PRACTICAL 4(a)

Aim: To solve the system of equations using Gaussian elimination method.

ASSIGNMENT

1 *Q1.Solve the system of equations*
3x1 - 0.1x2 - 0.2x3 = 7.85
0.1x1 + 7x2 -0.3x3 = -19.3
0.3x1 - 0.2x2 + 10x3 = 71.4
using the Gauss elimination method.

```
kill(all)$ /* kill all variables and clear memory */
keepfloat:true$ /* keep float values as it is */

'A = A:matrix( /* function to create a matrix */
        [3, -0.1, -0.2],
        [0.1, 7, -0.3],
        [0.3, -0.2, 10])$
'B = B:matrix(
        [7.85], [-19.3], [71.4])$
'X = X:matrix(
        ['x], ['y], ['z])$

/* Self-explainatory print statements */
print("Let",'A=A,",",'B=B,",",'X=X)$
print("")$
print("Now, the augmented matrix will be,")$
print("")$

/* Creating augmented matrix by joining B to A */
/* Since, B is a column matrix, addcol adds it to end */
'Aug = Aug:addcol(A,B);

print("")$
print("I. FORWARD ELIMINATION")$

n:length(A[1])$

/* -------- Forward Elimination -------- */
/* Moving from one pivot row to the next */
for k:1 thru n-1 do(
    /* Moving below the pivot row */
    for i:k+1 thru n do(
        factor: Aug[i,k]/Aug[k,k],
        print(""),
        print("=> R",i,"= R",i,"- (",'Aug[i,k]/'Aug[k,k],")*","R",k),
        /* Applying Ri -> Ri - (Augik/Augkk)*Rk */
        Aug[i]: Aug[i]-factor·Aug[k],
        print(Aug)
    )
)$

print("")$
print("Therefore, the augmented matrix")$
print("reduced to upper triangular form will be,")$
print("")$
Aug;

/* Printing reduced system of eqs */
print("")$
print("Now, the system of equations will be,")$
load("eigen")$ /* to use innerproduct function */
/* innerproduct returns dot product */
/* submatrix returns a new matrix from matrix Aug
with mentioned rows and columns deleted. */
AA:innerproduct(submatrix(Aug,n+1),X)$
```

2 Q2.Solve the following system of equations

10x +2y - z = 27

-3x -6y + 2z = −61.5

x + y + 5z =-21.5

using Gaussian elimination method.

```
kill(all)$ /* kill all variables and clear memory */
keepfloat:true$ /* keep float values as it is */

'A = A:matrix( /* function to create a matrix */
        [10, 2, -1],
        [-3, -6, 2],
        [1, 1, 5])$
'B = B:matrix(
        [27], [-61.5], [-21.5])$
'X = X:matrix(
        ['x], ['y], ['z])$

/* Self-explainatory print statements */
print("Let",'A=A,",",'B=B,",",'X=X)$
print("")$
print("Now, the augmented matrix will be,")$
print("")$

/* Creating augmented matrix by joining B to A */
/* Since, B is a column matrix, addcol adds it to end */
'Aug = Aug:addcol(A,B);

print("")$
print("I. FORWARD ELIMINATION")$

n:length(A[1])$

/* -------- Forward Elimination -------- */
/* Moving from one pivot row to the next */
for k:1 thru n-1 do(
    /* Moving below the pivot row */
    for i:k+1 thru n do(
        factor: Aug[i,k]/Aug[k,k],
        print(""),
        print("=> R",i,"= R",i,"- (",'Aug[i,k]/'Aug[k,k],")*","R",k),
        /* Applying Ri -> Ri - (Augik/Augkk)*Rk */
        Aug[i]: Aug[i]-factor·Aug[k],
        print(Aug)
    )
)$

print("")$
print("Therefore, the augmented matrix")$
print("reduced to upper triangular form will be,")$
print("")$
Aug;

/* Printing reduced system of eqs */
print("")$
print("Now, the system of equations will be,")$
load("eigen")$ /* to use innerproduct function */
/* innerproduct returns dot product */
/* submatrix returns a new matrix from matrix Aug
with mentioned rows and columns deleted. */
AA:innerproduct(submatrix(Aug,n+1),X)$
```

