Assignment 9

Due: 21th May.

1 π (Again!)

As we can approximate π from the following expression

$$\pi = 4 \int_0^1 \sqrt{1 - x^2} dx$$

let us implement a parallel numerical integration with, now, *MPI*.

- Use the serial code you wrote for the midterm that implements the trapezoidal rule

  $$\int_a^b f(x)\, dx \approx \frac{h}{2} \left(f(a) + f(b) \right) + h \sum_{i=1}^{n-1} f(a + ih)$$

  where

  $$h \equiv \frac{b - a}{n}$$

  with n being the number of subintervals of $[a, b]$. The code must receive n as a parameter and output the value of π and the error[1].

- (*40 points*) Use *MPI* to parallelize the previous code and approximate π for $n = 1.000.000$. What are the running times for one and two CPUs? The idea here is to split the calculation in half, you can decide how, and send it to two different CPUs. Each one computes part of the calculation and then sends back the results that at the end must be combined.

- (*10 points*) Compare and discuss your results with the *OpenMP* solution implemented in the midterm. Which implementation works best? Why?

[1] Trivially $\pi \approx 2 \arcsin(1.0)$