

BİL 113/012 Computer Programming I

HOMEWORK 5 (30 Points)

Nov 22, 2020

1 20 POINTS] FRACTIONAL NUMBERS

In this task, you are going to write a Java class named ***FractionalNumber*** which will support various operations on fractional numbers such as addition, subtraction, etc.

Fractional numbers consists of an integer *numerator* and *denominator*. So your class should have them as instance variables. You can find the methods that you need to implement below.

- *FractionalNumber* class should have two constructors. One of them should take a String as a parameter. The other one should take two integers (numerator and denominator) as a parameter.
- `public double getDoubleValue()`: This method should return the double value of the fractional number, e.g., if the fractional number is 4/5, then this method should return 0.8.
- `public String toString()`: This method should return string representation of the FractionalNumber which is formatted as " *numerator/denominator*". For example if the *numerator* is 4 and *denominator* is 5, then method should return "4/5".
- `public boolean equals(FractionalNumber)`: This method should return true if the FractionalNumber given in the parameter is equivalent to this one.

- `public static FractionalNumber simplify(FractionalNumber fn)`: This method should return the simplified version of the given `FractionalNumber`. For example, if the fractional number is $4/8$, then this method should return `FractionalNumber 1/2`. If the `FractionalNumber` is negative, then the $-$ sign should always be located before the numerator. For example, if the given `FractionalNumber` is $2/-4$, then this method should return the `FractionalNumber -1/2`. Hint: You need to find the greatest common divisor of numerator and denominator to implement this method. This method should be used inside the four methods below, so make sure that you write this method correctly, otherwise, you may a low score.
- `public static FractionalNumber add(FractionalNumber fn1, FractionalNumber fn2)`: This method should return the simplified version of the summation of the two given `FractionalNumbers`. For example, if the first fractional number is $4/8$ and the second fractional number is $2/8$ then this method should return the `FractionalNumber 3/4`.
- `public static FractionalNumber subtract(FractionalNumber fn1, FractionalNumber fn2)`: This method should return the simplified version of the difference between the two given `FractionalNumbers`. For example, if the first fractional number is $4/8$ and the second fractional number is $2/8$ then this method should return the `FractionalNumber 1/4`.
- `public static FractionalNumber multiply(FractionalNumber fn1, FractionalNumber fn2)`: This method should return the simplified version of the product of the two given `FractionalNumbers`. For example, if the first fractional number is $4/8$ and the second fractional number is $2/8$ then this method should return the `FractionalNumber 1/8`.
- `public static FractionalNumber divide(FractionalNumber fn1, FractionalNumber fn2)`: This method should return the simplified version of the division of the two given `FractionalNumbers`. If the second fractional number equals to 0 then this method should return null. For example, if the first fractional number is $4/8$ and the second fractional number is $2/8$ then this method should return the `FractionalNumber 2/1`. But if the first fractional number is $4/8$ and the second fractional number is $0/8$ then this method should return null.

We shared a demo class named ***FractionalNumberDemo***. Put this file to Q1 folder with your ***FractionalNumber***. You can use this class to check your implementation is correct. If you could not implement some methods before submitting your homework, write methods with same signature and make them return the default value of the return type. For example if you could not implement the subtract method, then write

```
public static FractionalNumber subtract(FractionalNumber fn1, FractionalNumber fn2){
    return null;
}
```

Otherwise, your code will not compile. Example outputs are given below. Green texts represent input.

EXAMPLE 1

Please enter the first fractional number in string representation

3/6

Please enter the second fractional number in string representation

7/9

Please enter the third fractional number in numerator and denominator form

2 4

First fractional number is 3/6 and its double value is 0.5

Second fractional number is 7/9 and its double value is 0.7777777777777778

Third fractional number is 2/4 and its double value is 0.5

First fractional number is 3/6 and its simplified version is 1/2

Second fractional number is 7/9 and simplified version is 7/9

Third fractional number is 2/4 and simplified version is 1/2

First and second fractional numbers are not equal

First and third fractional numbers are equal

Second and third fractional numbers are not equal

$$3/6 + 7/9 = 23/18$$

$$3/6 + 2/4 = 1/1$$

$$7/9 + 2/4 = 23/18$$

$$3/6 - 7/9 = -5/18$$

$$3/6 - 2/4 = 0/1$$

$$7/9 - 2/4 = 5/18$$

$$3/6 * 7/9 = 7/18$$

$$3/6 * 2/4 = 1/4$$

$$2/4 * 7/9 = 7/18$$

$$3/6 / 7/9 = 9/14$$

$$3/6 / 2/4 = 1/1$$

$$2/4 / 7/9 = 9/14$$

EXAMPLE 2

Please enter the first fractional number in string representation

2/4

Please enter the second fractional number in string representation

0/9

Please enter the third fractional number in numerator and denominator form

3 -6

First fractional number is 2/4 and its double value is 0.5

Second fractional number is 0/9 and its double value is 0.0

Third fractional number is 3/-6 and its double value is -0.5

First fractional number is 2/4 and its simplified version is 1/2

Second fractional number is 0/9 and simplified version is 0/1

Third fractional number is 3/-6 and simplified version is -1/2

First and second fractional numbers are not equal

First and third fractional numbers are not equal

Second and third fractional numbers are not equal

$$2/4 + 0/9 = 1/2$$

$$2/4 + 3/-6 = 0/1$$

$$0/9 + 3/-6 = -1/2$$

$$2/4 - 0/9 = 1/2$$

$$2/4 - 3/-6 = 1/1$$

$$0/9 - 3/-6 = 1/2$$

$$2/4 * 0/9 = 0/1$$

$$2/4 * 3/-6 = -1/4$$

$$3/-6 * 0/9 = 0/1$$

$$2/4 / 0/9 = \text{null}$$

$$2/4 / 3/-6 = -1/1$$

$$3/-6 / 0/9 = \text{null}$$

2 [10 POINTS] FRACTIONAL NUMBER CALCULATOR

In this task you are going to write a Java program named ***FractionalNumberCalculator*** which can be used to calculate the result of a mathematical expressions consisting of four basic operations and fractional numbers. You should use the ***FractionalNumber*** class you wrote in the first question. You must consider the precedence of the operations. Expressions start with a fractional number then followed by a number of operator fractional number pair. So there is no bound on the number of fractional numbers. There is a single space between a fractional number and a operator, e.g., $4/3 / 5/3$. Result must be simplified. You can check the examples below.

EXAMPLE 1

Please enter the formula you want to calculate: $1/2 * 2/1 + 5/4 - 4/3 / 4/1$

Result: $23/12$

EXAMPLE 2

Please enter the formula you want to calculate: $1/3 + 2/3 + 7/9 * 9/7 + -1/5 * 15/3$

Result: $1/1$

EXAMPLE 3

Please enter the formula you want to calculate: $1/3 + 2/3 + 7/9 * 9/7 + -1/5 * 15/3 * 0/13$

Result: $2/1$

EXAMPLE 4

Please enter the formula you want to calculate: $1/3 + 2/3 + 7/9 * 9/7 + -1/5 * 15/3 / 0/13$

Result: null