NAME: MANI GARG ROLL NO:102003470 BATCH:2CO19

EXPERIMENT-4

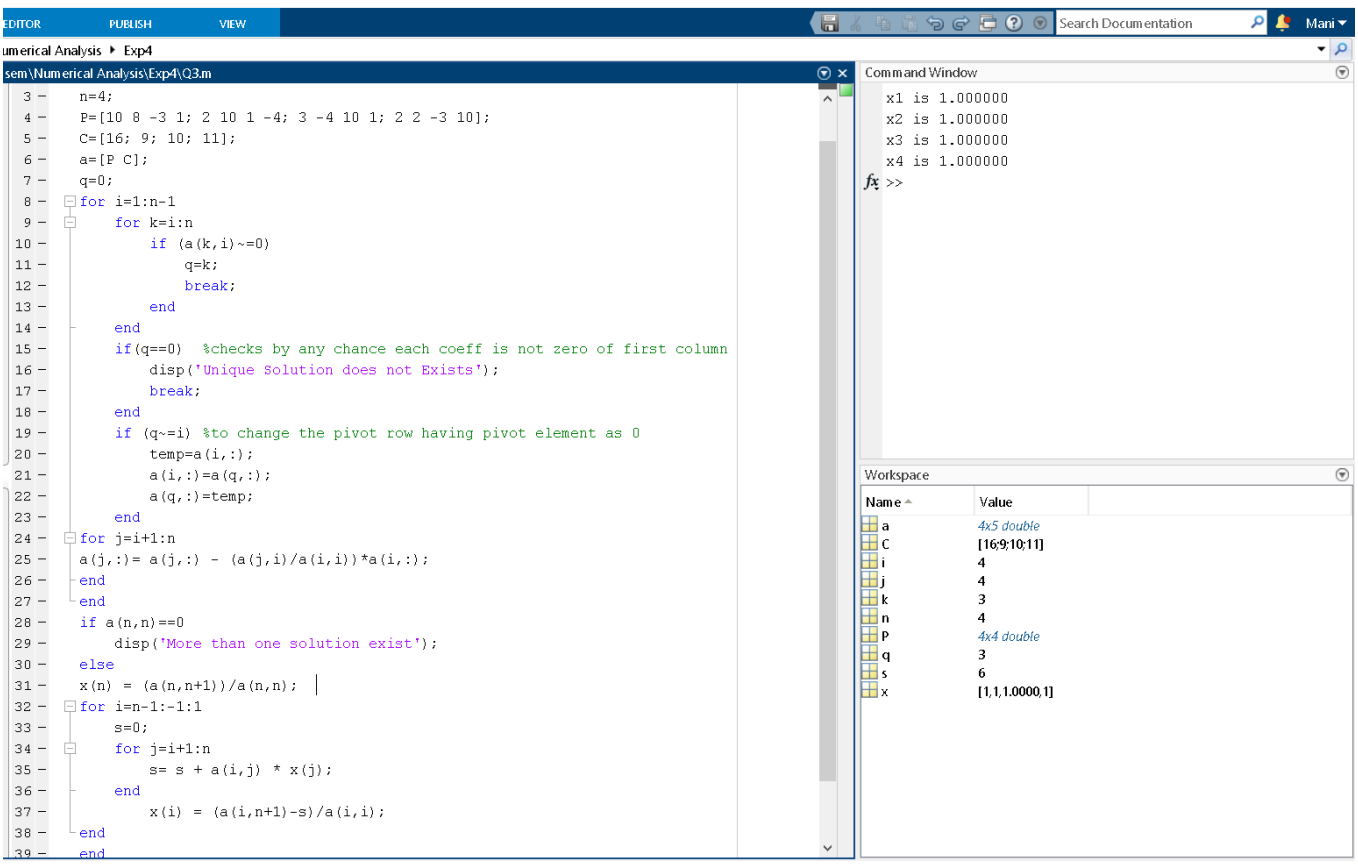
GAUSS ELIMINATION QUESTION:

ASSIGMENT QUES:

Q3

3. Use Gauss elimination method to find the solution of the following linear system of equations:

$$10x + 8y - 3z + u = 16$$
$$2x + 10y + z - 4u = 9$$
$$3x - 4y + 10z + u = 10$$
$$2x + 2y - 3z + 10u = 11$$



