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**04-02-24**

# LAB 3 (TASK 1)

```
%% Here, we have created a function LSSNEqn

function [X]=LSSNEqn(A,b)

   temp1=A.'; %temp1 is transpose of A

   C=temp1*A;

   D=chol(C); % chol function is basically a Cholesky decomposition

   temp3=D.';

   % Solving the system of linear equations using backward and forward

   % substitution

   Y=FdSubs(temp3,temp1*b);

   X=BdSubs(D,Y);

end
```

# LAB 3 (TASK 2)

```
%% Gram-Schmidt Method for QR decomposition

% This algorithm starts with n LI Vectors and

% produces n orthogonal vectors

function [Q,R] = GramSelf(A)

[m,n] = size(A);

Q = zeros(m,n);

R = zeros(n,n);

for j=1:n

   v = A(:,j);

   for i = 1:j-1

       R(i,j) = Q(:,i)'*A(:,j);

       v = v-R(i,j)*Q(:,i);

   end

   R(j,j)=norm(v);

   Q(:,j)=v/R(j,j);

end

end

% Here in the following example -

% Q will be [0.8, -0.6; 0.6, 0.8];

% R will be [5, -1 ; 0, 2];
```

```
%% Code to test the working of Gram-Schmidt Algorithm

prompt = "Enter the matrix which you want to decompose \nX= " ;

X = input(prompt);

disp("X=");

disp(X);

[Q,R]=GramSelf(X);

disp('Q=');

disp(Q);

disp('R=');

disp(R);
```

```
>> A3P4
Enter the matrix which you want to decompose
X=
[4,-2;3,1]
X=
     4    -2
     3     1

Q=
    0.8000   -0.6000
    0.6000    0.8000

R=
     5    -1
     0     2
```

# LAB 3 (TASK 3)

```
function [Q, R] =HouseSelf(A)

   [m, n] = size(A);

   Q = eye(m);

   R = A;


   for j = 1:n

       normx = norm(R(j:end, j));

       s = -sign(R(j, j));

       u1 = R(j, j) - s * normx;

       w = R(j:end, j) / u1;

       w(1) = 1;

       tau = -s * u1 / normx;

       R(j:end, :) = R(j:end, :) - (tau * w) * (w.' * R(j:end, :));

       Q(:, j:end) = Q(:, j:end) - (Q(:, j:end) * w) * (tau * w).';

   end

end
```

**INPUT:-**

```
A = [4, 3, 2; 2, 1, 3; 3, 2, 1];
```

**OUTPUT:-**

```
Q:
   -0.74536    0.45374   -0.48795
   -0.29814   -0.88645   -0.35484
   -0.59628    0.09295    0.79775

R:
   -5.3852   -4.0304   -2.6856
         0   -0.7428    1.0289
         0         0   -1.5431
```

# LAB 3 (TASK 4)

```
prompt = "Enter the matrix A=";

A = input(prompt);

prompt = "Enter the matrix b=";

b = input(prompt);

X=LSSNEqn(A,b);

disp("A=");

disp(A);

disp("b=");

disp(b);

disp("Solution matrix x by least square method is " );

disp('X=');

disp(X);

disp("Solution matrix by A\b is ");

disp('X=');

disp(A\b);
```

```
>> A3P4
Enter the matrix A=
[1,1;2,1;3,1]
Enter the matrix b=
[1;2;2]
A=
     1     1
     2     1
     3     1

b=
     1
     2
     2

Solution matrix x by least square method is
X=
    0.5000
    0.6667

Solution matrix by A\b is
X=
    0.5000
    0.6667
```