Classes and Objects II – Examples

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Ex. 2.1

Write the definition of a class named `Fraction` representing a fraction $\frac{a}{b}$. Your class should have two fields of type `int` representing the numerator and denominator of the fraction and implementations of appropriate constructors and methods so that it is possible to perform the following operations:

```
Fraction obj,obj2;
obj=new Fraction(6,8);
obj2=new Fraction(3,7);

System.out.println(obj);

double x=obj.decimalValue();

Fraction obj3=obj.plus(obj2);
Fraction obj4=obj.minus(obj2);
Fraction obj5=obj.times(obj2);

obj.inverse();
obj.reduce();
```

In the `decimalValue()` method, before dividing two `int` numbers, cast one of them to type `double`, as in the example below:

```
int i=7;
double x=(double)i;
```

Write an appropriate program and test the constructors and methods you have written.

Ex. 2.2

Write the definition of the `ComplexNumber` class. Implement methods performing operations on complex numbers.

Ex. 2.3

Write the definition of the `Vector` class whose objects will represent vectors in three-dimensional space. Implement methods performing vector addition, cross product, dot product and other operations on vectors.

Ex. 2.4

Write the definition of the `QuadraticPolynomial` class. Implement methods for adding polynomials, multiplying polynomials and finding the roots of the polynomial.

Ex. 2.5

Write the definition of the `BigNumber` class. Implement a method for testing whether the number is divisible by the number passed to this method as a parameter and a method testing whether the number is a prime number.

Ex. 2.6

Write the definition of the `Matrix` class whose objects will represent 3×3 matrices. Implement a method returning the determinant of the matrix, a method performing matrix transposition, a method performing matrix diagonalisation, a method returning the inverse matrix and other operations on matrices.

Note: Diagonalisation and inverse matrix are optional. Instead, you can propose other operations on matrices. If someone would (still) like to tackle the method returning the inverse matrix, it can be done, for example, using the Gauss–Jordan method – a hint can be found here:

`https://dendzik.pl/doku.php?id=mnum:mnum6`