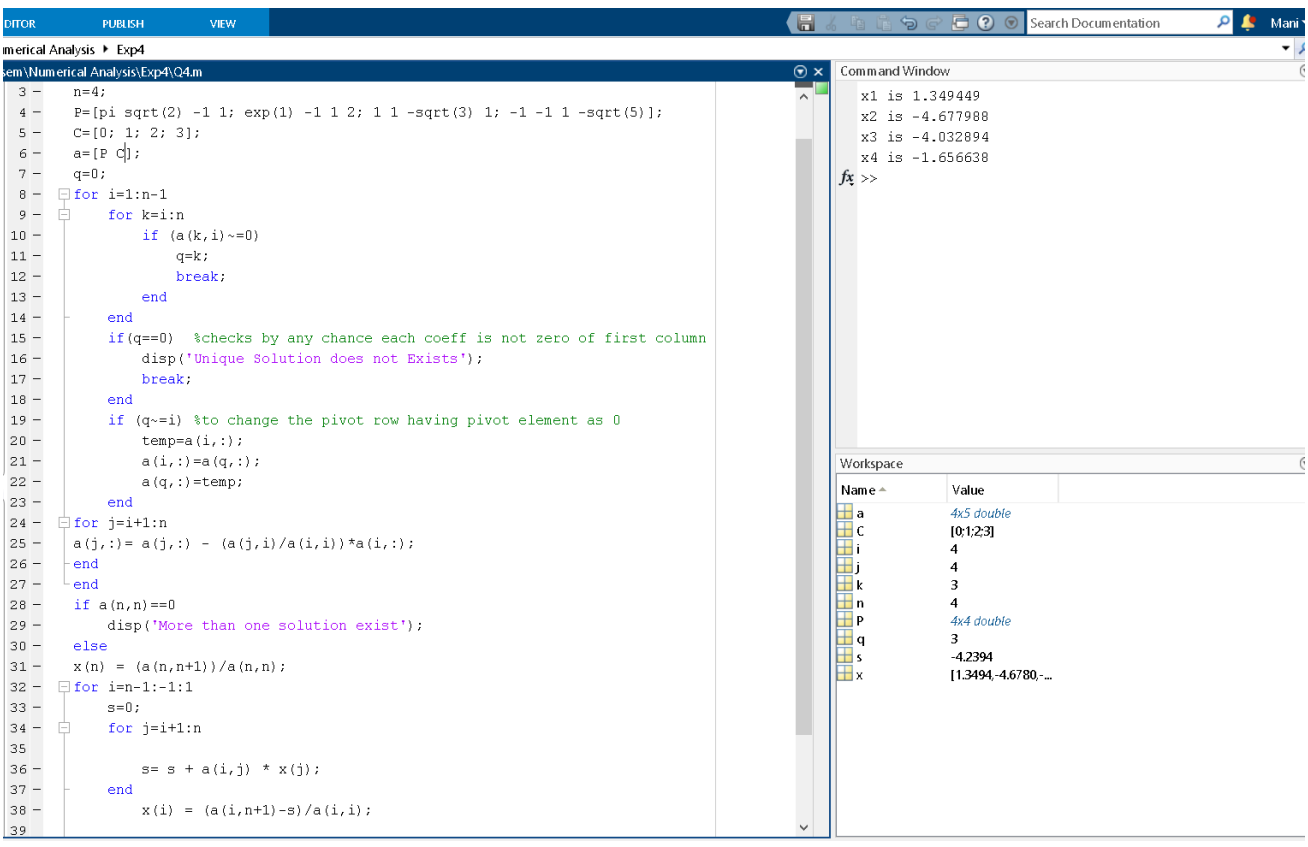
CODE:

```
clc
clear
n=4;
P=[10 8 -3 1; 2 10 1 -4; 3 -4 10 1; 2 2 -3 10];
C=[16; 9; 10; 11];
a=[P C];
q=0;
for i=1:n-1
   for k=i:n
      if (a(k,i)~=0)
         q=k;
         break;
      end
   end
   if(q==0)  %checks by any chance each coeff is not zero of first column
      disp('Unique Solution does not Exists');
      break;
   end
   if (q~=i) %to change the pivot row having pivot element as 0
      temp=a(i,:);
      a(i,:)=a(q,:);
      a(q,:)=temp;
   end
for j=i+1:n
a(j,:)= a(j,:) - (a(j,i)/a(i,i))*a(i,:);
end
end
if a(n,n)==0
   disp('More than one solution exist');
else
x(n) = (a(n,n+1))/a(n,n);
for i=n-1:-1:1
   s=0;
   for j=i+1:n
      s= s + a(i,j) * x(j);
   end
      x(i) = (a(i,n+1)-s)/a(i,i);
end
end
for i=1:n
   fprintf('x%d is %f\n',i,x(i));
end
```

