SOLUTION OF SYSTEM OF EQUATIONS BY MATRIX INVERSION METHOD

■ ***THEORY :***

The system of linear equations ,discussed in the above sections for various methods can be written in a compact form as,

$$Ax = b \qquad (1),$$

Where **A** is the coefficient matrix, **x** is the vector containing unknowns and **b** is the constant matrix (vector). Now, multiplied both sides of equation (1) from left by $\mathbf{A^{-1}}$, we get,

$$A^{-1}Ax = A^{-1}b \qquad (2),$$

We know that, $\mathbf{A^{-1}A=I}$,the identity matrix, equation (2) becomes,

$$x = A^{-1}b \qquad (3)$$

which gives the required solutions of the system of equations.

■ ***ALGORITHM:***

1. Declare variables
2. Enter the order and the coefficients of the matrix
3. Enter the identity matrix
4. Simultaneously use Gauss Jordan elimination on the coefficient matrix A and the same in identity matrix C
5. Multiply the new matrix C from identity C with constant vector **b**
6. do I=1,n
7. do j=1,n
8. d(i)=d(i)+c(i,j)*b(j)
9. do i=1,n
10. x(i)=d(i)
11. Write the roots and the inverse matrix
12. stop

■ ***FORTRAN CODE :***

```
!    SOLUTION OF SYSTEM OF LINEAR EQUATIONS BY MATRIX INVERSION METHOD
```

```
      real a(10,10),b(10),x(10),d(10),c(10,10),fact1,prod1,fact
      integer i,j,n

      write(*,*) "Enter the order of the system :"
      read(*,*) n
      write(*,*) "Enter the coefficients of the system of equations."
      do i=1,n
      read(*,*) (a(i,j),j=1,n), b(i)
      enddo
!     ENTER THE IDENTITY MATRIX
      do i=1,n
      do j=1,n
      if (i.eq.j) then
      c(i,j)=1
      else
      c(i,j)=0
      endif
      enddo
      enddo

!     FORWARD GAUSS ELIMINATION

      do k =1,n-1
      fact1=1/a(k,k)
      do i=k+1,n
      prod1=a(i,k)*fact1
      do j=1,n

      a(i,j)=a(i,j)-prod1*a(k,j)
      c(i,j)=c(i,j)-prod1*c(k,j)

      enddo
      enddo
      enddo

!     BACKWARD GAUSS ELIMINATION

      do k =n,1,-1
      fact1=1/a(k,k)
      do i=k-1,1,-1
```

```
      prod1=a(i,k)*fact1
      do j=n,1,-1
      a(i,j)=a(i,j)-prod1*a(k,j)
      c(i,j)=c(i,j)-prod1*c(k,j)
      enddo
      enddo
      Enddo

!     CREATE IDENTITY

      do i=1,n
      fact=a(i,i)
      do j=1,n
      a(i,j)=a(i,j)/fact
      c(i,j)=c(i,j)/fact
      enddo
      Enddo

!     MULTIPLICATION OF THE INVERSE AND THE VECTOR b(i)
      do i=1,n
      do j=1,n
      d(i)=d(i)+c(i,j)*b(j)
      enddo
      enddo

!     ROOTS AND THE INVERSE MATRIX
      do i=1,n
      x(i)=d(i)
      enddo
      write(*,*) "The solution of the system of equations are :", (x(i),i=1,n)
      write(*,*) "The inverse matrix is :"
      do i=1,n
      write(*,*) (c(i,j),j=1,n)
      enddo
      stop
      end
```

- ***OUTPUT :***

```
Enter the order of the system :
3
Enter the coefficients of the system of equations.
2 1 3 1
4 4 7 1
2 5 9 3
The solution of the system of equations are :     -5.000000E-01
-1.000000
          1.000000
The inverse matrix is :
     6.250000E-02       3.750000E-01      -3.125000E-01
         -1.375000       7.500000E-01      -1.250000E-01
     7.500000E-01      -5.000000E-01       2.500000E-01
Stop - Program terminated.
```

……