

Course Number	CSci 120
Descriptive Title	Object-oriented Programming
Programming Language	Java

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Problem Number	6
Activity Title	Rational Class

**Procedure Proper:**

1. Define a class for rational 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 on we mean the everyday 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. Call the class **Rational**.
2. Include a constructor with two arguments that can be used to set the member variables of an object to any legitimate 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`.
3. Include a default constructor that initializes an object to 0 (that is, to  $0/1$ ).
4. Create getters and setters for the numerator and denominator property of class **Rational**.
5. Numbers are in the form  $1/2$ ,  $15/32$ ,  $300/401$ , and so forth. Note that the numerator, the denominator, or both may contain a minus sign, so  $-1/2$ ,  $15/-32$ , and  $-300/-401$  are also possible values.
6. Create methods that accepts another Rational object such as: *isLessThan*(`<`), *isLessThanOrEqualTo*(`<=`), *isGreaterThan*(`>`), *isGreaterThanOrEqualTo*(`>=`), *add*(`+`), *subtract*(`-`), *multiply*(`*`), and *divide*(`/`). Write a test program to test your class. *Hints*: Two rational numbers  $a/b$  and  $c/d$  are equal if  $a*d$  equals  $c*b$ . If  $b$  and  $d$  are *positive* rational numbers,  $a/b$  is less than  $c/d$  provided  $a*d$  is less than  $c*b$ .
7. Override also the *equals* (`==`) method of superclass `Object` for comparison whether the parameter and the current object are of the same value.
8. You should include a function to normalize the values stored so that, after normalization, the denominator is positive and the numerator and denominator are as small as possible. For example, after normalization  $4/-8$  would be represented the same as  $-1/2$ .
9. Test the functionality and accuracy of your class by creating **Rational** objects and perform its functions accordingly.