

Binary Arithmetic

BINARY ADDITION

BINARY SUBTRACTION

BINARY MULTIPLICATION

BINARY DIVISION

1) BINARY ADDITION:-

Method by which binary addition occurs

- ▶ $0+0=0$
- ▶ $0+1=1$
- ▶ $1+0=1$
- ▶ $1+1=0$ with a carry of '1' to the next more significant bit.
- ▶ $1+1+1=1$ with a carry of '1' to the next more significant bit.
- ▶
- ▶ $(0+1=1, 1+1=10, 10+1=11)$,where the two bit there one is the carry .)

EXAMPLE :-

- ▶ $11101+10111=110100$
- ▶ $11101.01111+01110.11010=101100.01001$
- ▶ $(58)H + (8B)H = (?)H$
- ▶ For this first convert this hexadecimal number in the binary then use binary arithmetic after this result convert it in to the hexadecimal .
- ▶ $(58)H=(01011000)_2$ and $(8B)H=(10001011)_2$
- ▶ $01011000+10001011=11100011=(E3)H$
- ▶ $(5.6)O + (E.4)H =$
 $(0101.1100+1110.0100=10100.0000)=(24.00)O$

2) BINARY SUBTRACTION:-

- ▶ Methods by which binary subtraction occurs
- ▶ $0-0=0$
- ▶ $1-0=1$
- ▶ $1-1=0$
- ▶ $0-1=1$ with a borrow of 1 from the next more significant bit .
- ▶ $(11-1=10-1=1=1-1=0)$

EXAMPLE:-

- ▶ $11101-01011=10010$
- ▶ $1110.0010-1101.1100=0000.0110$
- ▶ $(41E)H - (13D)H = (2E1)H$
- ▶
- ▶ For this first convert this hexadecimal number in the binary then use binary arithmetic after this result convert it in to the hexadecimal .
- ▶
- ▶ $(5.C)H-(4.6)O = (01.00)O$

3) Binary Multiplication:-

Binary Multiplication Rules

- ▶ Binary multiplication, like other binary operations, is much easier, unlike the decimal multiplication when you remember the following multiplication rules. The rules of binary multiplication are:
 - ▶ $0 \times 0 = 0$
 - ▶ $0 \times 1 = 0$
 - ▶ $1 \times 0 = 0$
 - ▶ $1 \times 1 = 1$ [No borrow or carry method is applicable here]

EXAMPLE:-

Question 1:- 110 X 100

$$\begin{array}{r} 110 \\ \times 100 \\ \hline 000 \\ 000x \\ 110xx \\ \hline 11000 \\ \hline \end{array}$$

EXAMPLE 2:-

Question 2:

$$\begin{array}{r} 1000 \\ \times 1001 \\ \hline \end{array}$$

$$\begin{array}{r} 1000 \\ 0000 \\ 0000 \\ 1000 \\ \hline \end{array}$$

Product 1001000

4) Binary Division:-

Binary Division Rules

- ▶ $1 \div 1 = 1$
- ▶ $1 \div 0 = \text{Meaningless}$
- ▶ $0 \div 1 = 0$
- ▶ $0 \div 0 = \text{Meaningless}$

EXAMPLE 1 :-

Question 1: Solve $01111100 \div 0010$

SOLUTION:

$$\begin{array}{r} 10 \) \ 1111100 \quad (111110 \\ \underline{(-) \ 10} \\ 11 \\ \underline{(-) \ 10} \\ 11 \\ \underline{(-) \ 10} \\ 11 \\ \underline{(-) \ 10} \\ 10 \\ \underline{(-) \ 10} \\ 00 \\ \underline{} \\ 00 \end{array}$$

EXAMPLE 2:-

Example 2: Solve using the long division method: $101101 \div 101$

Solution:

$$\begin{array}{r} 101 \overline{) 101101} \quad (1001 \\ (-) 101 \\ \hline 101 \\ (-) 101 \\ \hline 0 \end{array}$$