

# CSCI 415: Networking and Parallel Computation

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## Assignment #3: Graphics Processing Units (GPU)

**Deadline: Tuesday, October 17<sup>th</sup> at 11:59PM**

The objectives of this assignment are:

1. Understanding the steps involved in designing a parallel program using Graphics Processing Units (GPU).
2. Writing programs for large vector addition.

## 1 Description

In class we have discussed the code for computing the vector addition of  $A$  and  $B$  into  $C$ , all of size  $n$ . In the original code, each threads calculates one entry in  $C$ . In this assignment, we will modify the code so that each thread calculates  $k$  vector additions. Try running the program for  $k = 100, 1, 000, 10, 000$ , and  $100, 000$ .

### Original Approach:

$$\begin{array}{ccccc} Thread_0 & Thread_1 & \cdots & \cdots & Thread_{n-1} \\ A[0] & A[1] & \cdots & \cdots & A[n-1] \\ + & + & + & + & + \\ B[0] & B[1] & \cdots & \cdots & B[n-1] \\ = & = & = & = & = \\ C[0] & C[1] & \cdots & \cdots & C[n-1] \end{array}$$

**New Approach:** Let  $nT = \lceil \frac{n}{k} \rceil$ .

$$\begin{array}{ccccccc}
& \textit{Thread}_0 & & \textit{Thread}_1 & & \cdots & & \textit{Thread}_{nT-1} \\
A[0]A[1] \cdots A[k-1] & & A[k]A[k+1] \cdots A[2k-1] & & \cdots & & A[(nT-1)*k]A[(nT-1)*k+1] \cdots A[n-1] \\
+ & & + & & + & & + \\
B[0]B[1] \cdots B[k-1] & & B[k]B[k+1] \cdots B[2k-1] & & \cdots & & B[(nT-1)*k]B[(nT-1)*k+1] \cdots B[n-1] \\
= & & = & & = & & = \\
C[0]C[1] \cdots C[k-1] & & C[k]C[k+1] \cdots C[2k-1] & & \cdots & & C[(nT-1)*k]C[(nT-1)*k+1] \cdots C[n-1]
\end{array}$$

## 2 What to turn in:

**Submission:** You should submit your code along with a readme file (.txt, .docx, or .pdf) explaining how to run the program. The file should be named in the following format, useridAssig3.zip, .tar, or .tgz. Late submission will get a 10% penalty for every late day.