Project 2 – Final Specification,
Due Date: Sunday, Feb 18, 2024 by 6 pm

February 14, 2024

General Instructions

Please follow the format described in this report carefully to get credit. Create a subdirectory in your repo name *final*. Your final report must be placed on time in this directory as a pdf file named

`HW1_Final_<first_initial>_<last_name>.pdf`

Please put your full name and email address at the top of the file. Also, include a Makefile and a README with any instructions on how to run your code. Make solution plots and populate your tables thoughtfully, considering readability, axis labels, digits of precision, etc.

Finally, setup your program so that all parameters are hardwired except the number of ray (nrays), the grid dimension (ngrid), the number of blocks (nblocks), and the number of threads per block (ntpb), which should be passed to the command line in the given order: **raytrace** nrays ngrid nblocks ntpb

Structure of Final Report

Introduction (Optional)

Any introductory background information on the application, algorithm, approach, etc. This is for completeness – to remind you of what you accomplished. It will not be graded.

Performance

The first two milestones provided a good general picture of the performance of Monte Carlo ray tracing on serial CPUs, multicore CPUs, and GPUs. Many specific questions remain, however, and performance comparisons have been complicated by insufficient specificity in the simulation parameters. In this milestone you will carry out a more comprehensive set of simulations with more rigorous specifications. This will allow us to better identify across all submissions what worked well and what didn't.

Your job is to carry out the set of simulations in the table below. The values reported are your best performance, presumably after exploring different configurations and optimization strategies. While you are mostly graded on correctness, code quality, and reasonable performance results, on this milestone an extra 10 points will be allotted in the rubric for identifying successful optimizations (you are not expected to be a GPU expert at this point, but there is a large parameter space to explore).

For each row in the table below, you must include an image of the solution to get full credit. Additionally, for each row in the table, list the key optimizations you that resulted in the reported performance. When there is nothing unique to report, "none" or something like "same as the A100 optimizations" is fine. Don't feel the need to add filler text, just substance.

Proc	Grid	Time(SP)	K Time(SP)	Time(DP)	K Time(DP)	Blk/TPB	Cores	Samples
A100	1000^2							
A100	100^2							
V100	1000^2							
V100	100^2							
RTX6000	1000^2							
RTX6000	100^2							
CPU Serial	1000^2						1	
CPU Serial	100^2						1	
CPU OMP	1000^2							
CPU OMP	100^2							
> 1 GPU*	1000^2							
> 1 GPU*	100^2							

Table 1: Fill out Table 1 with your best performance for the hardware and problem size specified. The Total Time (Time) and Kernel Time (K Time) columns must include both single and double precision performance (SP/DP). Assume one billion rays, xorwow RNG in curand, with problem parameters set as in Milestones 1 and 2. The CPU must be a Midway 3 Cascade Lake node. For the multi-GPU runs, the "cores" column should be used to denote the number of MPI ranks. Samples refers to the total number of random numbers drawn in the simulation. It is included as a sanity check.