

# HITEC University, Taxila

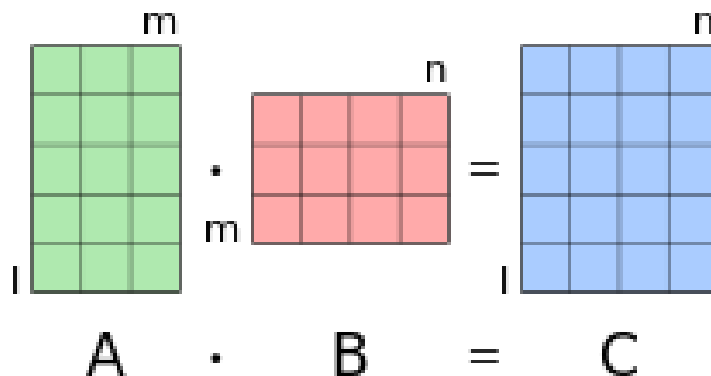
## Department of Computer Engineering

### BS Computer Engineering Program

<b>Course Title:</b>	<b>EC-444: Parallel and Distributed Computing (2+1)</b>
<b>Batch / Semester:</b>	Batch 2020 / 6 <sup>th</sup> Semester
<b>Instructor:</b>	Dr Imran Ashraf
<b>Target CLOs:</b>	CLO2, CLO3

### Complex Engineering Problem

In mathematics, particularly in linear algebra, matrix multiplication is a binary operation that produces a matrix from two matrices. For matrix multiplication, the number of columns in the first matrix must be equal to the number of rows in the second matrix. The resulting matrix, known as the matrix product, has the number of rows of the first and the number of columns of the second matrix. The product of matrices A and B is denoted as AB.



Matrix multiplication is thus a basic tool of linear algebra, and as such has numerous applications in many areas of mathematics, as well as in applied mathematics, statistics, physics, economics, quantum computing, machine learning and engineering. Computing matrix products is a central operation in all computational applications of linear algebra.

You should start with a baseline sequential source code (you can call this Version 0).

#### Part-I [CLO2]:

Profile the baseline sequential code and then analyze this profile in conjunction with source code to highlight target areas in the application for parallelization and your strategy of parallelization.

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### Part-II [CLO3]:

Design the parallel version of this application. You should come up with the following versions:

1. Version 1: Parallel Version using 8 threads of CPU.
2. Version 2: CUDA version which should be executed on GPU.
3. Version 3: Hybrid version which should use 8 threads on CPU and GPU. This is the hybrid of the Version 1 and Version 2.

Compile and run it on HCC machine to measure the execution time and speedup. You should provide the performance results for all the versions and compare and comment on results. You are expected to provide results in the form of Table as well as graphs.

### **Deliverable**

You need to submit the report (pdf format) and working source-code. Following should at least be the contents of the deliverable to clearly communicate your analysis, design and implementation.

1. Report
  1. Not more than 5-page report.
  2. Detailed profile and analysis
  3. Parallelization strategy
  4. Execution time and speedup results
  5. Other details, challenges, important things you encountered
2. Source code
  1. Properly formatted
  2. Properly commented