1. $L = \begin{bmatrix} 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 \\ -0.5 & -0.25 & 1 & 0 \\ 0 & -0.25 & -0.058 & 1 \end{bmatrix}$ U = $\begin{bmatrix} 2 & 0 & -1 & 0 \\ 0 & 4 & -1 & -1 \\ 0 & 0 & 4.25 & -0.25 \\ 0 & 0 & 0 & 3.73 \end{bmatrix}$

   Ly = b, Ux = y
   Solve the matrix, we get
   $Y = [1, 2, 4, 2.732]^T$
   $X = [0.992, 0.929, 0.984, 0.732]^T$

2. the LU factorization discussed in class for full matrices, along with the forward/backward substitution. To test your algorithm use it to factor and solve the below matrix from question 1. You do not need to code pivoting.

$$\mathbf{A} = \begin{bmatrix} 5 & 1 & 0 & -4 \\ 1 & 4 & 0 & -3 \\ 0 & 0 & 3 & -2 \\ -4 & -3 & -2 & 10 \end{bmatrix} \quad \mathbf{b} = \begin{bmatrix} 1 \\ 2 \\ 3 \\ 4 \end{bmatrix}$$

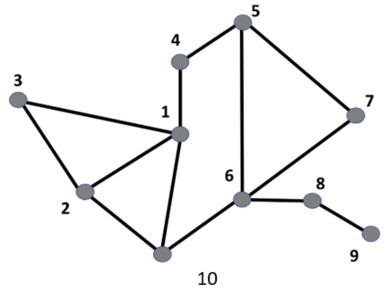
Solution : Using MATLAB

```
%% *** Matrix reduction ***
n = size(A,1);
 for i = 2:n
     for j = 1:i-1
         A(i,j) = A(i,j)/A(j,j);
         for k = (j+1):n
             A(i,k) = A(i,k) - A(i,j)*A(j,k);
         end
     end
 end
 %% *** 1) Forward substitution (solves y from Ly = b)***
 %  the b matrix is being overwritten (replaced by y)

 for i = 2:n
     for j=1:(i-1)
         b(i) = b(i)-A(i,j)*b(j); % using only the L matrix
     end
 end

 %% *** 2) Backward substitution (solves x from y = Ux) ***
 for i = n:-1:1
     for j = (i+1):n
         b(i) = b(i) - A(i,j)*b(j);
     end
     b(i)=b(i)/A(i,i);
 end
```

Then, the solution of the linear equation, Ax = b is:

```
1.3849
1.5565
2.2469
1.8703
```

3. Use the Tinney 1 approach to order the following network. Give the permutation vector.



Node	Valence
1	4
2	3
3	2
4	2
5	3
6	4
7	2
8	2
9	1
10	3

rowPerm = [9, 3, 4, 7, 8, 2, 5, 10, 1, 6]

4. Repeat question 3 using the Tinney 2 approach.
rowPerm = [9, 8, 3, 2, 1, 4, 7, 5, 6, 10]

Vertex									
1	4	4	4	3	2				
2	3	3	3	2					
3	2	2	2						
4	2	2	2	2	2				
5	3	3	3	3	3	3	2		
6	4	4	3	3	3	3	2	1	
7	2	2	2	2	2	2			
8	2	1							
9	1								
10	3	3	3	3	2	2	2	1	1

5. Using your reordered results from question 4, draw the full factorization path graph for the system.