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