Assignment 2 Integral Computation

Due: June 13th, 2022 (6 am) **SWE 510**

Write a Java program to compute integral of a maximum 3rd degree polynomial function of the form f(x) = ax^3 + bx^2 + cx + d using the left-hand Riemann sum method. Details of the Reimann sum method can be found on https://www.storyofmathematics.com/riemann-sum/

Method basically forms rectangles of width deltaX and the integral value is approximated by the area sum of these rectangles as shown in Figure 1. Note that the integral can also be negative depending on the function. Your program should get the function coefficients a, b, c, d and the deltaX from the user and output the approximated integral value.

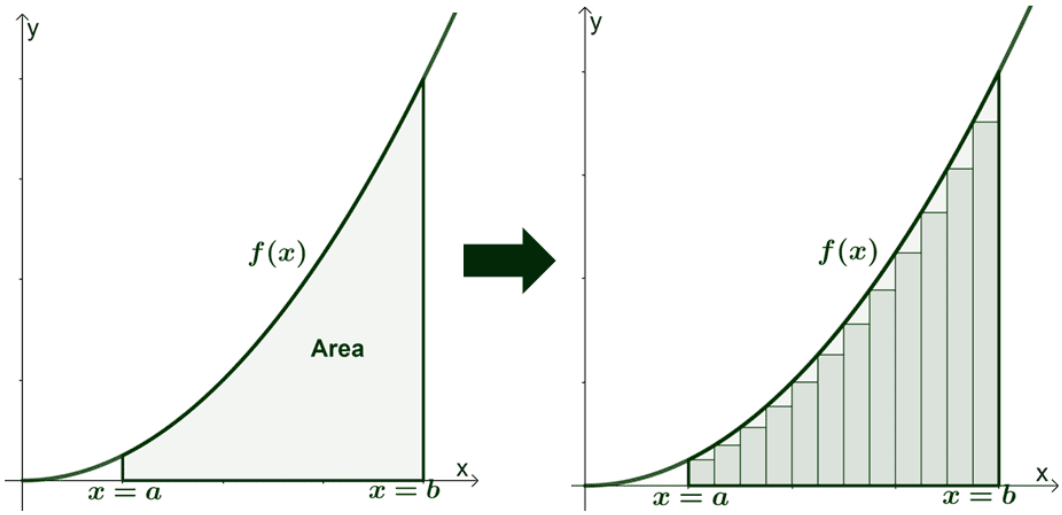

Figure 1. Illustration of numerical computation of an integral.
Image taken from https://www.storyofmathematics.com/riemann-sum/

In your program, you should use Polynomial class which stores 1) function coefficients in an array list and 2) deltaX as data fields. All data fields should be private. The constructor should be called as: Polynomial p = new Polynomial(a,b,c,d). You need to implement the following public class methods:

1. valueAt(x: double): returns double. This method returns the function value f(x) at x.
2. setDeltaX(deltaX: double): void. This method sets the deltaX parameter such as 0.0001
3. computeIntegral(minX: double, maxX: double): returns double. This method computes the Riemann sum and returns the approximate integral.

In your report, provide the user input and outputs for the following polynomials using a very small deltaX. Note that user may enter any polynomial up to a 3rd degree polynomial.

f(x) = x^2-2 in the range (0,2)
f(x) = $9x^2$-2x-18 in the range (-2,3)
f(x) = $3x^3$-2x-15 in the range (-4,3)
f(x) = 3 in the range (-6,6)

You are free to design how a user inputs the polynomial and deltaX values.

Evaluation Criteria and Grading for Assignments

Code
20% Compliance to programming style, e.g., naming conventions, indentation, comments.
70% Correctness of the solution

Report
10% Completeness of the report, compliance to the report format, correctness of the content and language.

Submission Guide

Submission Files
Submit a single compressed (.zip) file to Moodle.
Name your zip file as name_surname.zip.
Zip file should contain all source codes (under the \code directory), and report (in PDF format, under the \report directory).
Name the main code which is used to run your assignment as name_surname.java.
Name your report as name_surname.pdf.
Contents of each Java file should start with your name, student ID, date, and a brief code summary in a comment block.

Mandatory Submission
Submission of assignments is mandatory. If you do not submit an assignment, you will fail the course.

Late Submission Policy
Maximum submission delay is two days. Late submission will be graded on a scale of 50% of the original grade.
Submission is mandatory even if you submit your assignment late.

Plagiarism
Plagiarism leads to grade F and YÖK regulations will be applied