Q4

4. Solve the following linear system of equations:

$$\pi x_1 + \sqrt{2}x_2 - x_3 + x_4 = 0$$
$$ex_1 - x_2 + x_3 + 2x_4 = 1$$
$$x_1 + x_2 - \sqrt{3}x_3 + x_4 = 2$$
$$-x_1 - x_2 + x_3 - \sqrt{5}x_4 = 3$$



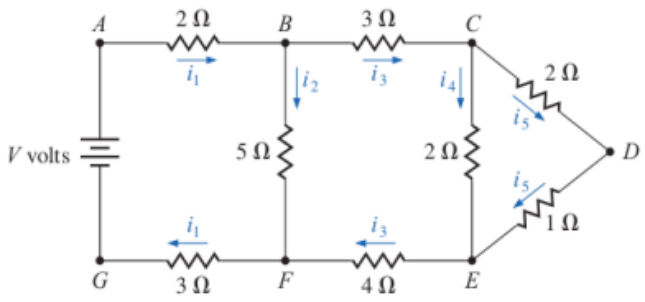
CODE:

```
clc
clear
n=4;
P=[pi sqrt(2) -1 1; exp(1) -1 1 2; 1 1 -sqrt(3) 1; -1 -1 1 -sqrt(5)];
C=[0; 1; 2; 3];
a=[P C];
q=0;
for i=1:n-1
   for k=i:n
      if (a(k,i)~=0)
         q=k;
         break;
      end
   end
   if(q==0)  %checks by any chance each coeff is not zero of first column
      disp('Unique Solution does not Exists');
      break;
   end
   if (q~=i) %to change the pivot row having pivot element as 0
      temp=a(i,:);
      a(i,:)=a(q,:);
      a(q,:)=temp;
   end
for j=i+1:n
a(j,:)= a(j,:) - (a(j,i)/a(i,i))*a(i,:);
end
end
if a(n,n)==0
   disp('More than one solution exist');
else
x(n) = (a(n,n+1))/a(n,n);
for i=n-1:-1:1
   s=0;
   for j=i+1:n
      s= s + a(i,j) * x(j);
   end
      x(i) = (a(i,n+1)-s)/a(i,i);
end
end
for i=1:n
   fprintf('x%d is %f\n',i,x(i));
end
```

