Lab 6

**Brief Introduction:**

In this lab you will create a class for complex numbers, which will perform basic arithmetic operations with complex numbers.

Complex numbers have the form: $X+Yi$, where $X$ and $Y$ are real numbers and $i$ is the imaginary unit. The imaginary unit, $i$, has the property $i^2 = -1$. The real number $X$ is called the real part of the complex number, and the real number $Y$ is called the imaginary part. Any real number, $A$, can be written as a complex number having the form: $A+0i$. For example, the number 15.5 is $15.5+0i$ as a complex number. These numbers are very important in the fields of mathematics, electrical engineering, and others.

You are to implement the basic arithmetic operations of addition, subtraction, multiplication, and division. The output of these operations must be in the form of a complex number. The operations are performed as illustrated below:

**Addition:**

$$(a + bi) + (c + di) = (a + c) + (b + d)i$$

For example:

$$(2 + 3i) + (1 + 4i) = (1 + 2) + (3 + 4)i = 3 + 7i$$

**Subtraction:**

$$(a + bi) - (c + di) = (a - c) + (b - d)i$$

For example:

$$(2 + 3i) - (1 + 4i) = (2 - 1) + (3 - 4)i = 1 - i$$

**Multiplication:**

$$(a + bi) * (c + di) =$$

$$(a * c) + (b * c)i + (a * d)i + (b * d * i^2) =$$

$$(a * c - b * d) + (b * c + a * d)i$$

For example:

$$(2 + 3i) - (1 + 4i) =$$

$$(2 * 1) + (3 * 1)i + (2 * 4)i + (3 * 4 * i^2) =$$

$$2 + 3i + 8i - 12 =$$

$$-10 + 11i$$

**Division:**

$$\frac{a + bi}{c + di} = \left(\frac{a * c + b * d}{c^2 + d^2}\right) + \left(\frac{b * c - a * d}{c^2 + d^2}\right)i$$

For example:

$$\frac{(2 + 3i)}{(1 + 4i)} = \left(\frac{2 * 1 + 3 * 4}{1^2 + 4^2}\right) + \left(\frac{3 * 1 - 2 * 4}{1^2 + 4^2}\right)i = \left(\frac{2 + 12}{1 + 16}\right) + \left(\frac{3 - 8}{1 + 16}\right)i = \frac{14}{17} - \frac{5}{17}i$$
Problem statement:
Create the ComplexNumber class. It has two instance data members, real and imaginary, of type float. It supports several instance behaviors as described below:

getReal()
This method returns the real value of the complex number.

getImag()
This method returns the imaginary value of the complex number.

setReal(int realPart)
This method sets the real value of the complex number.

setImag(int imagPart)
This method sets the imaginary value of the complex number.

addComplex(ComplexNumber cn)
This method adds the current complex number (the one receiving this message) object with cn and returns the resulting ComplexNumber object.

subComplex(ComplexNumber cn)
This method subtracts cn from the current complex number and returns the resulting ComplexNumber object.

multComplex(ComplexNumber cn)
This method multiplies the current complex number object with cn and returns the resulting ComplexNumber object.

divComplex(ComplexNumber cn)
This method divides the current complex number object with cn and returns the resulting ComplexNumber object.

magComplex()
This method computes the magnitude of the current complex number object and returns the resulting float value. For the complex number X+Yi the magnitude is $\sqrt{X^2 + Y^2}$.

toString()
This method overrides the default toString() method and returns the String representation of the complex number object in the X+Yi format.

Deliverables:
Develop the appropriate documentation, test cases, UML, and code for this problem.