PRACTICAL 4(b)

Aim: To solve the system of equations using Gauss Jordan method.

ASSIGNMENT

1 ***Q1.Solve the following system of equations***
2x1 + x2 -x3 = 1
5x1 + 2x2 + 2x3 = -4
3x1 + x2 + x3 = 5
using the Gauss-Jordan method.

```
→   kill(all)$
    keepfloat:true$

    A:matrix(                       /*...Coefficient Matrix...*/
            [2.0, 1.0, -1.0],
            [5.0, 2.0, 2.0],
            [3.0, 1.0, 1.0])$

    B:matrix(                       /*...Constants Matrix...*/
            [1.0], [-4.0], [5.0])$

    X:matrix(                       /*...Variables Matrix...*/
            [x], [y], [z])$

    print("Now, the augmented matrix will be,")$
    Aug:addcol(A,B);                /*...Creating Augmented Matrix...*/
    print(" ");

    print("Now, the Echelon Form is,")$
    S : echelon(Aug);               /*..Calculates Echolen Form of Matrix..*/
    print(" ");

    print("R2 -> R2 - ",float(S[2][3])," * R3")$
    S[2] : S[2] - S[2][3].S[3]$
    S;
    print(" ");

    print("R1 -> R1 - ",float(S[1][3])," * R3")$
    S[1] : S[1] - S[1][3].S[3]$
    S;
    print(" ");

    print("R1 -> R1 - ",float(S[1][2])," * R2")$
    S[1] : S[1] - S[1][2].S[2]$
    S;
    print(" ");

    print("The Solution Matrix is: ")$
    X=col(S,4);
```

Now, the augmented matrix will be,

(%o6) $\begin{pmatrix} 2.0 & 1.0 & -1.0 & 1.0 \\ 5.0 & 2.0 & 2.0 & -4.0 \\ 3.0 & 1.0 & 1.0 & 5.0 \end{pmatrix}$

(%o7)

Now, the Echelon Form is,

(%o9) $\begin{pmatrix} 1 & 0.5 & -0.5 & 0.5 \\ 0 & 1 & -9.0 & 13.0 \\ 0 & 0 & 1 & -5.0 \end{pmatrix}$

(%o10)

$R2 \rightarrow R2 - \quad -9.0 \quad * \ R3$

2 Q2.Solve the following system of equations

$x + y - z = -3$

$6x + 2y + 2z = 2$

$-3x + 4y + z = 1$

using the Gauss-Jordan method.

```
kill(all)$
keepfloat:true$

A:matrix(                    /*...Coefficient Matrix...*/
        [1.0, 1.0, -1.0],
        [6.0, 2.0, 2.0],
        [-3.0, 4.0, 1.0])$

B:matrix(                    /*...Constants Matrix...*/
        [-3.0], [2.0], [1.0])$

X:matrix(                    /*...Variables Matrix...*/
        [x], [y], [z])$

print("Now, the augmented matrix will be,")$
Aug:addcol(A,B);             /*...Creating Augmented Matrix...*/
print(" ");

print("Now, the Echelon Form is,")$
S : echelon(Aug);            /*..Calculates Echolen Form of Matrix..*/
print(" ");

print("R2 -> R2 - ",float(S[2][3])," * R3")$
S[2] : S[2] - S[2][3].S[3]$
S;
print(" ");

print("R1 -> R1 - ",float(S[1][3])," * R3")$
S[1] : S[1] - S[1][3].S[3]$
S;
print(" ");

print("R1 -> R1 - ",float(S[1][2])," * R2")$
S[1] : S[1] - S[1][2].S[2]$
S;
print(" ");

print("The Solution Matrix is: ")$
X=col(S,4);
```

Now, the augmented matrix will be,

(%o6) $$\begin{pmatrix} 1.0 & 1.0 & -1.0 & -3.0 \\ 6.0 & 2.0 & 2.0 & 2.0 \\ -3.0 & 4.0 & 1.0 & 1.0 \end{pmatrix}$$

(%o7)

Now, the Echelon Form is,

(%o9) $$\begin{pmatrix} 1 & 1.0 & -1.0 & -3.0 \\ 0 & 1 & -2.0 & -5.0 \\ 0 & 0 & 1 & 2.25 \end{pmatrix}$$

(%o10)

$R2 \rightarrow R2 - \ -2.0 \ * R3$

3 Q3.Using the Gauss-Jordan method, find the inverse of the following matrix.

([1 2 3]
[0 1 5]
[5 6 0])

```
kill(all)$
keepfloat:true$
A:matrix(                          /*...Given Matrix...*/
        [1.0, 2.0, 3.0],
        [0.0, 1.0, 5.0],
        [5.0, 6.0, 0.0])$
B:matrix(                          /*...Identity Matrix...*/
        [1.0,0.0,0.0],
        [0.0,1.0,0.0],
        [0.0,0.0,1.0])$

print("Now, the augmented matrix will be,")$
Aug:addcol(A,B);                   /*...Creating Augmented Matrix...*/
print("")$

print("The Echelon Form is :")$
S : echelon(Aug);                  /*..Calculates Echolen Form of Matrix..*/
print(" ")$

/*..Operations so as to form reduced row echelon form..*/
print("R2 -> R2 - ",float(S[2][3])," * R3")$
S[2] : S[2] - S[2][3].S[3]$
S;
print(" ")$

print("R1 -> R1 - ",float(S[1][3])," * R3")$
S[1] : S[1] - S[1][3].S[3]$
S;
print(" ")$

print("R1 -> R1 - ",float(S[1][2])," * R2")$
S[1] : S[1] - S[1][2].S[2]$
S;
print(" ")$

print("The Inverse of the Given Matrix is: ")$
Inv: submatrix(S,1,2,3);
```

