Binary Addition

- **Rules of Binary Addition**
  - 0 + 0 = 0
  - 0 + 1 = 1
  - 1 + 0 = 1
  - 1 + 1 = 0, and carry 1 to the next more significant bit

Example:

00011010 + 00001100 = ?????

	1 1	*carries*
	0 0 0 1 1 0 1 0	$= 26_{(base\ 10)}$
+	0 0 0 0 1 1 0 0	$= 12_{(base10)}$
	0 0 1 0 0 1 1 0	$= 38_{(base\ 10)}$

00010011 + 00111110 = ?????

	1 1 1 1 1	*carries*
	0 0 0 1 0 0 1 1	$= 19_{(base\ 10)}$
+	0 0 1 1 1 1 1 0	$= 62_{(base10)}$
	0 1 0 1 0 0 0 1	$= 81_{(base\ 10)}$

Binary Subtraction

- **Rules of Binary Subtraction**
  - 0 - 0 = 0
  - 0 - 1 = 1, and borrow 1 from the next more significant bit
  - 1 - 0 = 1
  - 1 - 1 = 0

Example

00100101 - 00010001 = ?????

0 *borrows*

0 0 1 ^{1}0 0 1 0 1 = $37_{(\text{base }10)}$

\- 0 0 0 1 0 0 0 1 = $17_{(\text{base}10)}$

0 0 0 1 0 1 0 0 = $20_{(\text{base }10)}$

00110011 - 00010110 = ?????

0 ^{1}0 1 *borrows*

0 0 1 1 0 ^{1}0 1 1 = $51_{(\text{base }10)}$

\- 0 0 0 1 0 1 1 0 = $22_{(\text{base}10)}$

0 0 0 1 1 1 0 1 = $29_{(\text{base }10)}$

Binary Multiplication

- **Rules of Binary Multiplication**
  - 0 x 0 = 0
  - 0 x 1 = 0
  - 1 x 0 = 0
  - 1 x 1 = 1, and no carry or borrow bits

Example

$$00101001 \times 00000110 = \ ????$$

$$
\begin{array}{rcl}
0\ 0\ 1\ 0\ 1\ 0\ 0\ 1 & = & 41_{(\text{base } 10)} \\
\times\, 0\ 0\ 0\ 0\ 0\ 1\ 1\ 0 & = & 6_{(\text{base } 10)} \\
\hline
0\ 0\ 0\ 0\ 0\ 0\ 0\ 0 & & \\
0\ 0\ 1\ 0\ 1\ 0\ 0\ 1 & & \\
0\ 0\ 1\ 0\ 1\ 0\ 0\ 1 & & \\
\hline
0\ 0\ 1\ 1\ 1\ 1\ 0\ 1\ 1\ 0 & = & 246_{(\text{base } 10)} \\
\hline
\end{array}
$$