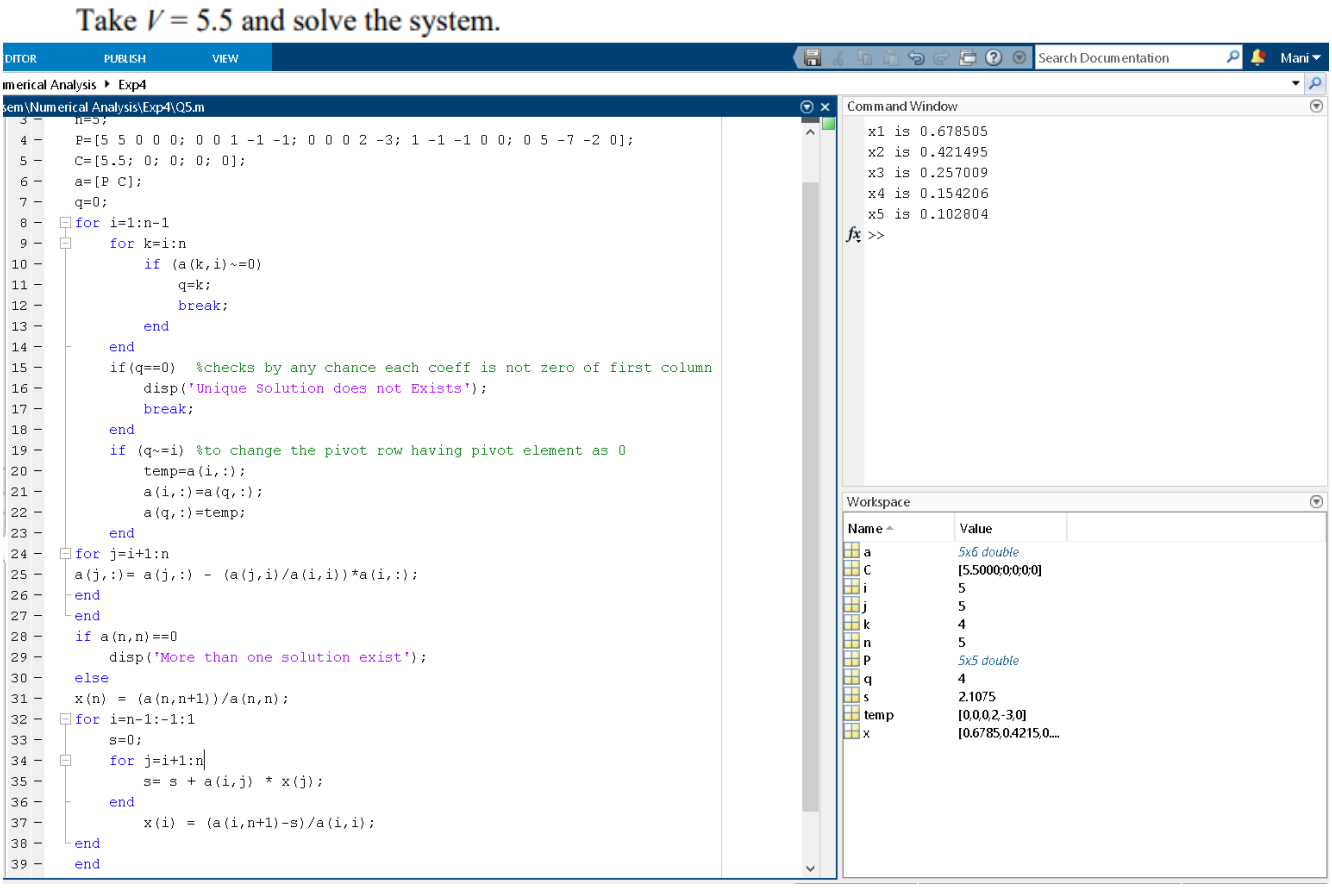
Q5

5. Kirchhoff's laws of electrical circuits state that both the net flow of current through each junction and the net voltage drop around each closed loop of a circuit are zero. Suppose that a potential of V volts is applied between the points A and G in the circuit and that i_1, i_2, i_3, i_4 and i_5 represent current flow as shown in the diagram. Using G as a reference point, Kirchhoff's laws imply that the currents satisfy the following system of linear equations:

$$\begin{aligned} 5i_1 + 5i_2 &= V \\ i_3 - i_4 - i_5 &= 0 \\ 2i_4 - 3i_5 &= 0 \\ i_1 - i_2 - i_3 &= 0 \\ 5i_2 - 7i_3 - 2i_4 &= 0 \end{aligned}$$



Take $V = 5.5$ and solve the system.



