جامعة كلكامش
الكلية التقنية الهندسية

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الكترونيك رقمي
Lecture 2

Arithmetic Operations

1-Addition

The following tables illustrate the rules of addition in Binary, Octal and hexadecimal.

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

Figure 1 Binary addition rules.

Example: Add $(0011010)_2$ to $(0001100)_2$?

Answer:

```
   1 1   <-- Carry
  0 0 1 1 0 1 0
+ 0 0 0 1 1 0 0
-----------------
  0 100 1 1 0
```

Example: Find the result of $(11010.1101)_2+(111101.111)_2$?

Answer:

```
  1 1 1 1 1 1 1          ←  Carry
    0 11010.1101
+
    111101.111 0
  ---------------------
  1 0 1 1 0 0 0 . 1 0 1 1
```

2- Subtraction

Binary Subtraction

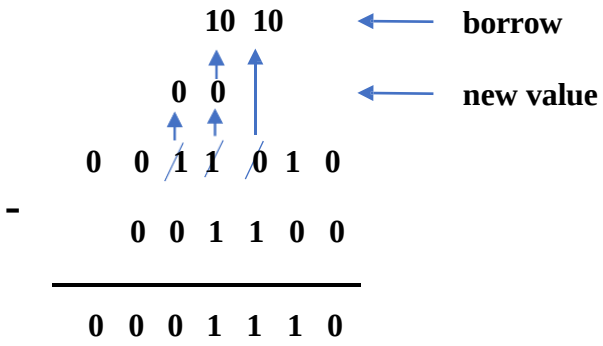
Subtraction and Borrow, these two words will be used very frequently for the binary subtraction. There are four rules of binary subtraction.

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

Figure2 Binary subtraction rules

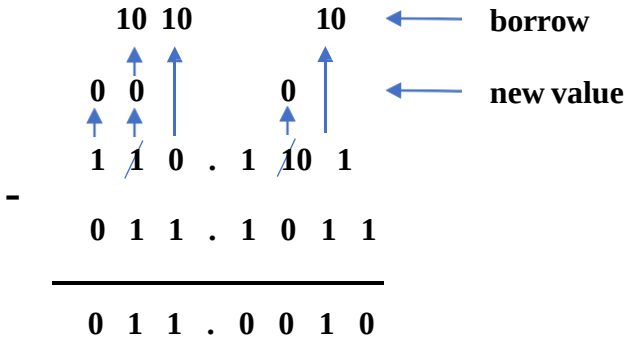
Example: Find the results of $(0011010)_2$-$(001100)_2$?

Answer:



Example: Find the results of $(110.1101)_2$-$(11.1011)_2$?

Answer:



3- Multiplication

In this section we will discuss the multiplication rules only in binary numbers.

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

Figure 3 Binary multiplication rules

Example: Find the results of $(10011)_2 \times (0101)_2$?

Answer:

$$
\begin{array}{r}
10011 \\
0101 \times \\
\hline
10011 \\
00000\ \ 0 \\
10011\ 0\ 0 \\
000000\ 0\ 0 \\
\hline
0101111\ 1
\end{array}
$$

Example: Find the results of $(100.111)_2 \times (010.11)_2$?

Answer:

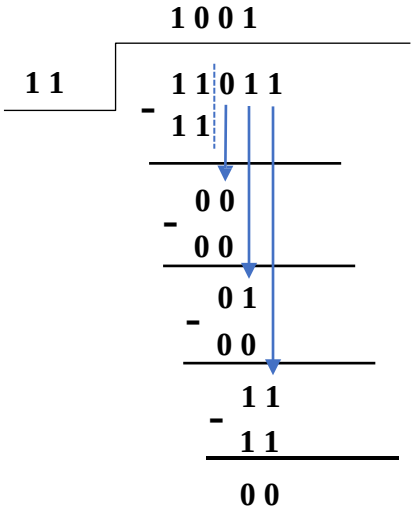
```
      1 0 0 . 1 1 1
      0 1 0 . 1 1
  -------------------
      1 0 01 1 1
    1 0 0 1 1 1 0
  0 0 0 0 0 0 0 0
1 0 0 1 1 1 0 0 0
0 0 0 0 0 0 0 0
-------------------
0 1 1 0 1. 0 1 1 0 1
```

4- Division

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

Example: Find the results of $(11011)_2 \div (11)_2$?

Answer:



Example: Find the results of $(101011.10)_2 \div (110)_2$?

Answer: