Lec._2
Binary Arithmetic Operations

Like we perform the arithmetic operations in numerals, in the same way, we can perform addition, subtraction, multiplication and division operations on Binary numbers. Let us learn them one by one.

Binary Addition

Adding two binary numbers will give us a binary number itself. It is the simplest method. Addition of two single-digit binary number is given in the table below.

Binary Numbers		Addition
0	0	0
0	1	1
1	0	1
1	1	0; Carry →1

Let us take an example of two binary numbers and add them.

For example: Add 1101_2 and 1001_2.
Solution:

$$
\begin{array}{r}
1101 \\
+1001 \\
\hline
10110 \\
\hline
\end{array}
$$

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Binary Subtraction

Subtracting two binary numbers will give us a binary number itself. It is also a straightforward method. Subtraction of two single-digit binary number is given in the table below.

Binary Numbers		Subtraction
0	0	0
0	1	1; Borrow 1
1	0	1
1	1	0

Let us take an **example** of two binary numbers and subtract them: Subtract 1101_2, and 1010_2.

Solution: $1101_2 - 1010_2 = 0011_2$

Binary Multiplication

The multiplication process is the same for the binary numbers as it is for numerals. Let us understand it with example.

Example: Multiply 1101_2 and 1010_2.

$$
\begin{array}{r}
1101 \\
\times\ 1010 \\
\hline
0000 \\
1101 \\
0000 \\
1101 \\
\hline
10000010 \\
\hline
\end{array}
$$

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Binary Division

The binary division is similar to the decimal number division method. We will learn with an example here.

Example: Divide 1010_2 by 10_2

$$
\begin{array}{r}
10)\overline{1010}(101 \\
\underline{10} \\
010 \\
\underline{10} \\
0
\end{array}
$$

Uses of Binary Number System

Binary numbers are commonly used in computer applications. All the coding and languages in computers such as C, C++, Java, etc. use binary digits 0 and 1 to write a program or encode any digital data. The computer understands only the coded language. Therefore these 2-digit number system is used to represent a set of data or information in discrete bits of information.

Problems and Solutions

Let us practice some of the problems for better understanding:

Question 1: What is binary number 1.1 in decimal?

Solution:

Step 1: 1 on the left-hand side is on the one's position, so it's 1.

Step 2: The one on the right-hand side is in halves, so it's

$1 \times \frac{1}{2}$

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Step 3: so, 1.1 = 1.5 in decimal.

Question 2: Write 10.11$_2$ in Decimal?

Solution:

10.11 = 1 x $(2)^1$ + 0 $(2)^0$ + 1 $(½)^1$ + 1$(½)^2$

= 2 + 0 + ½ + ½

= 2.75

So, 10.11 is 2.75 in Decimal.

Next >>> let us understand how the interconversions between these systems are done. نفهم دعونـا >>> القـادم كيف تتم التحويلات البينية بين هذه الأنظمة

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