Random Number Generation and Simulation

Exercise 8

Area estimation using Monte Carlo method

Author
Cesare De Cal

Professor
Annie Cuyt

Assistant Professor
Ferre Knaepkens

December 4, 2019

1 Introduction

The exercise asks to approximate the area of the figure defined by

$$\begin{cases} 1 \leq x \leq 3 \\ -1 \leq y \leq 4 \\ x^3 + y^3 \leq 29 \\ y \geq e^x - 2 \end{cases}$$

using the Monte Carlo method.

2 Tools

To solve this exercise, I've used the following libraries and programming languages:

- C
- Intel Math Kernel Library (Vector Statistical Library)
- OpenMP
- C Math Library

I've used the following Intel MKL routines:

- `vslNewStream(&stream, brng, seed)`
- `vslLeapfrogStream(stream, k, nstreams)`
- `vsRngUniform(method, stream, nrRandomNumbers, array, start, end)`
- `vslDeleteStream(&streamToDelete)`

OpenMP provides a user-friendly interface to build multi-threading applications. I've used the following methods and procedures:

- `omp_get_max_threads()`
- `#pragma omp parallel private(nrOfThreads, threadID)`
- `omp_get_thread_num()`

To make the code more clear, I've also wrote my own function `isInsideArea(x,y)` which checks if a given pair of coordinates (x, y) is inside the area drawn by the system of inequalities.