

American University of Armenia, CSE
CS120 Intro to OOP A, B, C
Spring 2022

Homework Assignment 11

Due Date: Friday, May 13 by 23:59 electronically on moodle

1. (20 points) Check out the class `java.lang.Number`. Your task is to define a generic class `Numeric` with a type parameter `T` with an upper bound `java.lang.Number`. The class should encapsulate a single instance variable of type `T` and support the following:

- a constructor with a single argument for the instance variable,
- an accessor and a mutator,
- a method `isPositive` that checks if the instance variable is positive,
- a method `isNegative` that checks if the instance variable is negative,
- a method `opposite` that generates and returns the number opposite to the instance variable as a `double`.

Note that you can use the `doubleValue` method to make different operators applicable on the encapsulated value.

Do you need to worry about privacy leaks? Briefly explain your answer.

Write a program that creates `Numeric` instantiations with each of the six number wrapper classes (`Integer`, `Float`, etc.) using *random* values. For each of the six `Numeric` objects, the program should check if the value is positive. If it is, then print the value. If it is not, then print its opposite value.

2. (10 points) Write a C++ program that reads the number of sides of a polygon, followed by the coordinates of its vertices, and prints the perimeter of the polygon.

sample input	sample output
3 0 0 3.0 0.0 0.0 4	12.0

3. (20 points) Develop C++ class `Polynomial`. The internal representation of a `Polynomial` is an array of real coefficients. Note that you may need additional data depending on how you implement the array. The class should contain:

- a constructor that receives an array with coefficients,
- a destructor,
- an accessor to get a single coefficient,
- a mutator to change a single coefficient,
- an `evaluate(double x)` method that calculates the value of the polynomial for the given `x`,
- overloaded addition operator `(+)` to add two `Polynomials`,
- overloaded subtraction operator `(-)` to subtract two `Polynomials`,
- overloaded assignment operator to assign one `Polynomial` to another,

- overloaded multiplication operator ($*$) to multiply two `Polynomials`,
- overloaded addition assignment operator ($+=$), subtraction assignment operator ($-=$), and multiplication assignment operator ($*=$).

Use the class `Polynomial` in a C++ program to add two sample polynomials and evaluate the resulting polynomial for $x=22$.