3 Q3.Solve the following system of equations

$$4x - y + 2z = 15$$

$$-x + 2y + 3z = 5$$

$$5x - 7y + 9z = 8$$

using Gauss elimination method.

```
kill(all)$ /* kill all variables and clear memory */
keepfloat:true$ /* keep float values as it is */

'A = A:matrix( /* function to create a matrix */
        [4, -1, 2],
        [-1, 2, 3],
        [5, -7, 9])$
'B = B:matrix(
        [15], [5], [8])$
'X = X:matrix(
        ['x], ['y], ['z])$

/* Self-explainatory print statements */
print("Let",'A=A,",",'B=B,",",'X=X)$
print("")$
print("Now, the augmented matrix will be,")$
print("")$

/* Creating augmented matrix by joining B to A */
/* Since, B is a column matrix, addcol adds it to end */
'Aug = Aug:addcol(A,B);

print("")$
print("I. FORWARD ELIMINATION")$

n:length(A[1])$

/* -------- Forward Elimination -------- */
/* Moving from one pivot row to the next */
for k:1 thru n-1 do(
    /* Moving below the pivot row */
    for i:k+1 thru n do(
        factor: Aug[i,k]/Aug[k,k],
        print(""),
        print("=> R",i,"= R",i,"- (",'Aug[i,k]/'Aug[k,k],")*","R",k),
        /* Applying Ri -> Ri - (Augik/Augkk)*Rk */
        Aug[i]: Aug[i]-factor·Aug[k],
        print(Aug)
    )
)$

print("")$
print("Therefore, the augmented matrix")$
print("reduced to upper triangular form will be,")$
print("")$
Aug;

/* Printing reduced system of eqs */
print("")$
print("Now, the system of equations will be,")$
load("eigen")$ /* to use innerproduct function */
/* innerproduct returns dot product */
/* submatrix returns a new matrix from matrix Aug
with mentioned rows and columns deleted. */
AA:innerproduct(submatrix(Aug,n+1),X)$
```

4 Q4.Solve the following system of equations

$$0.5x_1 - x_2 = -9.5$$

$$1.02x_1 - 2x_2 = -18.8$$

using Gaussian elimination method.

```
kill(all)$ /* kill all variables and clear memory */
keepfloat:true$ /* keep float values as it is */
'A = A:matrix( /* function to create a matrix */
        [0.5, -1],
        [1.02, -2])$
'B = B:matrix(
        [-9.5], [-18.8])$
'X = X:matrix(
        ['x], ['y])$

/* Self-explainatory print statements */
print("Let",'A=A,",",'B=B,",",'X=X)$
print("")$
print("Now, the augmented matrix will be,")$
print("")$

/* Creating augmented matrix by joining B to A */
/* Since, B is a column matrix, addcol adds it to end */
'Aug = Aug:addcol(A,B);

print("")$
print("I. FORWARD ELIMINATION")$

n:length(A[1])$

/* -------- Forward Elimination -------- */
/* Moving from one pivot row to the next */
for k:1 thru n-1 do(
    /* Moving below the pivot row */
    for i:k+1 thru n do(
        factor: Aug[i,k]/Aug[k,k],
        print(""),
        print("=> R",i,"= R",i,"- (",'Aug[i,k]/'Aug[k,k],")*","R",k),
        /* Applying Ri -> Ri - (Augik/Augkk)*Rk */
        Aug[i]: Aug[i]-factor·Aug[k],
        print(Aug)
    )
)$

print("")$
print("Therefore, the augmented matrix")$
print("reduced to upper triangular form will be,")$
print("")$
Aug;

/* Printing reduced system of eqs */
print("")$
print("Now, the system of equations will be,")$
load("eigen")$ /* to use innerproduct function */
/* innerproduct returns dot product */
/* submatrix returns a new matrix from matrix Aug
with mentioned rows and columns deleted. */
AA:innerproduct(submatrix(Aug,n+1),X)$
BB:col(Aug,n+1)$ /* col returns specified column */
for i:1 thru n do(
```

5 Q5.Solve the system of equations

$$7x - 11z = -17$$
$$-4x - 3y + 3z = 9$$
$$25x + 7y + 8z = 34$$

using Gauss elimination method.

```
kill(all)$
keepfloat:true$
'A = A:matrix(
        [7, 0, 11],
        [-4, -3, 3],
        [25, 7, 8])$
'B = B:matrix(
        [-17], [9], [34])$
'X = X:matrix(
        ['x], ['y], ['z])$

print("Let",'A=A,",",'B=B,",",'X=X)$
print("")$
print("Now, the augmented matrix will be,")$
print("")$
'Aug = Aug:addcol(A,B);

print("")$
print("I. FORWARD ELIMINATION")$

n:length(A[1])$

/* -------- Forward Elimination -------- */
for k:1 thru n-1 do(

    /* Partial Pivoting */
    /* determine the largest element in the column */
    /* and store the row number to max_i */
    max_i: k,
    for i:k thru n do(
        if abs(Aug[i,k]) > abs(Aug[max_i,k]) then
            max_i: i
    ),

    if max_i#k then( /* if row number is not k */
        /* switch rows */
        [Aug[k],Aug[max_i]]:[Aug[max_i],Aug[k]],
        print(""),
        print("=> R",k,"< -- >","R",max_i),
        print(Aug)
    ),

    for i:k+1 thru n do(
        factor: Aug[i,k]/Aug[k,k],
        print(""),
        print("=> R",i,"= R",i,"- (",'Aug[i,k]/'Aug[k,k],")*","R",k),
        /* Applying Ri -> Ri - (Augik/Augkk)*Rk */
        Aug[i]: Aug[i]-factor·Aug[k],
        print(Aug)
    )
)$

print("")$
print("Therefore, the augmented matrix")$
print("reduced to upper triangular form will be,")$
```