# Multiplying Large Integers Problems

- The positional numeral system is not convenient for performing multiplication of large integers.

The generalize formula is :-

$$c = a * b$$
$$c = c_2 10^n + c_1 10^{n/2} + c_0$$

where n is the no. of digits in the integer

$$c_2 = a_1 * b_1$$
$$c_0 = a_0 * b_0$$
$$c_1 = (a_1 + a_0) * (b_1 + b_0) - (c_2 + c_0)$$

The two digit no. are

$$a = a_1 a_0$$
$$b = b_1 b_0$$

## Example

Input no. 12 and 20

$\therefore a = 12$
$b = 20$

where $a_1 = 1$, $a_0 = 2$
$b_1 = 2$, $b_0 = 0$

Now, find $c_1, c_2, c_0$

→ $C_2 = a_1 * b_1$

$= 1 * 2$

$= 2$

$\boxed{C_2 = 2}$

→ $C_0 = a_0 * b_0$

$= 2 * 0$

$= 0$

$\boxed{C_0 = 0}$

→ $C_1 = (a_1 + a_0) * (b_1 + b_0) - (C_2 + C_0)$

$= (1+2) * (2+0) - (2+0)$

$= 3 * 2 - 2$

$= 4$

$\boxed{C_1 = 4}$

→ $a * b = C_2 10^2 + C_1 10^1 + C_0$

$= 2 \times 10^2 + 4 \times 10^1 + 0$

$= 200 + 40 + 0$

$\boxed{a * b = 240}$