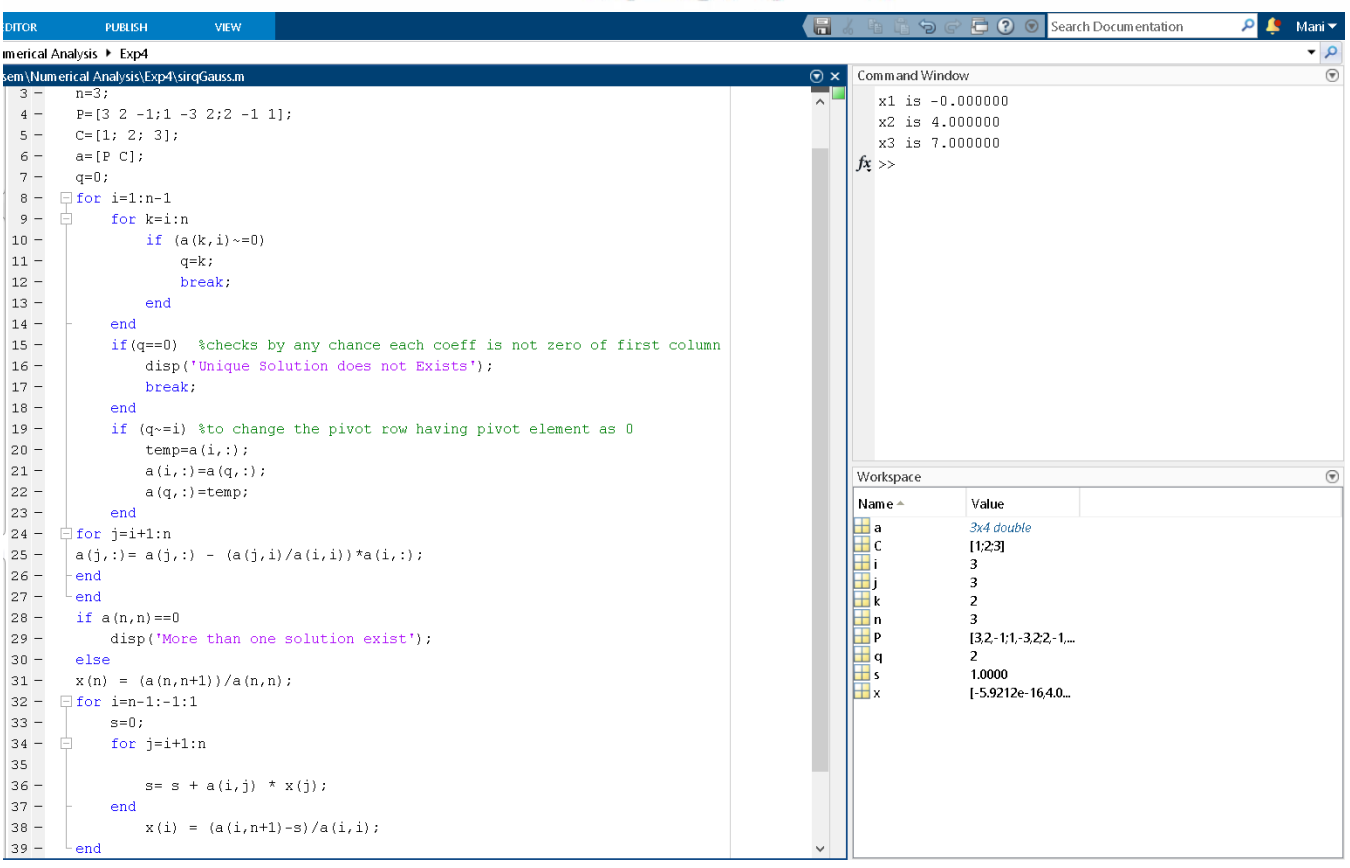
CODE:

```
clc
clear
n=5;
P=[5 5 0 0 0; 0 0 1 -1 -1; 0 0 0 2 -3; 1 -1 -1 0 0; 0 5 -7 -2 0];
C=[5.5; 0; 0; 0; 0];
a=[P C];
q=0;
for i=1:n-1
   for k=i:n
      if (a(k,i)~=0)
         q=k;
         break;
      end
   end
   if(q==0)  %checks by any chance each coeff is not zero of first column
      disp('Unique Solution does not Exists');
      break;
   end
   if (q~=i) %to change the pivot row having pivot element as 0
      temp=a(i,:);
      a(i,:)=a(q,:);
      a(q,:)=temp;
   end
for j=i+1:n
a(j,:)= a(j,:) - (a(j,i)/a(i,i))*a(i,:);
end
end
if a(n,n)==0
   disp('More than one solution exist');
else
x(n) = (a(n,n+1))/a(n,n);
for i=n-1:-1:1
   s=0;
   for j=i+1:n
      s= s + a(i,j) * x(j);
   end
      x(i) = (a(i,n+1)-s)/a(i,i);
end
end
for i=1:n
   fprintf('x%d is %f\n',i,x(i));
end
```

EXTRA QUES (GIVEN BY SIR IN LAB):

