

**EXPERIMENT-4**

**GAUSS ELIMINATION QUESTION:**

**ASSIGNMENT QUES:**

**Q3**

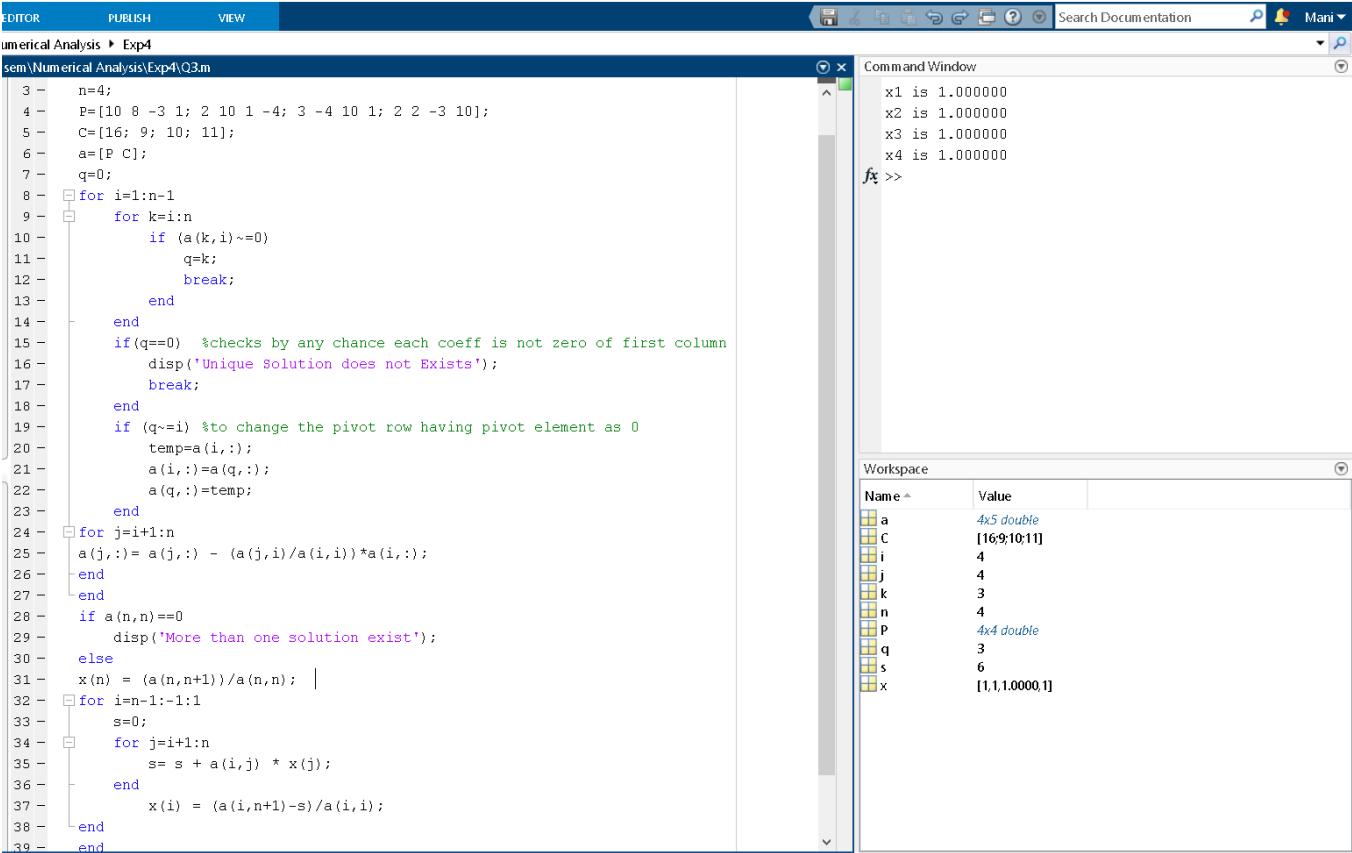
3. Use Gauss elimination method to find the solution of the following linear system of equations:

$$10x + 8y - 3z + u = 16$$

$$2x + 10y + z - 4u = 9$$

$$3x - 4y + 10z + u = 10$$

$$2x + 2y - 3z + 10u = 11$$



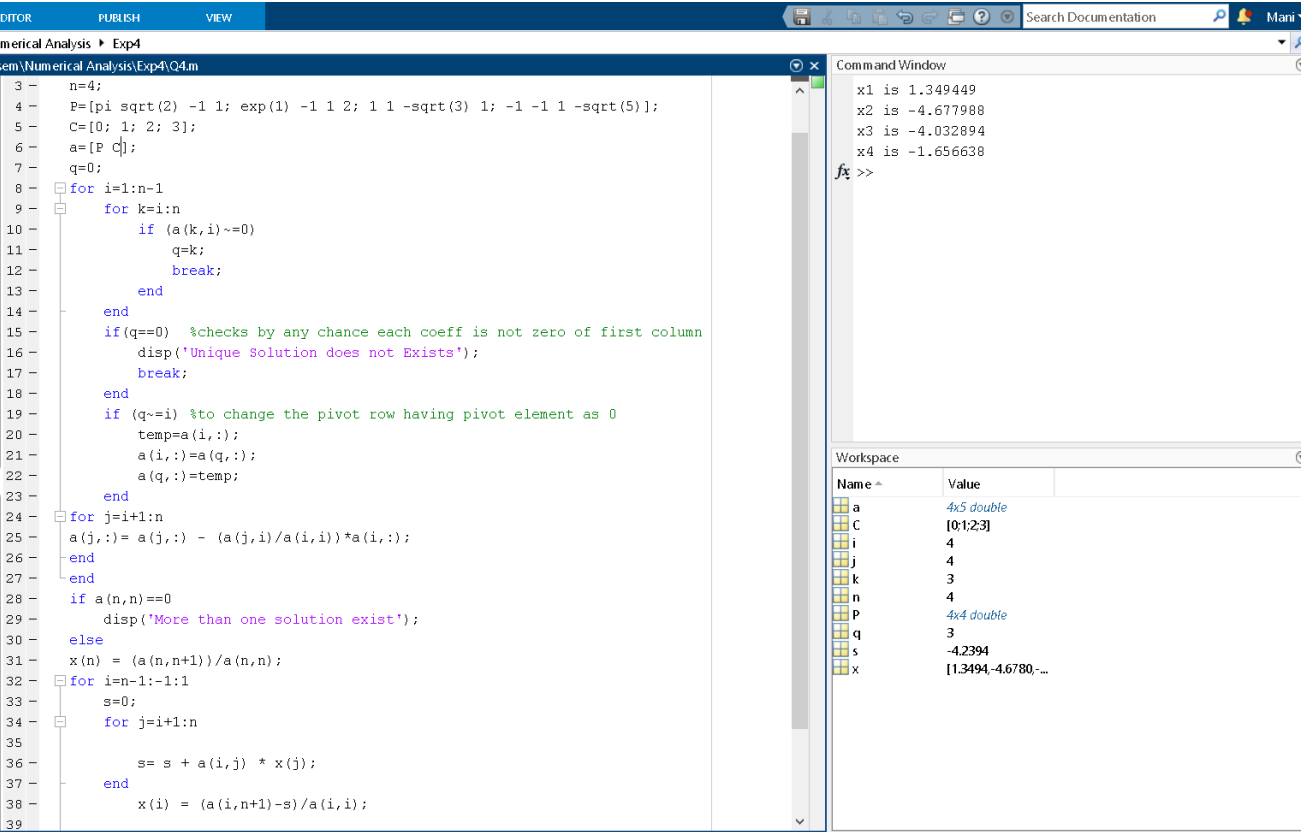
**CODE:**

```
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:

```

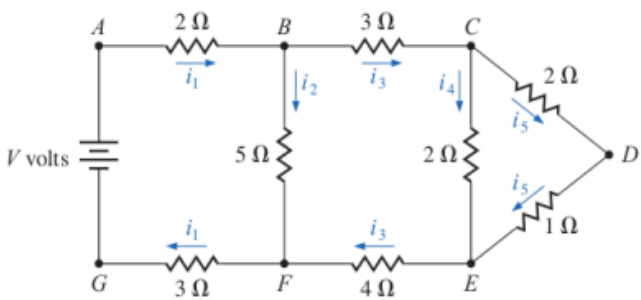
clc
clear
n=4;
P=[pi sqrt(2) -1 1; exp(1) -1 1 2; 1 1 -sqrt(3) 1; -1 -1 1 -sqrt(5)];
C=[0; 1; 2; 3];
a=[P C];
q=0;
for i=1:n-1
    for k=i:n
        if (a(k,i)~=0)
            q=k;
            break;
        end
    end
    if(q==0) %checks by any chance each coeff is not zero of first column
        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
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:

$$5i_1 + 5i_2 = V$$
$$i_3 - i_4 - i_5 = 0$$
$$2i_4 - 3i_5 = 0$$
$$i_1 - i_2 - i_3 = 0$$
$$5i_2 - 7i_3 - 2i_4 = 0$$



Take  $V = 5.5$  and solve the system.

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```
4 - 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];
5 - C=[5.5; 0; 0; 0; 0];
6 - a=[P C];
7 - q=0;
8 - for i=1:n-1
9 -     for k=i:n
10 -        if (a(k,i)~=0)
11 -            q=k;
12 -            break;
13 -        end
14 -    end
15 -    if(q==0) %checks by any chance each coeff is not zero of first column
16 -        disp('Unique Solution does not Exists');
17 -        break;
18 -    end
19 -    if (q~=i) %to change the pivot row having pivot element as 0
20 -        temp=a(i,:);
21 -        a(i,:)=a(q,:);
22 -        a(q,:)=temp;
23 -    end
24 -    for j=i+1:n
25 -        a(j,:)= a(j,:) - (a(j,i)/a(i,i))*a(i,:);
26 -    end
27 - end
28 - if a(n,n)==0
29 -     disp('More than one solution exist');
30 - else
31 -     x(n) = (a(n,n+1))/a(n,n);
32 -     for i=n-1:-1:1
33 -         s=0;
34 -         for j=i+1:n
35 -             s= s + a(i,j) * x(j);
36 -         end
37 -         x(i) = (a(i,n+1)-s)/a(i,i);
38 -     end
39 - end
```

Command Window

