

## **SOLUTION OF SYSTEM OF EQUATIONS BY GAUSS-JORDAN METHOD**

### ● **THEORY :**

Gauss Jordan method is a modified version of Gauss elimination method for solving system of linear equations by elimination. In Gauss elimination method we eliminate the lower triangular part of the coefficient matrix by pivoting elimination, whereas in GJ method we not only eliminate the lower part as well as the upper triangular part of the coefficient matrix by pivoting elimination. Then in GJ method we simplify the trace element of the coefficient matrix to unity to make the coefficient matrix an identity matrix. Then in the last step ,we use back substitute method to find the solution of the system.

$$\begin{pmatrix} a_{11} & a_{12} & a_{13} \\ a_{21} & a_{22} & a_{23} \\ a_{31} & a_{32} & a_{33} \end{pmatrix} \begin{pmatrix} x \\ y \\ z \end{pmatrix} = \begin{pmatrix} b_1 \\ b_2 \\ b_3 \end{pmatrix} \quad (1)$$

After performing GJ method in this equation, we get,

$$\begin{pmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{pmatrix} \begin{pmatrix} x \\ y \\ z \end{pmatrix} = \begin{pmatrix} b'_1 \\ b'_2 \\ b'_3 \end{pmatrix}$$

From this we can get the solution of the system as,

$$x=b'_1, y= b'_2, \text{ and } z=b'_3$$

### ● **ALGORITHM :**

1. Declare variables
2. Enter the order and coefficients of the system of equations
3. Use do loop for i,j,k from 1,n to
4.  $A(i,j)=A(i,j)-A(i,k)/A(k,k)*A(k,j)$
5. End do loop
6. Use do loop for i,j,k from n,1,-1 to
7.  $A(i,j)=A(i,j)-A(i,k)/A(k,k)*A(k,j)$
8. end do loop
9. Use do loop for i,j=1,n

10.  $A(i,j)=A(i,j)/A(i,i)$
11. End do loop
12.  $X(i)=A(i,n+1)$
13. Write the roots
14. Stop programme

### ● **FORTRAN CODE :**

#### **! SOLUTION OF SYSTEM OF LINEAR EQUATIONS BY GAUSS-JORDAN METHOD**

```
real a(10,10),x(10),fact,prod
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+1)
enddo

do k =1,n-1
  fact=1/a(k,k)
  do i=k+1,n
    prod=a(i,k)*fact
    do j=1,n+1

      a(i,j)=a(i,j)-prod*a(k,j)

    enddo
  enddo
enddo

do k =n,1,-1
  fact=1/a(k,k)
  do i=k-1,1,-1
    prod=a(i,k)*fact
    do j=n+1,1,-1
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a(i,j)=a(i,j)-prod*a(k,j)

enddo
enddo
enddo

do i=1,n
fact=a(i,i)
do j=1,n+1
a(i,j)=a(i,j)/fact
enddo
enddo
do i=1,n
x(i)=a(i,n+1)
enddo
write(*,*) "The solution of the system of equations are :", (x(i),i=1,n)
stop
end

```

● **OUTPUT :**

Enter the order of the system :

3

Enter the coefficients of the system of equations.

3 6 1 16

2 4 3 13

1 3 2 9

The solution of the system of equations are : 1.000000

2.000000

1.000000

Stop - Program terminated.