1 Hands-on–Solving Sets of Equations with MATLAB I

1. Solve the following set of linear equations first **by hand using Gaussian Elimination method** and then by MATLAB as the following.

```
>> A=[2 4 -2 -2; 1 2 4 -3; -3 -3 8 -2; -1 1 6 -3];
>> b=[-4 5 7 7];
>> GEshow(A,b')
>> GEpivShow(A,b')
```

2. **Upper Triangularization Followed by Back Substitution**. To construct the solution to $Ax = b$, by first reducing the augmented matrix $[A|b]$ to upper-triangular form then performing back substitution.

   - reducing the augmented matrix $[A|b]$ to upper-triangular form; uptrbk.m.
   - back substitution; backsub.m.

   Analyze these MATLAB codes, then by using these codes solve the following linear system;

$$\begin{aligned} x_1 + 2x_2 + x_3 + 4x_4 &= 13 \\ 2x_1 + 4x_3 + 3x_4 &= 28 \\ 4x_1 + 2x_2 + 2x_3 + x_4 &= 20 \\ -3x_1 + x_2 + 3x_3 + 2x_4 &= 6 \end{aligned}$$

   Solution:
   save with the names uptrbk.m and backsub.m. Then;

```
>> A=[? ? ? ?;? ? ? ?;? ? ? ?;? ? ? ?]
>> B=[? ? ? ?]'
>> uptrbk(A,B)
```

3. **Factorization with Pivoting**, $PA = LU$.

   - To construct the solution to $Ax = b$, where A is a non-singular matrix.
   - Solve the following linear system by LU-decomposition of coefficient matrix;

$$\begin{aligned} x_1 + 2x_2 + 4x_3 + x_4 &= 21 \\ 2x_1 + 8x_2 + 6x_3 + 4x_4 &= 52 \\ 3x_1 + 10x_2 + 8x_3 + 8x_4 &= 79 \\ 4x_1 + 12x_2 + 10x_3 + 6x_4 &= 82 \end{aligned}$$

   Solution:

   - Download the file lufact.m.

```
>> A=[? ? ? ?;? ? ? ?;? ? ? ?;? ? ? ?]
>> B=[? ? ? ?]
```

   - LU-decomposition

```
>> [X,Y]=lufact(A,B')
```