*University of California, Riverside*

*CS 211: High Performance Computing - Project 2*

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**Part 1.**

Verify the solution of MATLAB program with MATLAB build in solver.

Execution in MATLAB:

|  |
| --- |
| >> mylu(5)  myfactorization =  1.5651 0.8412 -1.1424 -0.5936 0.1203  0.3499 -2.2864 0.8089 1.5096 1.1542  -0.6225 -0.0325 1.2273 -1.4892 -0.3920  0.1642 0.8010 -0.7130 -2.7984 -0.7874  -0.7325 -0.2326 -0.8470 0.3403 0.3947  mypivoting =  5 4 2 1 3  Matlab\_L =  1.0000 0 0 0 0  0.3499 1.0000 0 0 0  -0.6225 -0.0325 1.0000 0 0  0.1642 0.8010 -0.7130 1.0000 0  -0.7325 -0.2326 -0.8470 0.3403 1.0000  Matlab\_U =  1.5651 0.8412 -1.1424 -0.5936 0.1203  0 -2.2864 0.8089 1.5096 1.1542  0 0 1.2273 -1.4892 -0.3920  0 0 0 -2.7984 -0.7874  0 0 0 0 0.3947  Matlab\_P =  0 0 0 0 1  0 0 0 1 0  0 1 0 0 0  1 0 0 0 0  0 0 1 0 0  Solution\_Difference\_from\_Matlab =  5.5023e-16 |

Performance compassions in matrix size = 1000.

|  |  |  |
| --- | --- | --- |
|  | Running time(s) | Gflops |
| mydgetrf | 4.337413 | 0.153701 |
| LAPACK | 0.402123 | 1.657866 |

Performance compassions in matrix size = 2000.

|  |  |  |
| --- | --- | --- |
|  | Running time(s) | Gflops |
| mydgetrf | 35.791320 | 0.149012 |
| LAPACK | 3.304381 | 1.614019 |

Performance compassions in matrix size = 3000.

|  |  |  |
| --- | --- | --- |
|  | Running time(s) | Gflops |
| mydgetrf | 120.963554 | 0.148805 |
| LAPACK | 11.505180 | 1.564513 |

Performance compassions in matrix size = 4000.

|  |  |  |
| --- | --- | --- |
|  | Running time(s) | Gflops |
| mydgetrf | 281.802088 | 0.151406 |
| LAPACK | 26.969558 | 1.582031 |

Performance compassions in matrix size = 5000.

|  |  |  |
| --- | --- | --- |
|  | Running time(s) | Gflops |
| mydgetrf | 576.526947 | 0.144544 |
| LAPACK | 63.687450 | 1.308473 |

**Part 2.**

Performance Comparison of un-optimized version and optimized version.

Find proper block size.

Performance in different block size(N=3000):

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | 10 | 20 | 30 | 40 | 50 | 60 | 70 | 80 | 90 |
| Running Time | 79.957 | 79.098 | 76.588 | 80.379 | 80.256 | 76.750 | 86.399 | 81.514 | 87.883 |
| Gflops | 0.2251 | 0.2275 | 0.2350 | 0.2239 | 0.2242 | 0.2345 | 0.2083 | 0.2208 | 0.2048 |

The optimized block size is 30.

Performance compassions in matrix size = 3000 with block size = 30.

|  |  |  |
| --- | --- | --- |
|  | Running time(s) | Gflops |
| un-optimized | 84.5856 | 0.212802 |
| optimized | 84.2015 | 0.213773 |