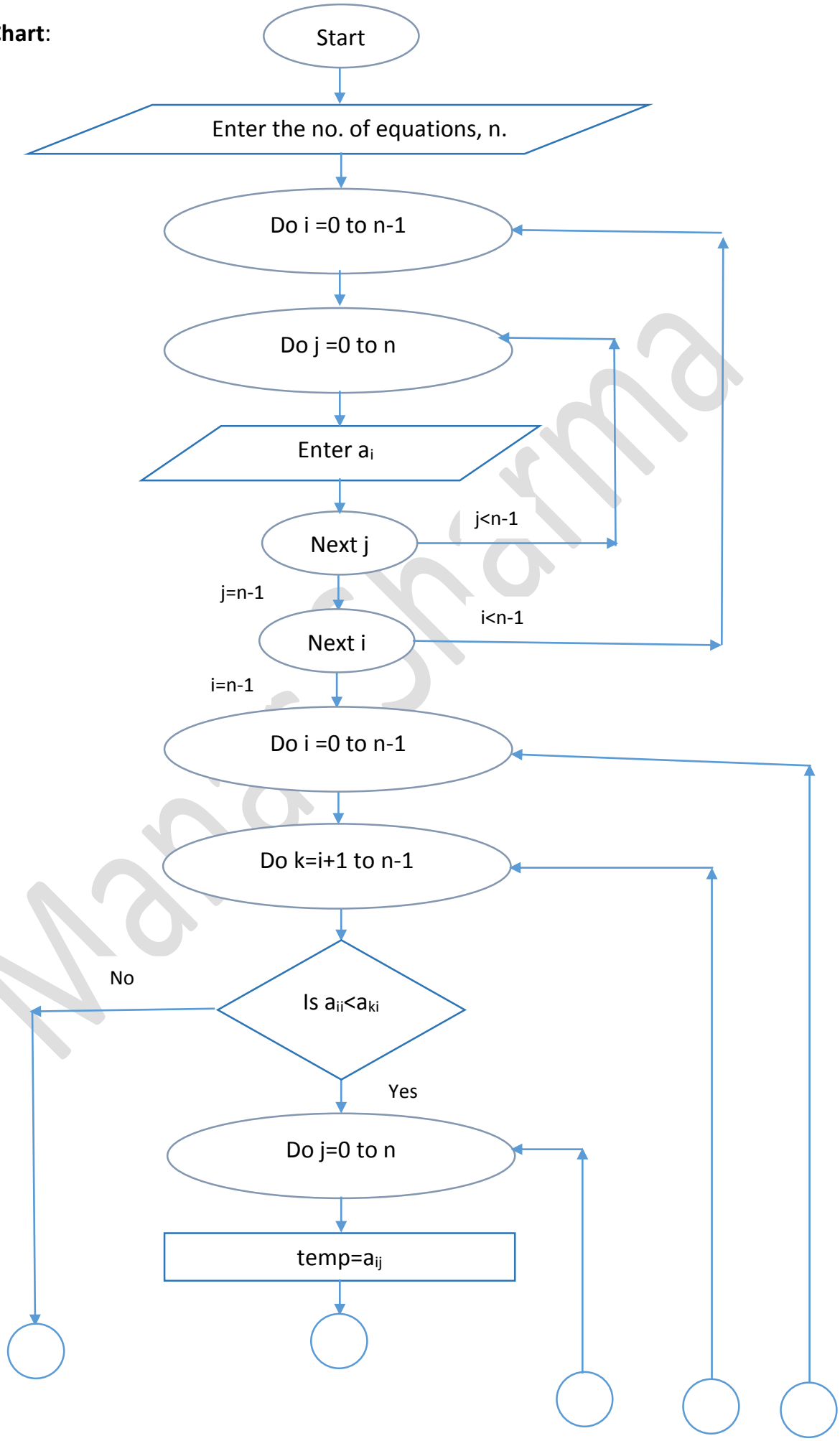
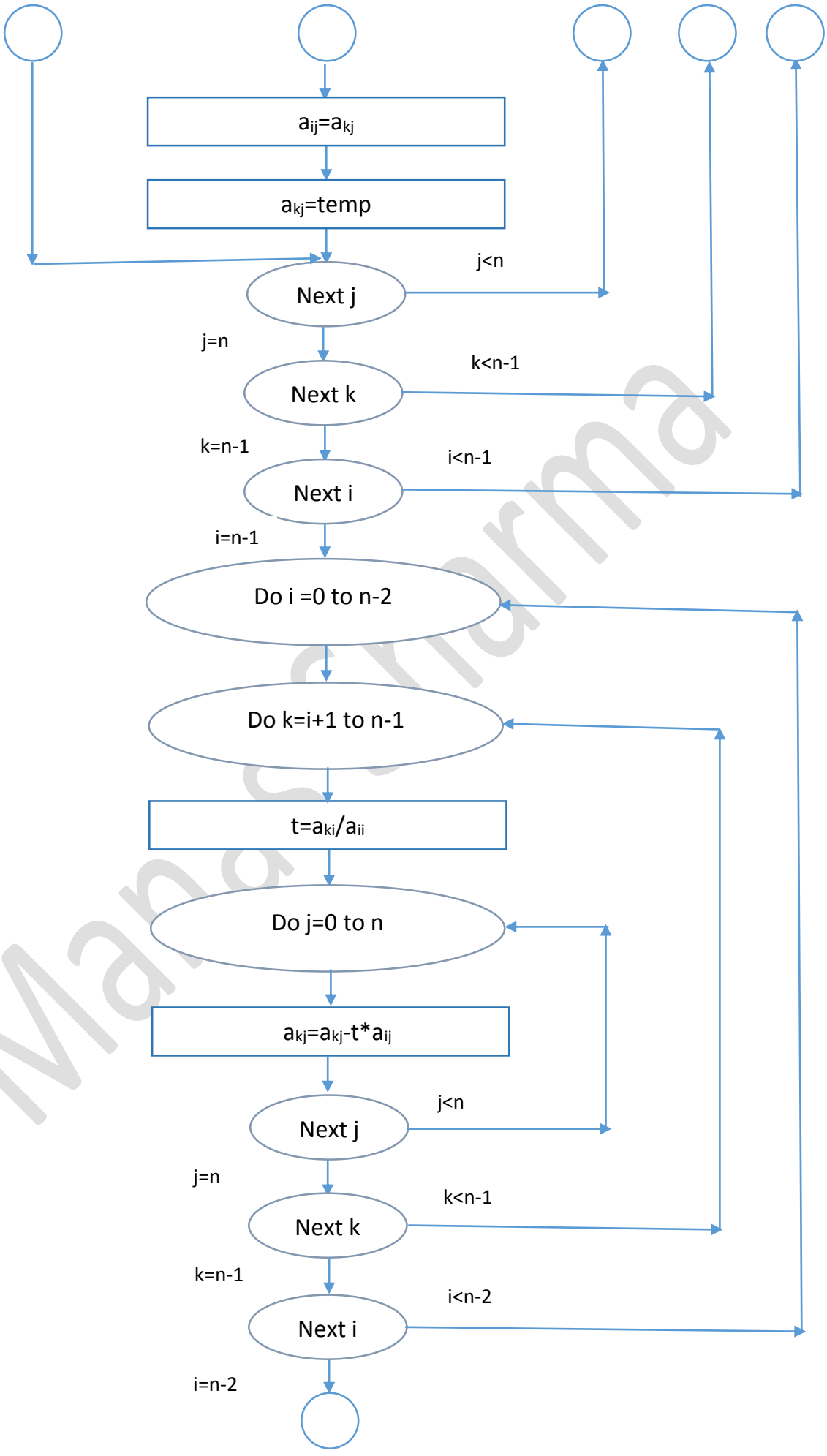
Aim: To solve a system of linear equations using Gaussian Elimination.

