Exercise 8

360.252 - Computational Science on Many-Core Architectures
WS 2020

December 9, 2020

The following tasks are due by 23:59pm on Tuesday, December 15, 2020. Please document your answers (please add code listings in the appendix) in a PDF document and email the PDF (including your student ID to get due credit) to karl.rupp@tuwien.ac.at.

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!

> "To steal ideas from one person is plagiarism;
> to steal from many is research." — Steven Wright

There is a dedicated environment set up for this exercise:

https://gtx1080.360252.org/2020/ex8/.

To have a common reference, please run all benchmarks for the report on this machine.

Libraries (5 Points)

Given vectors $x = (1, 1, \ldots, 1)$ and $y = (2, 2, \ldots, 2)$ of size N, compute the dot product $\langle x+y, x-y \rangle$ with the following libraries:

1. Boost.Compute (1 Point)
2. Thrust (1 Point)
3. VexCL (1 Point)
4. ViennaCL (make sure to have `VIENNACL_WITH_CUDA` or `VIENNACL_WITH_OPENCL` defined before including the respective headers) (1 Point)

Compare the execution times of these library implementations with your own CUDA and OpenCL implementations for values $N = 10^k$ with $k \in \{1, 2, 3, 4, 5, 6, 7\}$. (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.