OBJECT-ORIENTED PROGRAMMING
HOMEWORK #2
SPRING 2023

DUE: Thursday, February 23

(1) The following question uses the **Rational** class. Write the following functions (you must decide if they are member functions or global functions).

(a) You are to write a function to calculate $x^{p/q}$ where x is a real number and p/q is a Rational. Your function may use the standard library function pow(), but it must work correctly in the following cases:
(i) If x > 0 then function should give the same result as pow().

(ii) If x is 0 then your function should return a result of 0 if p > 0, else if p is 0 you should throw a "indeterminate number" error, else throw a "divide by zero" error.

(iii) If x < 0 then your function should give the correct result if q is odd, else throw an "imaginary number" error.
Your function can only have two parameters, the base (of type double) and the power (of type Rational). You must determine what the function returns.
(b) Write a function to calculate $(p/q)^n$ where p/q is a Rational and n is an integer. The function should return a Rational. There is an error condition. If p is 0 then you should throw an error if n <= 0.
(c) Overload the floor, ceil, and round functions so that they take an argument of type Rational.
(d) Write a function to_s that converts a Rational to a string.

Write a main program that tests these functions. You must include the code for the main program and corresponding test output.

(2) For each of the following pairs of classes state the appropriate relationship: generalization, association, aggregation, or composition. In each case explain your answer.

(Circle,Point); (Earth, Planet); (Computer, Workstation); (Rectangle, Square); (Person, Shoes); (ATM, Bank Card); (Car, Tire); (File, Directory); (Rectangle, Square); (College, Students); (Professor, Students); (Sports Team, Fans); (Computer Science Department, Computer Science Professor); (Cocktail, Martini); (Person, Heart), (Programming Language, Object-Oriented Programming Language), (Shark, Teeth), (Function, Derivative), (Watch, Time).

(3) Write a version of the Rational class in Python. Here are the requirements.
(a) You should have num and denom data members.
(b) You should have a constructor that takes two arguments. Also, the constructor should check for divide by zero errors.
(c)You should have the simplify() member function.
(d) You should write getters for the numerator and denominator.
(e) You should overload the following operators: +, -, *, /, <
(f) You should have a print member function
(g) Write code that tests your class.