Exercise 8

360.252 - Computational Science on Many-Core Architectures
WS 2022

December 5, 2022

The following tasks are due by 23:59pm on Tuesday, December 13, 2022. Please document your answers (please add code listings in the appendix) in a PDF document and submit the PDF together with the code in TUWEL.

You are free to discuss ideas with your peers. Keep in mind that you learn most if you come up with your own solutions. In any case, each student needs to write and hand in their own report. Please refrain from plagiarism!

> "Art is either plagiarism or revolution." — Paul Gauguin

There is a dedicated environment set up for this exercise:

https://k40.360252.org/2022/ex8/
https://rtx3060.360252.org/2022/ex8/

To have a common reference, please run all benchmarks for the report on both machines in order to see differences across GPU generations.

Dot Product with OpenCL (4 Points)

Given vectors of size N,

1. write an OpenCL kernel to compute the dot product of two vectors (1 Point) based on the provided code skeleton,
2. compare the performance of your dot product kernel with your existing CUDA implementation(s) from previous exercises. Make sure to select the NVIDIA OpenCL platform. (1 Point)
3. compare the performance of your dot product kernel on the CPU. Make sure to select an OpenCL platform with CPU support. (1 Point)
4. measure the time it takes to build OpenCL programs for different program sizes. Find a way to generate M different variations of the dot product kernel and measure the kernel compilation time with respect to $M \in \{1, 10, 20, 30, \ldots, 100\}$. Compare the time it takes to actually compile the kernels versus the time it takes to retrieve the kernels from cache. (1 Point)

Bonus: Implement CUDA+OpenCL (CUCL) Approach (1 Point)

In the lecture we discussed a method to support both CUDA and OpenCL with just a single kernel code base. Check out the skeleton code provided and add the missing code such that the dot product kernel in the file `dot.cucl` can be used with either CUDA or OpenCL.