James Hahn
MATH1080
Coding Assignment #3

The below tables display Gaussian elimination with and without pivoting, as indicated. A matrix A_{nxn} is fed into the program. When pivoted *is not* used, only an upper triangular matrix U_{nxn} and lower triangular matrix L_{nxn} are output. When pivoting *is* used, an upper triangular matrix U_{nxn}, lower triangular matrix L_{nxn}, and projection (or row swap) matrix P_{nxn} are output.

In the example provided in the homework, the non-pivoting Gaussian elimination relative accuracy is 3.5604×10^{-12}. The pivoting Gaussian elimination relative accuracy is 8.9907×10^{-17}.

Gauss (non-pivot)

```
L1:
    1.0000         0         0         0         0
   -1.1250    1.0000         0         0         0
   -0.8750   47.0000    1.0000         0         0
   -2.3750  107.0000    2.2730    1.0000         0
   -1.8750   55.0000    1.1308 -692.7727    1.0000

U1:
   1.0e+03 *

   -0.0080   -0.0090    0.0070    0.0190    0.0030
         0   -0.0001    0.0169    0.0224   -0.0126
         0         0   -0.7950   -1.0370    0.5990
         0         0    0.0000    0.0001   -0.0065
         0         0         0         0   -4.4988

Gauss (non-pivot) relative accuracy:
   3.5604e-12
```

Gauss (pivot)

```
L2:
    1.0000         0         0         0         0
    0.4737    1.0000         0         0         0
    0.7895    0.5932    1.0000         0         0
   -0.4211   -0.9068    0.7729    1.0000         0
    0.3684   -0.1525    0.0659    0.0844    1.0000

U2:
   19.0000    8.0000  -18.0000   -8.0000   -3.0000
         0    6.2105   17.5263    4.7895  -14.5789
         0         0   19.8136  -12.5254   -6.9831
         0         0         0   29.6553   -6.0860
         0   -0.0000   -0.0000         0    2.8550

P2:
     0     0     0     1     0
     0     1     0     0     0
     0     0     0     0     1
     1     0     0     0     0
     0     0     1     0     0

Gauss (partial pivot) relative accuracy:
   8.9907e-17
```

Clearly, pivoting provides more stability for the Gaussian elimination, which is used to solve linear systems, very common, practical problems. With the above relative accuracies, we can see pivoting is about 39601 times more accurate than non-pivoting.