

TP 4: Calculating π using Riemann Sum in C++ with OpenMP

November 9, 2023

Introduction

In this assignment, you will implement a parallelized C++ program to calculate the value of π using the Riemann sum method. The function to integrate is $f(x) = \frac{1}{1+x^2}$ over the interval $[0, 1]$. You are required to use only the standard C++ library and parallelize the code using OpenMP compiler directives.

Task Description

1. Implement the Riemann sum algorithm to approximate the integral. (1)

$$\int_0^1 f(x) = \lim_{|\Delta x| \rightarrow \infty} f(x_i^*) \Delta x \quad (1)$$

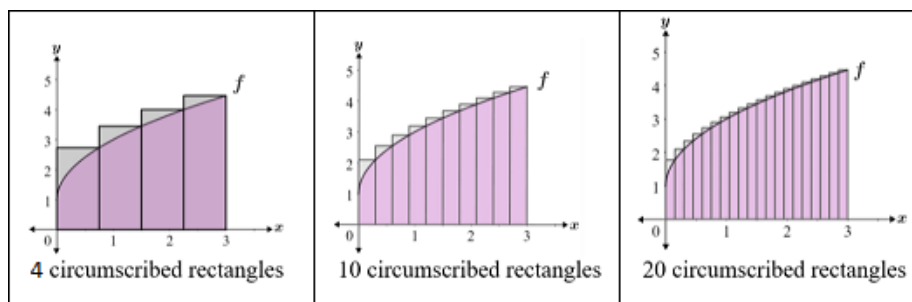


Figure 1: Rieman sum converging to integral

2. Parallelize your implementation using OpenMP compiler directives.
3. Divide the interval into 10^8 small rectangles and calculate the sum to find the final area.

4. Test your code's performance by varying the number of threads (`nThreads`) from 2^1 to 2^8 .
5. Measure the execution time for each configuration.
6. Create a report documenting your approach, including the following:
 - Description of the Riemann sum implementation.
 - Explanation of the parallelization using OpenMP.
 - Presentation of the execution time results with varying thread counts.
 - Graphs depicting the scaling of execution times.
 - Observations and conclusions based on your findings.

Implementation Guidelines

- Use the `omp_get_wtime()` function for measuring execution times.
- Ensure that your implementation is correct by comparing the results with a serial version.
- Comment your code thoroughly to explain key steps and decisions.

Submission

Submit your C++ code files, the report, and any additional graphs or data files.