```
x1 is 0.678505
x2 is 0.421495
x3 is 0.257009
x4 is 0.154206
x5 is 0.102804

fx >>
```

Workspace

Name	Value
a	5x6 double
C	[5.5000;0;0;0;0]
i	5
j	5
k	4
n	5
P	5x5 double
q	4
s	2.1075
temp	[0.0;0.2;-3.0]
x	[0.6785;0.4215;0...

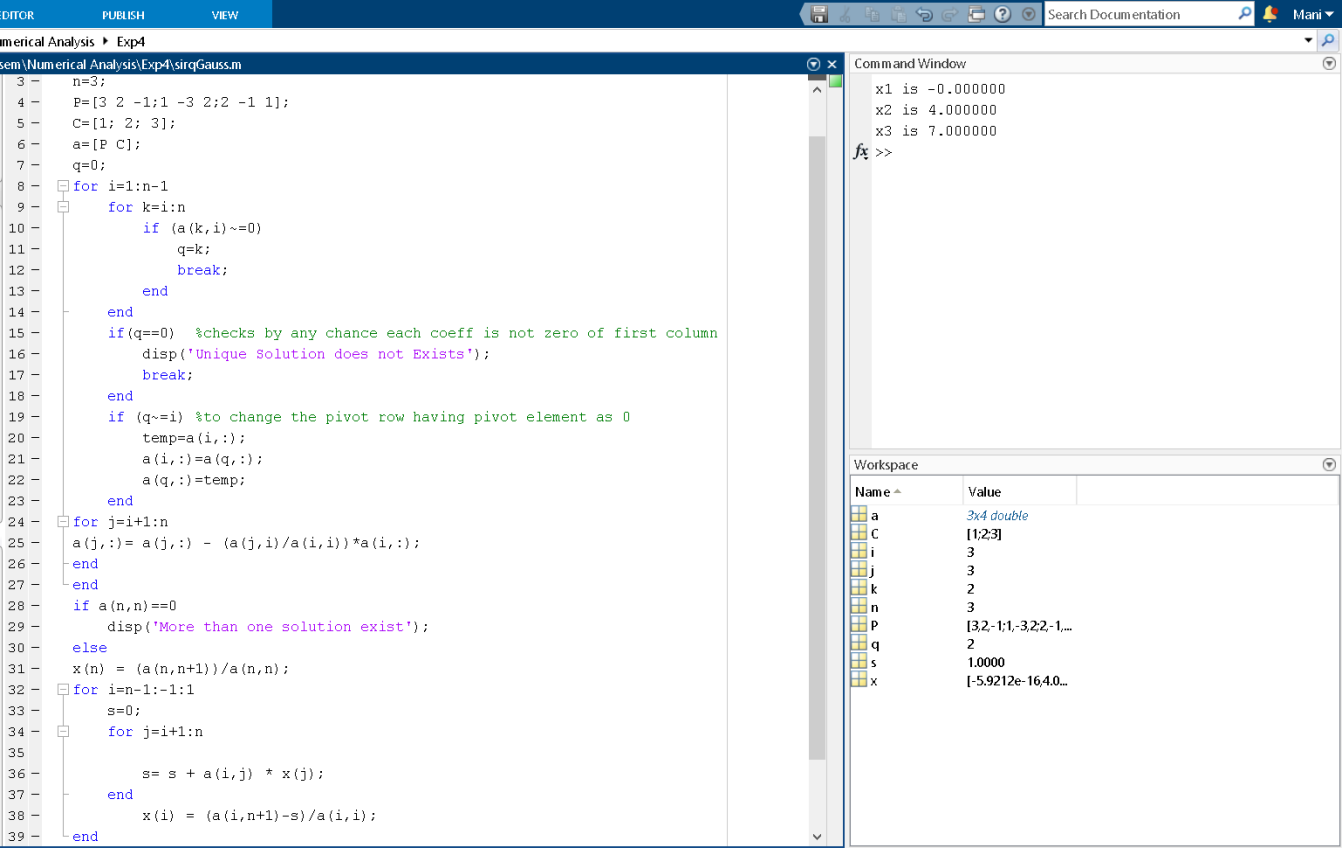
CODE:

```
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');
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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;
    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

$$3x_1 + 2x_2 - x_3 = 1$$
$$x_1 - 3x_2 + 2x_3 = 2$$
$$2x_1 - x_2 + x_3 = 3.$$



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
```

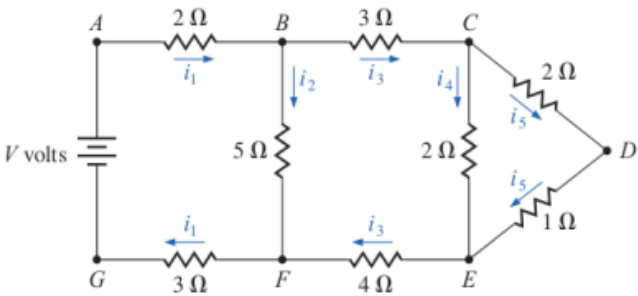
LU FACTORIZATION QUESTION:

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.

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```
5 - C=[5.5; 0; 0; 0; 0];
6 - q=0;
7 - for i=1:n-1
8 -     for k=i:n
9 -         if (a(k,i)~=0)
10 -             q=k;
11 -             break;
12 -         end
13 -     end
14 -     if(q==0) %checks by any chance each coeff is not zero of first column
15 -         disp('Unique Solution does not Exists');
16 -         break;
17 -     end
18 -     if (q~=i) %to change the pivot row having pivot element as 0
19 -         temp=a(i,:);
20 -         a(i,:)=a(q,:);
21 -         a(q,:)=temp;
22 -         temp=C(i,:);
23 -         C(i,:)=C(q,:);
24 -         C(q,:)=temp;
25 -     end
26 -     for j=i+1:n
27 -         m(j,i)=a(j,i)/a(i,i);
28 -         a(j,:)= a(j,:) - m(j,i)*a(i,:);
29 -     end
30 - end
31 - if a(n,n)==0
32 -     disp('More than one solution exist');
33 - else
34 -     U=a;
35 -     L=m;
36 -     for i=1:n
37 -         L(i,i)=1;
38 -     end
39 -     y=inv(L)*C; %or we can use y=L\C;
40 -     x=inv(U)*y; %x=U\y;
41 - end
```

Command Window

x1 is 1.120561  
x2 is -0.020561  
x3 is 0.041121  
x4 is -0.195327  
x5 is 0.236449  
fx >>

Workspace

Name	Value
a	5x5 double
C	[5.5000;0;0;0;0]
i	5
j	5
k	4
L	5x5 double
m	5x4 double
n	5
q	4
temp	0
U	5x5 double
x	[1.1206;-0.0206;0...
y	[5.5000;0;0;-1.10...

