

CS102 – Algorithms and Programming II
Programming Assignment 1
Spring 2024

ATTENTION:

- Compress all Java program source files (.java) files into a single zip file.
- The name of the zip file should follow the below convention:
CS102_SecX_Asgn1_YourSurname_YourName.zip
- Replace the variables “SecX”, “YourSurname” and “YourName” with your actual section, surname, and name.
- You may ask questions on Moodle and during your section’s lab.
- Upload the above zip file to Moodle by the deadline (if not, significant points will be taken off). You will have a chance to update and improve your solution by consulting with the TAs and tutors during your section’s lab.

GRADING WARNING:

- Please read the grading criteria provided on Moodle. The work must be done individually. Code sharing is strictly forbidden. We are using sophisticated tools to check the code similarities. The Honor Code specifies what you can and cannot do. Breaking the rules will result in disciplinary action.

Polynomial Calculation

Q1 [100 p.] In this lab, you are going to implement a **Polynomial** class that represents polynomials of the form $P(x) = c_0 + c_1x + c_2x^2 + \dots + c_nx^n$

The class should support the following:

1. Polynomial class should contain its coefficients in an array. (Use double type for coefficients).
2. Include a constructor that takes an integer, d, and a double, c, to construct polynomials of the form $P(x) = cx^d$. Include a default constructor that takes no argument and constructs a zero polynomial ($P(x) = 0$).
3. Include another constructor that takes an array of coefficients and produces a polynomial with these coefficients.
4. Add a getter method for the coefficient, which takes the degree and returns the coefficient of the term with that degree.
5. Include **getDegree()** method that returns the polynomial degree. The degree of a polynomial is the degree of the highest non-zero term in a polynomial. For example, the degree of polynomial $P(x) = 3 + 5x + 12x^2$ is 2. You can assume that the degree of zero polynomial is 0.
6. Add **toString()** method that returns the String representation of the polynomial. Zero terms in polynomials should not be included in the string. For instance, for polynomial $P(x) = 3 - 5x^2 + 2x^3$, toString method should return “3.0 - 5.0x^2 + 2.0x^3”.
7. Add **eval(double x)** method that evaluates the polynomial at x and returns the result.
 - a. Use Math.pow(double a, double b) method to evaluate each term individually and the polynomial as a sum of the terms.
 - b. Implement another method, **eval2(double x)**, that evaluates the polynomial using Horner’s method. Horner’s method is an efficient way of evaluating

polynomials at a given point. A polynomial $P(x) = c_0 + c_1x + c_2x^2 + \dots + c_nx^n$ can be evaluated at x_0 by rearranging computation as $P(x_0) = ((\dots((c_n)x_0 + c_{n-1})x_0 \dots + c_4)x_0 + c_3)x_0 + c_1)x_0 + c_0$ and computing the result from innermost paranthesis to outwards.

8. Implement a class called **PolynomialTester** to test your Polynomial class.

Preliminary Submission: You will submit an early version of your solution before the final submission. This version should at least include the following:

- The functionality of the list items in the range [1, 6] should be completed. Do not forget also to test your implementation.

You will have time to complete your solution after you submit your preliminary solution. You can consult the TAs and tutors during the lab. Do not forget to make your final submission at the end.

Even if you finish the assignment in the preliminary submission, you should submit for the final submission on Moodle.

Not completing the preliminary submission on time results in 50% reduction of this assignment's final grade.