**KIE1008: Programming 2**
**Week 4: Object-Oriented Programming – Operator Overloading**

1. Find the error(s) in the following class definition.

```
1    class myClass
2    {
3    public:
4       myClass operator+(const int& obj);
5       myClass(int = 0, int = 0);
6    private
7       int a;
8       int b;
9    };
```

2. Consider class `Complex` shown below. The class enables operations on so-called complex numbers. These are numbers of the form `realPart + imaginaryPart* i`, where `i` has the value $\sqrt{-1}$.

```
class Complex
 {
public:
   Complex(double = 0.0, double = 0.0); // constructor
   Complex operator+(const Complex &) const; // addition
   Complex operator*(const Complex &) const; // multiplication
   bool operator== (const Complex &) const; //comparison
private:
   double real; // real part
   double imaginary; // imaginary part
};

Complex::Complex(double x, double y)
: real(x),imaginary(y) { }
```

   a) Modify the class to enable input and output of complex numbers via overloaded >> and << operators, respectively. The input and output of a complex number should be in the form (`realPart, imaginaryPart`).
   b) Overload the operators `+` and `*` to perform addition and multiplication of two complex numbers as in algebra.
   c) Overload the == operators to allow comparisons of complex numbers.
   d) Write a test program that tests various operations on the class `Complex`. Format your answer with two decimal places.

3. A rational number (fraction) is any number that can be expressed in the form a/b, in which a and b are integers and b≠0.
   a) Create a class `Rational` with a constructor that prevents a 0 denominator in a fraction.
   b) The subtraction and division operations on fractions are defined by the following rules:

$$\frac{a}{b} - \frac{c}{d} = \frac{ad-bc}{bd}; \qquad \frac{a/b}{c/d} = \frac{ad}{bc}$$

Overload the subtraction and division operators for this class.

c) Overload the stream insertion and stream extraction operators for easy input and output. The input and output of a rational number should be in the form `a/b`.
d) Overload the addition assignment operator (+=) where a certain value will be added to the rational number. For example, `2/3 += 3` → `11/3`
e) Write a test program that tests various operations on the class `Rational`.

4. A matrix is a set of numbers arranged in rows and columns. Two matrices can be added and subtracted if they have the same size. Suppose $A = [a_{ij}]$ and $B = [b_{ij}]$ are two matrices of the size $m \times n$, in which $a_{ij}$ denotes the element of *A* in the *i*th row and the *j*th column, and so on.
   a) Design and implement a class `matrixType` that can store a matrix of any size.
   b) Overload the operator + to perform the matrix addition operation. Note that two matrices can be added if they have the same size.
   $$A + B = [a_{ij} + b_{ij}]$$
   c) The multiplication of *A* and *B* (*A* ***** *B*) is defined only if the number of columns of *A* is the same as the number of rows of *B*.
   $$A * B = a_{i1}b_{1k} + a_{i2}b_{2k} + \cdots + a_{in}b_{nk}$$
   Overload the operator * to perform the matrix multiplication operation.
   d) Write a test program to test various operations on the matrices.