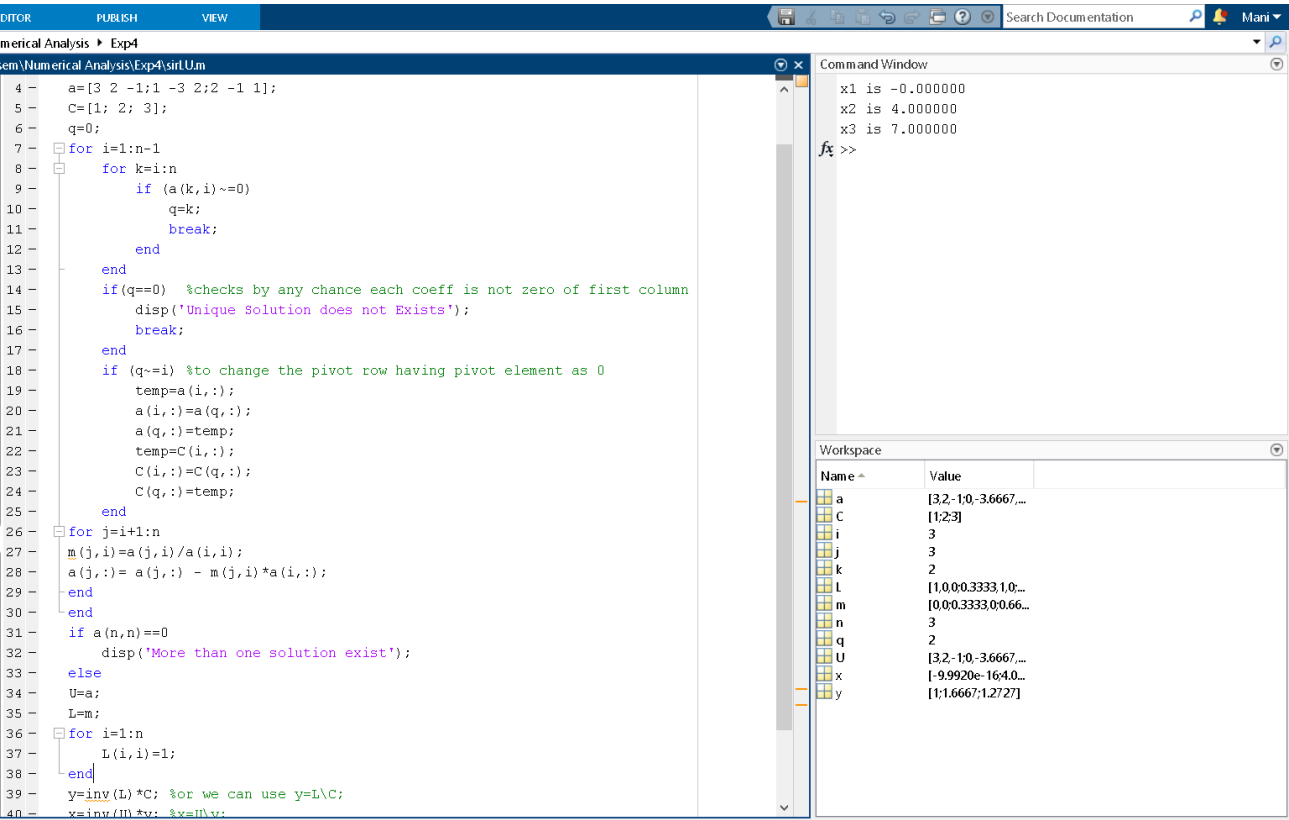
CODE:

```
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
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    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

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



CODE:

```
clc
clear
n=3;
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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    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
```