Now, the augmented matrix will be,

(%o5) $\begin{pmatrix} 1.0 & 2.0 & 3.0 & 1.0 & 0.0 & 0.0 \\ 0.0 & 1.0 & 5.0 & 0.0 & 1.0 & 0.0 \\ 5.0 & 6.0 & 0.0 & 0.0 & 0.0 & 1.0 \end{pmatrix}$

The Echelon Form is :

(%o8) $\begin{pmatrix} 1 & 1.2 & 0 & 0 & 0 & 0.2 \\ 0 & 1 & 5.0 & 0 & 1.0 & 0 \\ 0 & 0 & 1 & -1.0 & 0.8 & 0.2 \end{pmatrix}$

$R2 \rightarrow R2 - \quad 5.0 \quad * R3$

(%o12) $\begin{pmatrix} 1 & 1.2 & 0 & 0 & 0 & 0.2 \\ 0 & 1 & 0.0 & 5.0 & -3.0 & -1.0 \\ 0 & 0 & 1 & -1.0 & 0.8 & 0.2 \end{pmatrix}$

4 Q4.Solve the following given system of equations

$-3y + 7z = 2$

$x + 2y - z = 3$

$5x - 2y = 2$

using the Gauss-Jordan method

```
kill(all)$
keepfloat:true$

A:matrix(                    /*...Coefficient Matrix...*/
        [0.0, -3.0, 7.0],
        [1.0, 2.0, -1.0],
        [5.0, -2.0, 0.0])$

B:matrix(                    /*...Constants Matrix...*/
        [2.0], [3.0], [2.0])$

X:matrix(                    /*...Variables Matrix...*/
        [x], [y], [z])$

print("Now, the augmented matrix will be,")$
Aug:addcol(A,B);             /*...Creating Augmented Matrix...*/
print(" ");

print("Now, the Echelon Form is,")$
S : echelon(Aug);            /*..Calculates Echolen Form of Matrix..*/
print(" ");

print("R2 -> R2 - ",float(S[2][3])," * R3")$
S[2] : S[2] - S[2][3].S[3]$
S;
print(" ");

print("R1 -> R1 - ",float(S[1][3])," * R3")$
S[1] : S[1] - S[1][3].S[3]$
S;
print(" ");

print("R1 -> R1 - ",float(S[1][2])," * R2")$
S[1] : S[1] - S[1][2].S[2]$
S;
print(" ");

print("The Solution Matrix is: ")$
X=col(S,4);
```

Now, the augmented matrix will be,

(%o6) $$\begin{pmatrix} 0.0 & -3.0 & 7.0 & 2.0 \\ 1.0 & 2.0 & -1.0 & 3.0 \\ 5.0 & -2.0 & 0.0 & 2.0 \end{pmatrix}$$

(%o7)

Now, the Echelon Form is,

(%o9) $$\begin{pmatrix} 1 & -0.4 & 0 & 0.4 \\ 0 & 1 & -0.4166666666666666 & 1.083333333333333 \\ 0 & 0 & 1 & 0.913043478260869 6 \end{pmatrix}$$

(%o10)

*R2 → R2 − −0.4166666666666666 * R3*

5 Q5.Show that the following system of equations have infinite number of solutions :

$$
\begin{aligned}
x + y - 3z &= 4 \\
2x + y - z &= 2 \\
3x + 2y - 4z &= 6.
\end{aligned}
$$

```
kill(all)$
keepfloat:true$
A:matrix(                     /*...Coefficient Matrix...*/
        [1.0, 1.0, -3.0],
        [2.0, 1.0, -1.0],
        [3.0, 2.0, -4.0])$
B:matrix(                     /*...Constants Matrix...*/
        [4.0], [2.0], [6.0])$
X:matrix(                     /*...Variables Matrix...*/
        [x], [y], [z])$

print("Now, the augmented matrix will be,")$
Aug:addcol(A,B);              /*...Creating Augmented Matrix...*/
print(" ");

print("Now, the Echelon Form is,")$
S : echelon(Aug);             /*..Calculates Echolen Form of Matrix..*/
print(" ");

print("R2 -> R2 - ",float(S[2][3])," * R3")$
S[2] : S[2] - S[2][3].S[3]$
S;
print(" ");

print("R1 -> R1 - ",float(S[1][3])," * R3")$
S[1] : S[1] - S[1][3].S[3]$
S;
print(" ");

print("R1 -> R1 - ",float(S[1][2])," * R2")$
S[1] : S[1] - S[1][2].S[2]$
S;
/*..The last row after solving the matrix consists of all zeroes
this shows that the given set of equations has infinite number of
solutions...*/
```

Now, the augmented matrix will be,

(%o6) $$\begin{pmatrix} 1.0 & 1.0 & -3.0 & 4.0 \\ 2.0 & 1.0 & -1.0 & 2.0 \\ 3.0 & 2.0 & -4.0 & 6.0 \end{pmatrix}$$

(%o7)

Now, the Echelon Form is,

(%o9) $$\begin{pmatrix} 1 & 1.0 & -3.0 & 4.0 \\ 0 & 1 & -5.0 & 6.0 \\ 0 & 0 & 0 & 0 \end{pmatrix}$$

(%o10)

$R2 \rightarrow R2 - \quad -5.0 \quad * R3$

(%o13) $$\begin{pmatrix} 1 & 1.0 & -3.0 & 4.0 \\ 0 & 1 & -5.0 & 6.0 \end{pmatrix}$$