Lab 6 - Graphics Processing Unit

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4x4 Matrix Verification

```
matrixA =
1383    886     777     915
1793    335     1386    492
649     1421    362     27
690     59      1763    1926

matrixB =

540     1426    1172    1736
1211    1368    567     429
1782    1530    862     1123
67      1135    1929    1802

matrixC=

3265685 5411541 4558047 5302383
3876721 5694098 4435141 5699425
2718184 3453907 1930462 2191453
3714757 5948052 6077093 6673652

Dimension of matrixA: 4 x 4
Dimension of matrixB: 4 x 4
Multiplication of matrixA and matrixB need 0000.001 ms
bash-4.4$
```

Figure 1: matrixMul.c output

```
matrixA =

        1383         886         777         915
        1793         335        1386         492
         649        1421         362          27
         690          59        1763        1926


matrixB =

         540        1426        1172        1736
        1211        1368         567         429
        1782        1530         862        1123
          67        1135        1929        1802


matrixC =

     3265685     5411541     4558047     5302383
     3876721     5694098     4435141     5699425
     2718184     3453907     1930462     2191453
     3714757     5948052     6077093     6673652
```

Figure 2: MATLAB output

Time Comparison Table

Matrix Size A	Matrix Size B	CPU (ms)	GPU (ms)
512x512	512x512	557.568	7.944
632x632	632x632	705.06	18.079
1024x1024	1024x1024	5135.083	67.768
1560x1560	1560x1560	11528.949	286.136
1600x1000	1000x1600	7555.151	162.553
2048x2048	2048x2048	68693.977	653.105

From the table, it can be seen that the GPU computes these matrix multiplications much faster than the cpu. This is due to the parallelism of the GPU with its many ALU's allowing for major computations to be done quickly. Each element of matrix C is all calculated in parallel.