Problem 4: Gaussian elimination and partial pivoting

a) Please check problem4_a.py
b) Please check problem4_b.py
c) Please check problem4_c{1,2,3}.py
    1) a ‘random' matrix
        - condition number for matrix A : 2032.7
        - residual from un-pivoted solve: 9.57203e-11
        - error from un-pivoted solve: 4.5902e-11
        - residual from partially-pivoted solve: 6.66282e-11
        - error from partially-pivoted solve: 2.56879e-10
        - residual from np.linalg.solve: 1.48289e-13
        - error from np.linalg.solve: 8.26606e-13

        This is not a well conditioned matrix, Gaussian elimination with partial pivoting is more accurate than Gaussian elimination without pivoting.

    2) the matrix given by
        - condition number for matrix A : 1.02
        - un-pivoted solves failed
        - residual from partially-pivoted solve 3.89423e-14
        - error from partially-pivoted solve: 7.90039e-15
        - residual from np.linalg.solve: 3.92022e-14
        - error from np.linalg.solve: 7.95229e-15

        This is a well conditioned matrix. From the result, we can find that unpivoted case would be possible to fail solving the problem. However, partially-pivoted Gaussian elimination could solve the problem somewhat well.

    3) the matrix given by
        - condition number for matrix A : 1.30228
        - residual from un-pivoted solve: 6.38225e-08
        - error from un-pivoted solve: 6.42032e-08
        - residual from partially-pivoted solve 4.67187e-15
        - error from partially-pivoted solve: 4.53856e-15
        - residual from np.linalg.solve: 4.51273e-15
        - error from np.linalg.solve: 4.35569e-15

        This is a well conditioned matrix. Both Gaussian unpivoted and partially-pivoted Gaussian elimination could solve the problem. For this matrix, Gaussian elimination with partial pivoting is more accurate than Gaussian elimination without pivoting.