

King Fahd University of Petroleum and Minerals  
College of Computer Science and Engineering  
Information and Computer Science Department  
**Spring Semester (062)**  
**ICS 102 - Introduction to Computing I**  
**Homework # 03**

**Solve the following Problems**

**Q1.** Define a class for complex numbers. A complex number is a number of the form

$$a + b*i$$

where, for our purposes,  $a$  and  $b$  are numbers of type double, and  $i$  is a number that represents the quantity  $\sqrt{-1}$ . Represent a complex number as two values of type double. Name the instance variables real and imaginary. (The instance variable for the number that is multiplied by  $i$  is the one called imaginary.) Call the class **Complex**. Include a constructor with two parameters of type double that can be used to set the instance variables of an object to any values. Also include a constructor that has only a single parameter of type double; call this parameter `realPart` and define the constructor so that the object will be initialized to `realPart + 0*i`. Also include a no-argument constructor that initializes an object to 0 (that is, to `0 + 0*i`). Define accessor and mutator methods as well as the methods **equals** and **toString**. Define static methods for addition, subtraction, and multiplication of objects of your class `Complex`. These methods should be static and should each have two parameters of type `Complex` and return a value of type `Complex`. For example, `Complex.add(c1, c2)` will return the result of adding the two complex numbers (two objects of the class `Complex`) `c1` and `c2`. Also write a test program to test your class.

*Hints:* To add or subtract two complex numbers, you add or subtract the two instance variables of type double. The product of two complex numbers is given by the following formula:

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

Part Two: Add a second version of the methods for addition, subtraction, and multiplication. These methods should have the same names as the static version but should use a calling object and a single argument. For example, this version of the add method (for addition) has a calling object and one argument. So `c1.add(c2)` returns the result of adding the complex numbers `c1` and `c2`. Note that your class should have all these methods; for example, there should be two methods named `add`.

**Notes:**

- Due date is **Wednesday May 9, 2007** by **11:00 PM**
- *Late work* is **not accepted**.
- *Copying* will result in a grade of **F** in the course.