

GPU Programming

Prac 1

Instructions

Due date: 5 pm Friday 3 May 2024

By submitting your assignment via the RUConnected link, you declare that the assignment submitted is entirely your own work, unless noted otherwise.

Aim

Create optimised CUDA code for the sequential CPU code for the Monte Carlo program provided

Task: Monte Carlo calculation of PI (40 marks)

There is a very well-known Monte Carlo algorithm for calculating the value of PI. (See <https://www.youtube.com/watch?v=VJTfflqO4TU> for a very simple explanation of this.) On the course website, there is some C code (MCPi.c) to implement this approximation of PI on a CPU.

You are required to use the GPU, with no more than 100 million points (raindrops), to calculate the best estimate of PI (using the Monte Carlo algorithm) in the shortest amount of time. How you divide these points between threads is very important. You should generate all random numbers using cuRAND and minimise the amount of computation done on the CPU.

Submit your optimized CUDA-C code as well as the timings (separate timings for random number generation on GPU only, kernel execution only, and overall timing on CPU from start to finish of main()) and PI estimate obtained.

Allocation of marks will be as follows:

50% of marks for a running version on the GPU.

Remainder of marks allocated for optimisations applied to the code. Note that you need to provide evidence of pre- and post-optimisation speeds, what you changed and why this change accelerated the performance.