2021 OOPI

0519 Practice

Notices :

1. Please notice the deadline !!!

2. If you late for the deadline, you still need to hand in this homework, or you will get an F at the end of this semester !!!

The deadline of this homework：

Deadline : **2021/05/25 (Tue) 23:59:00**

Please upload 2 files (the example for filename : A1073316_ Rational.java) to certain place of Google Classroom. (the details of files you need to hand in is on page 4)

If you don’t hand in your homework on time, you will get -1 for your total grade per day until you complete the work and hand it in.

Before you hand in your homework, please check your filename and the content of file is correct or not. If there is any problem about files, you will get zero for this homework.

Question for this Homework：

For this homework, please follow the content below, and complete the "Rational.java".

Define a class for rantional numbers. A rational number is a number that can be represented as the quotient of two integers. For example, 1/2, 3/4, 64/2, and so forth are all rational numbers. (By 1/2 and so forth, we mean the everyday meaning of the fraction, not the integer division this expression would produce in a Java program.) Represent rational numbers as two values of type int, one for the numerator and one for the denominator. Your class should have two instance variables of type int. Call the class Rational. Include a constructor with two arguments 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 int; call this single parameter wholeNumber and define the constructor so that the object will be initialized to the rational number wholeNumber/1. Also include a no-argument constructor that initializes an object to 0 (that is, to 0/1). Note that the numerator, the denominator, or both may contain a minus sign. Define the methods for addition, subtraction, multiplication, and division of objects of your class Rational. These methods should be static methods that each have two parameters of type Rational and return a value of type Rational. For example, Rational.add(r1, r2) will return the result of adding the two rational numbers (two objects of the class Rational, r1 and r2). Define accessor and mutator methods as well as the methods equals and toString. You should include a method to normalize the sign of the rational number so that the denominator is positive and the numerator is either positive or negative. For example, after normalization, 4/-8 would be represented the same as -4/8. Add a second version of the methods for addition, subtraction, multiplication, and division. 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 r1.add(r2) returns the result of adding the rationals r1 and r2. Note that your class should have all these methods; for example, there should be two methods named add.

Hints: Two rational numbers a/b and c/d are equal if a*d equals c*b.

1. Content of Homework

Please complete Rational.java according to the above content.

Hint : there are some parts you need to do.

a. private variables of class (numerator、denominator)

b. getNumerator()、setNumerator()、getDenominator()、setDenominator()

c. three constructors (according to the question)

d. toString()、equals()、normalize()

e. static methods for add、subtract、multiply、divide (return Rational object)

f. general methods for add、subtract、multiply、divide (return Rational object)

When you finish the requests above, you can compile “RationalDemo.java” and execute it by “java RationalDemo” command.

```
Number is: 0/1
Number is: 5/1
Number is: 1/4
Rational1's numerator is: 0
Rational1's denominator is: 1
Changing rational1's numerator.
Rational1 is : 3/1
Chaning rational1's denominator.
Rational1 is: 3/4
rational1 is equal to rational2: false
Rational is equal to a copy of rational2: true
A non-normalized number (10, -25), should normalize before printing: -10/25
Adding 1/4 and 3/4: 4/4
Adding 3/4 and 5/1: 23/4
Subtracting 3/4 - 1/4: 2/4
Subtracting 5/1 - 3/4: 17/4
Multiplying 1/4 * 3/4: 3/16
Dividing 5/1 by 1/2: 10/1
Adding 3/4 and 1/4: 4/4
Adding 5/1 and 3/4: 23/4
Subtracting 1/4 - 3/4: -2/4
Subtracting 3/4 - 5/1: -17/4
Multiplying 3/4 * 1/4: 3/16
Dividing 5/1 by 1/3: 15/1
```

picture 1 The example of output

2. Files you need to hand in

There are two files you need to hand in：

- **StudentID(Upper)_ RationalDemo.java**
- **StudentID(Upper)_ Rational.java**

Any plagiarism is not allowed, if you against this rule, it will affect your grade.

If you have any question, please consult the assistants or the teacher for help.

Please be mature and gentle in the emails.