Example 1. *Solve the following systems using the simple Gaussian elimination method*

$$\begin{aligned} 3x_1 + 2x_2 - x_3 &= 1 \\ x_1 - 3x_2 + 2x_3 &= 2 \\ 2x_1 - x_2 + x_3 &= 3. \end{aligned}$$



CODE:

```
clc
clear
n=3;
P=[3 2 -1;1 -3 2;2 -1 1];
C=[1; 2; 3];
a=[P C];
q=0;
for i=1:n-1
   for k=i:n
      if (a(k,i)~=0)
         q=k;
         break;
      end
   end
   if(q==0)  %checks by any chance each coeff is not zero of first column
      disp('Unique Solution does not Exists');
      break;
   end
   if (q~=i) %to change the pivot row having pivot element as 0
      temp=a(i,:);
      a(i,:)=a(q,:);
      a(q,:)=temp;
   end
for j=i+1:n
a(j,:)= a(j,:) - (a(j,i)/a(i,i))*a(i,:);
end
end
if a(n,n)==0
   disp('More than one solution exist');
else
x(n) = (a(n,n+1))/a(n,n);
for i=n-1:-1:1
   s=0;
   for j=i+1:n
      s= s + a(i,j) * x(j);
   end
      x(i) = (a(i,n+1)-s)/a(i,i);
end
end
for i=1:n
   fprintf('x%d is %f\n',i,x(i));
end
```

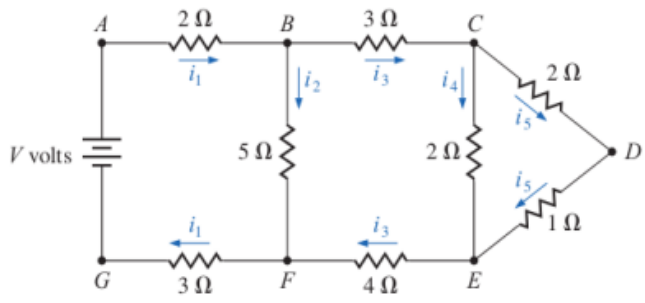
LU FACTORIZATION QUESTION:

ASSIGMENT QUE:

