Assignment #3: OpenCL Matrix Multiplication

Create an OpenCL program that takes as inputs two square matrices A and B with dimension (40 x 40) and perform the multiplication of the two matrices to create matrix C = A x B.

Requirements:

1. For the purpose of easy grading and error checking, please define N and BLOCK_SIZE to 40 and 1 respectively, and initialize your input matrices A and B as below ("inputMatrix1" and "inputMatrix2" stand for A and B, "results" stands for C):

```
#define N 40
#define BLOCK_SIZE 1
...
cl_float *inputMatrix1;
cl_float *inputMatrix2;
cl_float *results;
cl_uint width = N;

int x,y;
int data = 0;
inputMatrix1 = (cl_float *) malloc(sizeof(cl_float) * width * width);
inputMatrix2 = (cl_float *) malloc(sizeof(cl_float) * width * width);
results = (cl_float *) malloc(sizeof(cl_float) * width * width);

for(y = 0; y < width; y++) {
  for(x = 0; x < width; x++) {
     inputMatrix1[y * width + x]= data;
     inputMatrix2[y * width + x]= data;
     results[y * width + x]=0;
     data ++;
  }
}
```

2. Write your kernel function in the offline mode, i.e., creating a separate .cl file for your kernel function other than writing it as a string inside the main program. You can load your .cl kernel file by calling loadProgSource(…) function. (Refer to Sample Code in Lecture 14 "vecSquare_2.cpp") .
3. Retrieve the latest compilation results embedded in the program object by clGetBuildProgramInfo(). (Refer to page 14 in Lecture 14).
4. In your kernel function, decompose the multiplication into small work-groups working in parallel, i.e., you need to specify both the total number of work-items (global dimensions) and the number of

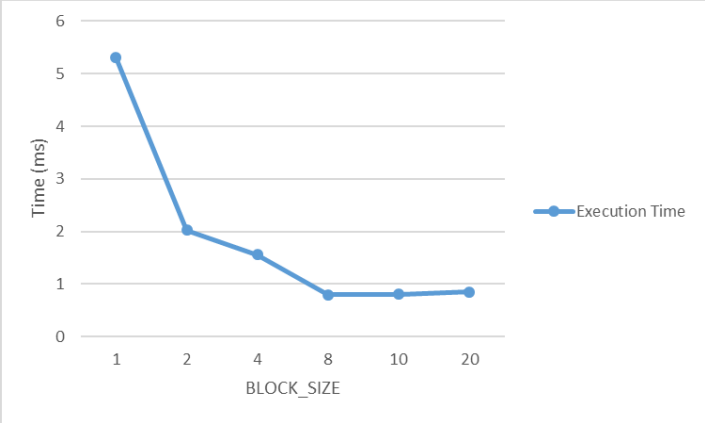
work-items per work-group (local dimensions) and pass them to clEnqueueNDRangeKernel(…), e.g.,

```
global[0] = width;
global[1] = width;

local[0] = BLOCK_SIZE;
local[1] = BLOCK_SIZE;

clEnqueueNDRangeKernel(..., global, local, ...);
```

5. Use event to profile the kernel execution time. (Refer to Page 60 on Lecture 15, but using CL_PROFILING_COMMAND_START and CL_PROFILING_COMMAND_END in clGetEventProfilingInfo(…) calls instead.)
6. Gradually increase the BLOCK_SIZE from 1 to 2, 4, 8, 10, and 20, respectively, run your code again, record your kernel execution time from event profiling each time, and finally draw a time vs. BLOCK_SIZE chart to show the trend, e.g,



Due by Wednesday 7/17/2020 11:59pm! Good luck!