PS 703106
Exercise 3
Group 4:

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Folders:

- code
- for_csv

Files:

- valgrind_report_seq.txt
- valgrind_report_omp.txt
- valgrind_report_ocl.txt

Hardware: CPU: Intel i5-3320M
GPU: Intel HD Graphics 4000

Performance

The sequential version of the matrix multiplication program is the slowest. The openMP version is a bit faster. On the graph the sequential and the openMP versions runtime grows exponentially with a bigger matrix size. The fastest matrix multiplication program is the openCL version. The openCL version's runtime grows very slowly with a bigger matrix size.

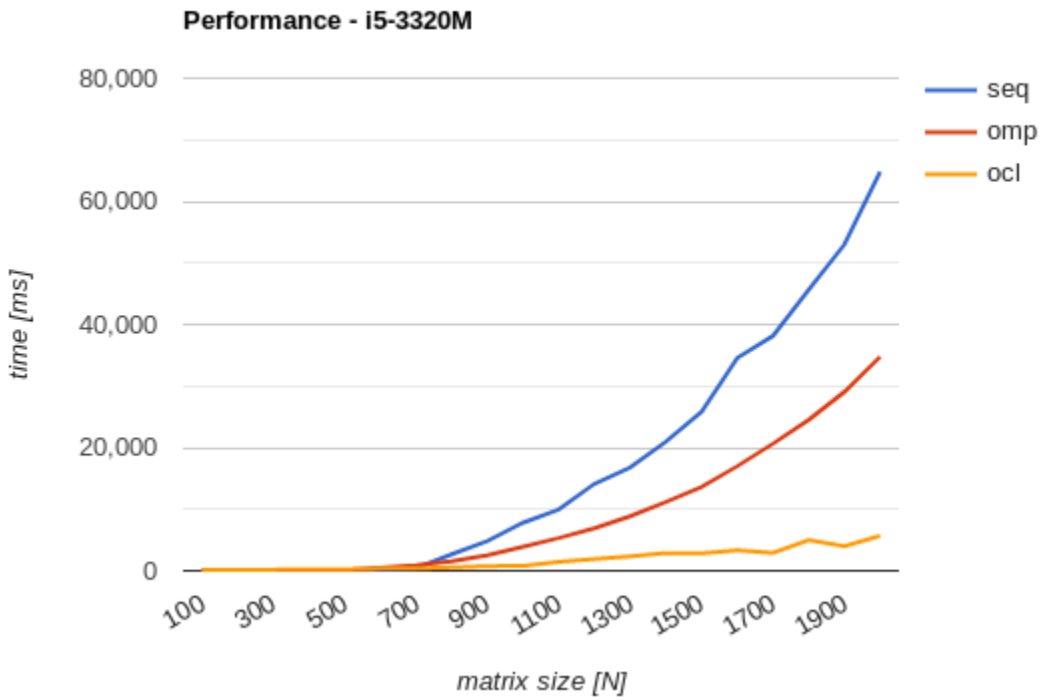

Figure 1: Runtime of the sequential, openMP and openCL version

Errors

When running the openCL version of the program with matrix sizes bigger than 2000, the verification fails. I had the same problem with the sample solution of the matrix multiplication exercise. However, it seems that I am the only one with this problem. The other team members didn't have any such problems.

Valgrind

Sequential: No errors.

OpenMP: Shows one error.
Possibly lost: 864 bytes in 3 blocks

OpenCL: Shows 16 errors.
Definitely lost: 4,244,408 bytes in 5 blocks
indirectly lost: 552 bytes in 4 blocks
possibly lost: 7,008 bytes in 11 blocks

FLOPs

Calculation:

Upper bound of FLOP: Each integer operation is as slow as a float one. Assuming the compiler does not just use inc and a cached variable to cut those operations down. So N*N*N(1+1+3+3) -> N^3 for the loops, then there is 1 for the += then 1 for the * in the middle (arguably the only floating point operation) finally +3 and +3 for the index calculation making this probably a very wide upper bound.

```
// MFLOPs performance of the kernel
double mflops = (double) N*N*N*8 / (totalTime/1000); // 8 operation
```

Average MFLOPs from N=100 – N=2000 in +100 steps
Average MFLOPs of the sequential program: 3344.4242
Average MFLOPs of the openMP program: 5516.4791
Average MFLOPs of the openCL program: 8909.48285

Data transfer rate

The data transfer time from the host to the device was between 10Gbit/s and 20Gbit/s.
The data transfer time from the device to the host was normally not more than 10Gbit/s.