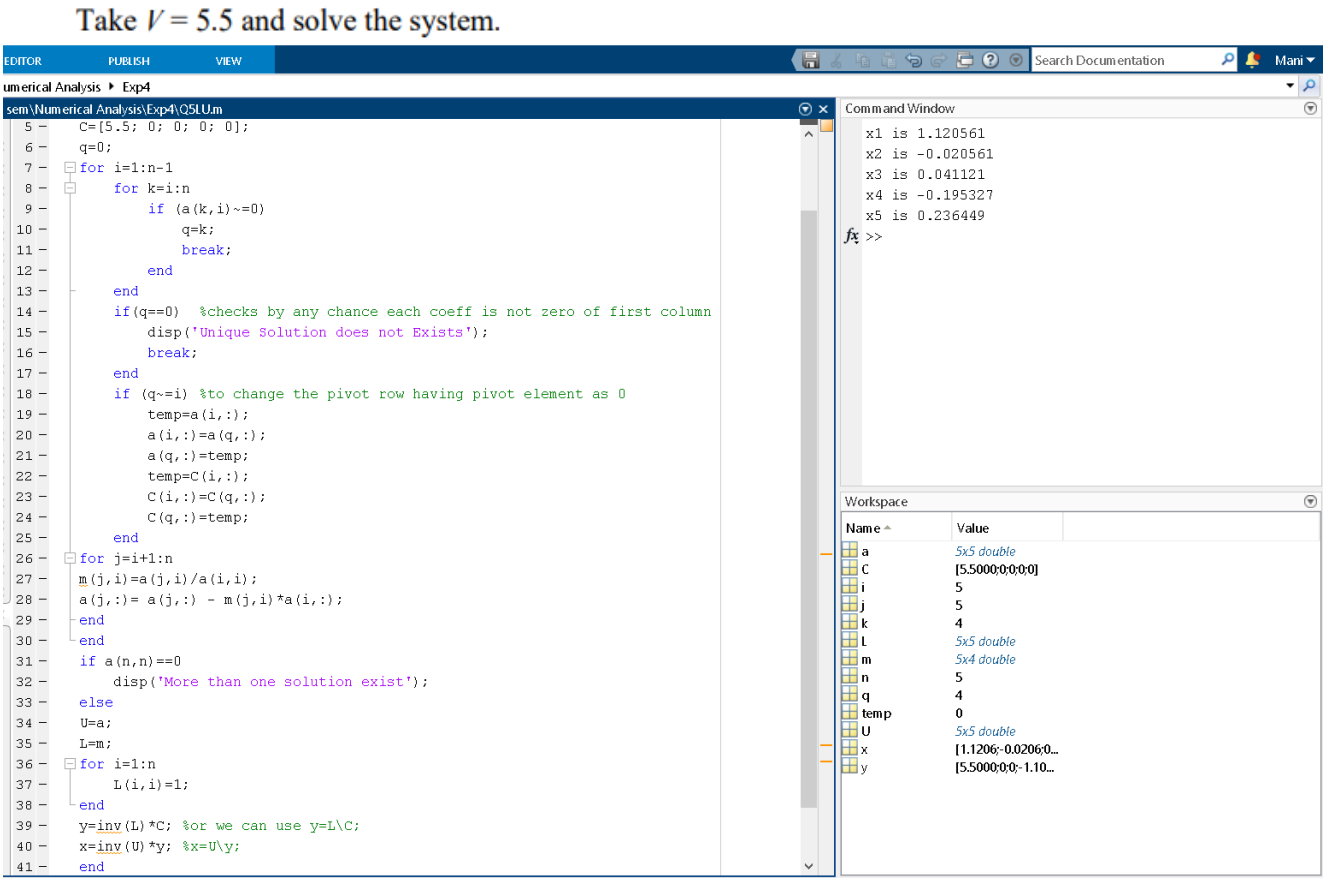
Q5

5. Kirchhoff's laws of electrical circuits state that both the net flow of current through each junction and the net voltage drop around each closed loop of a circuit are zero. Suppose that a potential of V volts is applied between the points A and G in the circuit and that i_1, i_2, i_3, i_4 and i_5 represent current flow as shown in the diagram. Using G as a reference point, Kirchhoff's laws imply that the currents satisfy the following system of linear equations:

$$\begin{aligned} 5i_1 + 5i_2 &= V \\ i_3 - i_4 - i_5 &= 0 \\ 2i_4 - 3i_5 &= 0 \\ i_1 - i_2 - i_3 &= 0 \\ 5i_2 - 7i_3 - 2i_4 &= 0 \end{aligned}$$



Take $V = 5.5$ and solve the system.



CODE:

```
clc
clear
n=5;
a=[5 5 0 0 0; 0 0 1 -1 -1; 0 0 0 2 -3; 1 -1 -1 0 0; 0 5 -7 -2 0];
C=[5.5; 0; 0; 0; 0];
q=0;
for i=1:n-1
   for k=i:n
      if (a(k,i)~=0)
         q=k;
         break;
      end
   end
   if(q==0)  %checks by any chance each coeff is not zero of first column
      disp('Unique Solution does not Exists');
      break;
   end
   if (q~=i) %to change the pivot row having pivot element as 0
      temp=a(i,:);
      a(i,:)=a(q,:);
      a(q,:)=temp;
      temp=C(i,:);
      C(i,:)=C(q,:);
      C(q,:)=temp;
   end
for j=i+1:n
m(j,i)=a(j,i)/a(i,i);
a(j,:)= a(j,:) - m(j,i)*a(i,:);
end
end
if a(n,n)==0
   disp('More than one solution exist');
else
U=a;
L=m;
for i=1:n
   L(i,i)=1;
end
y=inv(L)*C; %or we can use y=L\C;
x=inv(U)*y; %x=U\y;
end
for i=1:n
   fprintf('x%d is %f\n',i,x(i));
end
```

EXTRA QUES (GIVEN BY SIR IN LAB):

Example 1. *Solve the following systems using the simple Gaussian elimination method*

