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

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.

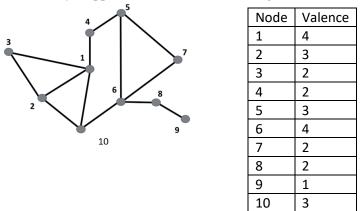
$$\mathbf{A} = \begin{bmatrix} 5 & 1 & 0 & -4 \\ 1 & 4 & 0 & -3 \\ 0 & 0 & 3 & -2 \\ -4 & -3 & -2 & 10 \end{bmatrix} \quad \mathbf{b} = \begin{bmatrix} 1 \\ 2 \\ 3 \\ 4 \end{bmatrix}$$

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.



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]								
4	4	4	3	<mark>2</mark>				
3	3	3	<mark>2</mark>					
2	2	2						
2	2	2	2	<mark>2</mark>				
3	3	3	3	3	3	<mark>2</mark>		
4	4	3	3	3	3	2	1	
2	2	2	2	2	<mark>2</mark>			
2	1							
1								
3	3	3	3	2	2	2	1	1
	4 3 2 2 3 4 2 2 2 2 1 3	4 4 3 3 2 2 2 2 3 3 4 4 2 2 3 3 4 4 2 2 2 1 1 3 3 3	4 4 4 3 3 3 2 2 2 2 2 2 3 3 3 4 4 3 4 4 3 2 2 2 3 3 3 4 4 3 2 2 2 2 1 - 1 . . 3 3 3	4 4 4 3 3 3 3 2 2 2 2 2 2 2 2 2 3 3 3 3 2 2 2 2 3 3 3 3 4 4 3 3 4 4 3 3 2 2 2 2 3 3 3 3 4 4 3 3 2 2 2 2 2 2 2 2 3 3 3 3 3 3 3 3	4 4 4 3 2 3 3 3 2 - 2 2 2 2 - 2 2 2 2 2 3 3 3 3 3 2 2 2 2 2 3 3 3 3 3 4 4 3 3 3 2 2 2 2 2 2 3 3 3 3 3 3 4 4 3 3 3 3 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 1 - - - - 3 3 3 3 3 2	4 4 4 3 2 1 3 3 3 2 1 1 3 3 3 2 1 1 2 2 2 2 1 1 2 2 2 2 2 1 1 3 3 3 3 3 3 3 4 4 3 3 3 3 3 4 4 3 3 3 3 3 2 2 2 2 2 2 2 2 3 3 3 3 3 3 3 3 4 4 3 3 3 3 3 3 2 <td>4443213332113332112222222222223333334433332222224433332222222333333332233332</td> <td>4$4$$3$$2$$1$$1$$1$$3$$3$$3$$2$$1$$1$$1$$1$$2$$2$$2$$2$$1$$1$$1$$1$$2$$2$$2$$2$$2$$2$$2$$2$$1$$1$$3$$3$$3$$3$$3$$3$$2$$1$$1$$4$$4$$3$$3$$3$$3$$2$$1$$2$$2$$2$$2$$2$$2$$2$$1$$2$$2$$2$$2$$2$$2$$2$$1$$2$$1$$1$$1$$1$$1$$1$$1$</td>	4443213332113332112222222222223333334433332222224433332222222333333332233332	4 4 3 2 1 1 1 3 3 3 2 1 1 1 1 2 2 2 2 1 1 1 1 2 2 2 2 2 2 2 2 1 1 3 3 3 3 3 3 2 1 1 4 4 3 3 3 3 2 1 2 2 2 2 2 2 2 1 2 2 2 2 2 2 2 1 2 1 1 1 1 1 1 1

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

