BINARY ARITHMETIC

Binary arithmetic is essential part of all the digital computers and many other digital system.

Binary Addition

It is a key for binary subtraction, multiplication, division. There are four rules of binary addition.

Case	A + B	Sum	Carry
1	0 + 0	0	0
2	0 + 1	1	0
3	1 + 0	1	0
4	1 + 1	0	1

In fourth case, a binary addition is creating a sum of 1 + 1 = 10 i.e. 0 is written in the given column and a carry of 1 over to the next column.

Example − Addition

0011010 + 001100 = 00100110

```
  1 1          carry
  0 0 1 1 0 1 0  = 26₁₀
+ 0 0 0 1 1 0 0  = 12₁₀
-----------------
  0 1 0 0 1 1 0  = 38₁₀
```

Binary Subtraction

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

Case	A - B	Subtract	Borrow
1	0 - 0	0	0
2	1 - 0	1	0
3	1 - 1	0	0
4	0 - 1	0	1

Example − Subtraction

0011010 - 001100 = 00001110

```
    1 1        borrow
  0 0 1 1 0 1 0  = 26₁₀
- 0 0 0 1 1 0 0  = 12₁₀
-----------------
  0 0 0 1 1 1 0  = 14₁₀
```

Binary Multiplication

Binary multiplication is similar to decimal multiplication. It is simpler than decimal multiplication because only 0s and 1s are involved. There are four rules of binary multiplication.

Case	A x B	Multiplication

1	0 x 0	0
2	0 x 1	0
3	1 x 0	0
4	1 x 1	1

Example − Multiplication

Example:

0011010 x 001100 = 100111000

$$
\begin{array}{rl}
0\,0\,1\,1\,0\,1\,0 & = 26_{10} \\
\times\, 0\,0\,0\,1\,1\,0\,0 & = 12_{10} \\
\hline
0\,0\,0\,0\,0\,0\,0 & \\
0\,0\,0\,0\,0\,0\,0 & \\
0\,0\,1\,1\,0\,1\,0 & \\
0\,0\,1\,1\,0\,1\,0 & \\
\hline
0\,1\,0\,0\,1\,1\,1\,0\,0\,0 & = 312_{10}
\end{array}
$$

Binary Division

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

Example − Division

101010 / 000110 = 000111

$$
\begin{array}{rl}
1\,1\,1 & = 7_{10} \\
000110\,\overline{)\,1\,0\,1\,0\,1\,0} & = 42_{10} \\
-\,1\,1\,0 & = 6_{10} \\
\hline
1\,0\,0\,1 & \\
-\,1\,1\,0 & \\
\hline
1\,1\,0 & \\
-\,1\,1\,0 & \\
\hline
0 &
\end{array}
$$