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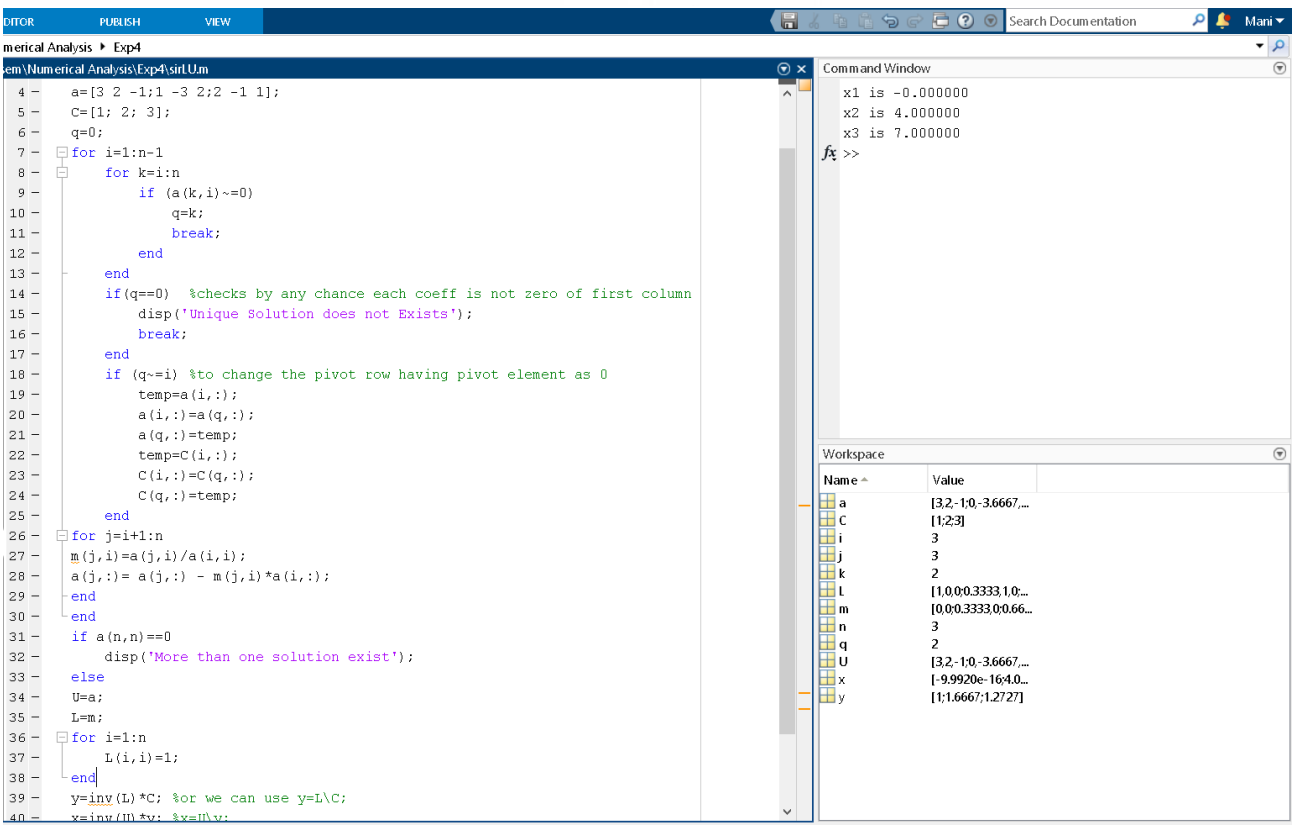

CODE:

```
clc
clear
n=3;
a=[3 2 -1;1 -3 2;2 -1 1];
C=[1; 2; 3];
q=0;
for i=1:n-1
   for k=i:n
      if (a(k,i)~=0)
         q=k;
         break;
      end
   end
   if(q==0)  %checks by any chance each coeff is not zero of first column
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   end
   if (q~=i) %to change the pivot row having pivot element as 0
      temp=a(i,:);
      a(i,:)=a(q,:);
      a(q,:)=temp;
      temp=C(i,:);
      C(i,:)=C(q,:);
      C(q,:)=temp;
   end
for j=i+1:n
m(j,i)=a(j,i)/a(i,i);
a(j,:)= a(j,:) - m(j,i)*a(i,:);
end
end
if a(n,n)==0
   disp('More than one solution exist');
else
U=a;
L=m;
for i=1:n
   L(i,i)=1;
end
y=inv(L)*C; %or we can use y=L\C;
x=inv(U)*y; %x=U\y;
end
for i=1:n
   fprintf('x%d is %f\n',i,x(i));
end
```