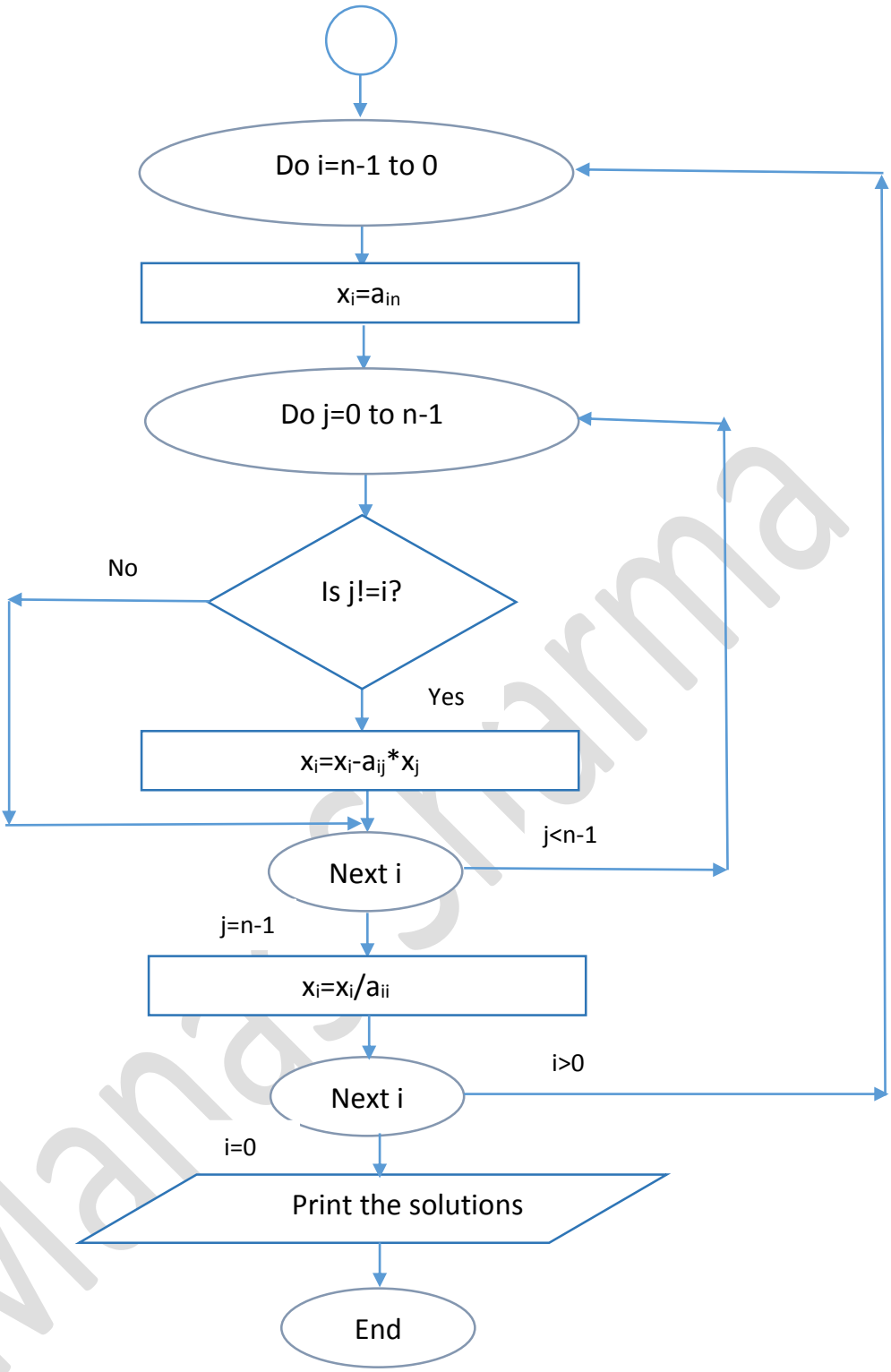
Algorithm:

1. Enter the no. of equations, n.
2. Create an nx(n+1) matrix, which will be the augmented matrix.
3. Create an array ‘x’ of size ‘n’ which will store the solutions.
4. Enter the elements of augmented matrix.
5. Pivoting:
   For i=0 to n-1
   For k=i+1 to n-1
   If $a_{ii}<a_{ki}$
   Then For j=0 to n
   Swap a_{ij} with a_{kj}
6. Gaussian Elimination:
   For
   For k=i+1 to n-1
   $t=a_{ki}/a_{ii}$
   For j=0 to n-1
   $a_{kj}=a_{kj}-t*a_{ij}$
7. Back-substitution:
   For i=n-1 to 0
   $x_i=a_{in}$
   For j=0 to n-1
   If j != i
   Then $x_i=x_i-a_{ij}*x_j$
   $x_i=x_i/a_{ii}$
8. Print the solution i.e. the elements of x.

Flow Chart:




$a_{ij}=a_{kj}$
$a_{kj}=temp$
j<n
Next j
j=n
k<n-1
Next k
k=n-1
i<n-1
Next i
i=n-1
Do i =0 to n-2
Do k=i+1 to n-1
$t=a_{ki}/a_{ii}$
Do j=0 to n
$a_{kj}=a_{kj}-t*a_{ij}$
j<n
Next j
j=n
k<n-1
Next k
k=n-1
i<n-2
Next i
i=n-2



Program:

```
//Gauss Elimination
#include<iostream>
#include<iomanip>
using namespace std;
int main()
{
    int n,i,j,k;
    cout.precision(4);        //set precision
    cout.setf(ios::fixed);
    cout<<"\nEnter the no. of equations\n";
    cin>>n;                 //input the no. of equations
    float a[n][n+1],x[n];        //declare an array to store the elements
of augmented-matrix
    cout<<"\nEnter the elements of the augmented-matrix row-wise:\n";
    for (i=0;i<n;i++)
        for (j=0;j<=n;j++)
            cin>>a[i][j];    //input the elements of array
    for (i=0;i<n;i++)                    //Pivotisation
        for (k=i+1;k<n;k++)
            if (a[i][i]<a[k][i])
                for (j=0;j<=n;j++)
                {
                    double temp=a[i][j];
                    a[i][j]=a[k][j];
                    a[k][j]=temp;
                }
    cout<<"\nThe matrix after Pivotisation is:\n";
    for (i=0;i<n;i++)            //print the new matrix
    {
        for (j=0;j<=n;j++)
            cout<<a[i][j]<<setw(16);
        cout<<"\n";
    }
    for (i=0;i<n-1;i++)          //loop to perform the gauss elimination
        for (k=i+1;k<n;k++)
            {
                double t=a[k][i]/a[i][i];
                for (j=0;j<=n;j++)
                    a[k][j]=a[k][j]-t*a[i][j];    //make the elements below
the pivot elements equal to zero or elimnate the variables
            }

    cout<<"\n\nThe matrix after gauss-elimination is as follows:\n";
    for (i=0;i<n;i++)            //print the new matrix
    {
        for (j=0;j<=n;j++)
            cout<<a[i][j]<<setw(16);
        cout<<"\n";
    }
    for (i=n-1;i>=0;i--)                //back-substitution
    {                         //x is an array whose values correspond to the
values of x,y,z..
        x[i]=a[i][n];                //make the variable to be calculated
equal to the rhs of the last equation
        for (j=0;j<n;j++)
            if (j!=i)            //then subtract all the lhs values except
the coefficient of the variable whose value
is being calculated
                x[i]=x[i]-a[i][j]*x[j];
```

```
        x[i]=x[i]/a[i][i];            //now finally divide the rhs by the
coefficient of the variable to be calculated
    }
    cout<<"\nThe values of the variables are as follows:\n";
    for (i=0;i<n;i++)
        cout<<x[i]<<endl;            // Print the values of x, y,z,....
    return 0;
}
```

Output:

```
Enter the no. of equations
4

Enter the elements of the augmented-matrix row-wise:
10      -7      3       5       6
-6      8       -1      -4      5
3       1       4       11      2
5       -9      -2      4       7

The matrix after Pivotisation is:
10.0000         -7.0000          3.0000          5.0000          6.0000
-6.0000          8.0000         -1.0000         -4.0000          5.0000
3.0000          1.0000          4.0000         11.0000          2.0000
5.0000         -9.0000         -2.0000          4.0000          7.0000


The matrix after gauss-elimination is as follows:
10.0000         -7.0000          3.0000          5.0000          6.0000
-0.0000          3.8000          0.8000         -1.0000          8.6000
0.0000         -0.0000          2.4474         10.3158         -6.8158
-0.0000         -0.0000         -0.0000          9.9247          9.9247

The values of the variables are as follows:
5.0000
4.0000
-7.0000
1.0000
```

```
Enter the no. of equations
3

Enter the elements of the augmented-matrix row-wise:
1       4       -1      -5
1       1       -6      -16
3       -1      -1      4^C
manas@manas-VirtualBox:~/NA$ ./a.out

Enter the no. of equations
3

Enter the elements of the augmented-matrix row-wise:
1       4       -1      -5
1       1       -6      -12
3       -1      -1      4

The matrix after Pivotisation is:
3.0000         -1.0000         -1.0000          4.0000
1.0000          4.0000         -1.0000         -5.0000
1.0000          1.0000         -6.0000        -12.0000


The matrix after gauss-elimination is as follows:
3.0000         -1.0000         -1.0000          4.0000
0.0000          4.3333         -0.6667         -6.3333
0.0000         -0.0000         -5.4615        -11.3846

The values of the variables are as follows:
1.6479
-1.1408
2.0845
```