6 \\ -7F \\ \hline 27 \end{array}$$

In hexadecimal, when you borrow from the next column, it is 16 instead of 10. The 16 is then added to 6 to give 22. Then 15 (F) is subtracted from 22 to give 7. The A in the second column is reduced by 1 to become 9 and the 7 is then subtracted to give you 2.

SUBTRACTING

2's COMPLEMENT METHOD

The 2's complement method is used by computers to subtract because circuitry can not be built for the borrow method.

There are two steps. The first step (1's complement) to change 1's to 0's and 0's to 1's. The second step is to add 1 to the 1's complement value. The last step is to add the two values you together.

Any carry after adding is ignored because you are to end up with the same number of bits that you start with.

MULTIPLYING

Multiplying in binary is just like multiplying in decimal except it is either multiplying 1×1 or 1×0 .

After you go through all the numbers, the columns have to be added up. Two 1's is **10**, three 1's is **11** and four 1's is **100**. In **green** is what you carry over.

MULTIPLYING

EXAMPLE

$$\begin{array}{r} 101010 \times 101 \\ \times 101 \\ \hline 101010 \\ 10101000 \\ \hline 11010010 \end{array}$$

DIVIDING

To divide binary numbers a subtraction method is used.

The divisor is slid under the dividend to make it as large as possible without making it larger than the dividend. A 1 plus the number of 0s used to make it larger is recorded and is later added up to make the quotient.

DIVIDING

$$111010 \div 101$$

$$\begin{array}{r} 000 \\ \hline 010010 \\ 0 \\ \hline 1000 \\ \hline 011 \end{array}$$

$$1000$$

$$10$$

$$1$$

$$1011$$

YOUR ANSWER