# Multiplication of Two Complex Numbers - Nested Loop

## Algorithm

### Integer Multiplication

These are steps for multiplying two integer numbers:

* First ignore the sign of numbers
* Find the minimum and the maximum number and save them as ‘n’ and ‘m’
* Add ‘m’ to itself ‘n’ times and save the result
* If just one of the original numbers is negative, negate the result

### Complex Multiplication

These are steps for multiplying two complex numbers:

* Multiplication of two complex numbers is a complex number
* Use the integer multiplication algorithm
  + For calculating the real part
    - Multiply the real of the first number by the real of the second number
    - Multiply the imaginary of the first number by the imaginary of the second number
    - Subtract the two results
  + For calculating the imagination part
    - Multiply the real of the first number by the imaginary of the second number
    - Multiply the imaginary of the first number by the real of the second number
    - Add the two results

## Analysis

### Integer Multiplication

|  |  |
| --- | --- |
| Step | Time Complexity |
| a = <the first integer number>;  b = <the second integer number>;  n = unsigned minimum of (a, b);  m = unsigned maximum of (a, b);  s = 0; // the result | 1 |
| for (0 to n) {  s += m;  } | min(n, m) |
| if (a is negative) or (b is negative) {  return -s;  } else {  return s;  } | 1 |
| END | O(min(a, b)) |

### Complex Multiplication

|  |  |
| --- | --- |
| Step | Time Complexity |
| a = <the first complex number>;  b = <the second complex number>; | 1 |
| result.real = integer\_multiply(a.real, b.real) – integer\_multiply(a.imag, b.imag); | 2 \* min(a, b) |
| result.imag = integer\_multiply(a.real, b.imag) + integer\_multiply(a.imag, b.real); | 2 \* min(a, b) |
| END | O(4 \* min(a, b)) |