CSCI 4060U – Laboratory #8
Programming Matrix Multiplication in OpenCL
Lab Due: <u>11pm, Apr. 11, 2023 (Canvas)</u>

Introduction

The main goal of this lab is to take a sequential implementation of matrix multiplication and parallelize it in OpenCL.

Activity #1

First, we will start with a sequential implementation of matrix multiplication – http://www.sqrlab.ca/exercises/csci4060u-w23/matrix_mult_seq.c. This program includes a function to multiple two matrices stored as one-dimensional arrays:

```
//[AB] = [A] * [B]
void seq_matrix_mult(
  int m_dim, int k_dim, int n_dim,
  float *a, float *b, float *ab);
```

The function implements matrix multiplication as follows:

$$\text{Matrix A * Matrix B = Matrix AB}$$
$$[m * k] * [k * n] = [m * n]$$

Make sure you familiarize yourself with the sequential algorithm. Next, in OpenCL C write a parallel version of the algorithm to run on the device (GPUs) where every kernel calculates one element in Matrix AB. Finally, write the host code in C before testing your program. Compare the results of the sequential program with your OpenCL program to ensure that it works correctly.

Activity #2

Although the parallel version is an improvement, it is not the most efficient parallelization. In a comment at the top of your code explain <u>*why*</u> and propose (no code needed!) an <u>*alternative*</u> parallelization scheme.

Marking Scheme

Activity #1

- Device (kernel) code	3 marks
- Host code	3 marks

Activity #2

- Description of efficiency problem	2 marks
- Proposed improvement to parallelization	2 marks

TOTAL   **10 MARKS**