Q. To determine the inverse of a matrix A using LU decomposition method followed by forward and back substitution.

A =[

9 -4 1 0 0 0 0 0 0 0 0 0 0 0 0

-4 6 -4 1 0 0 0 0 0 0 0 0 0 0 0

1 -4 6 -4 1 0 0 0 0 0 0 0 0 0 0

0 1 -4 6 -4 1 0 0 0 0 0 0 0 0 0

0 0 1 -4 6 -4 1 0 0 0 0 0 0 0 0

0 0 0 1 -4 6 -4 1 0 0 0 0 0 0 0

0 0 0 0 1 -4 6 -4 1 0 0 0 0 0 0

0 0 0 0 0 1 -4 6 -4 1 0 0 0 0 0

0 0 0 0 0 0 1 -4 6 -4 1 0 0 0 0

0 0 0 0 0 0 0 1 -4 6 -4 1 0 0 0

0 0 0 0 0 0 0 0 1 -4 6 -4 1 0 0

0 0 0 0 0 0 0 0 0 1 -4 6 -4 1 0

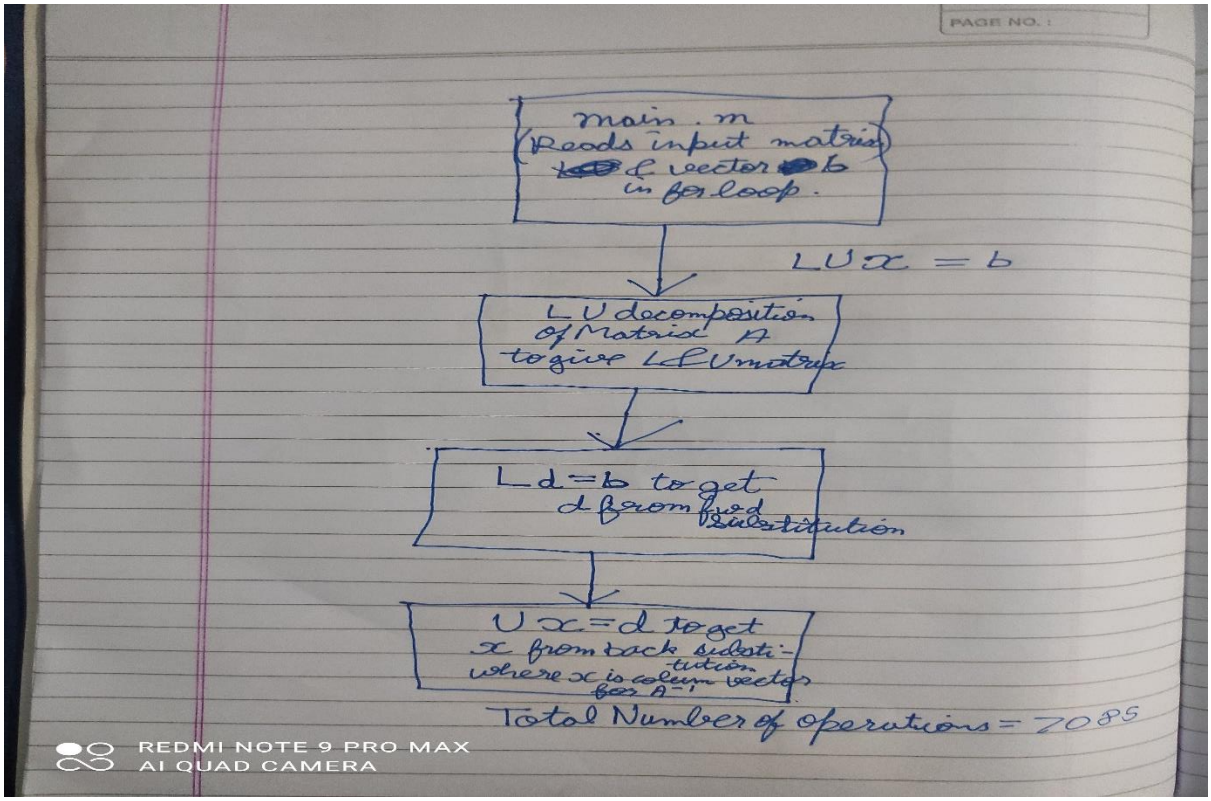
0 0 0 0 0 0 0 0 0 0 1 -4 6 -4 1

0 0 0 0 0 0 0 0 0 0 0 1 -4 5 -2

0 0 0 0 0 0 0 0 0 0 0 0 1 -2 1

]

Work Flow


PAGE NO. :
main . m
(Reads input matrix A & vector b in for loop.
LUx = b
LU decomposition of Matrix A to give L & U matrix
Ld = b to get d from fwd substitution
Ux = d to get x from back substitution
where x is column vector for A⁻¹
Total Number of operations = 7085
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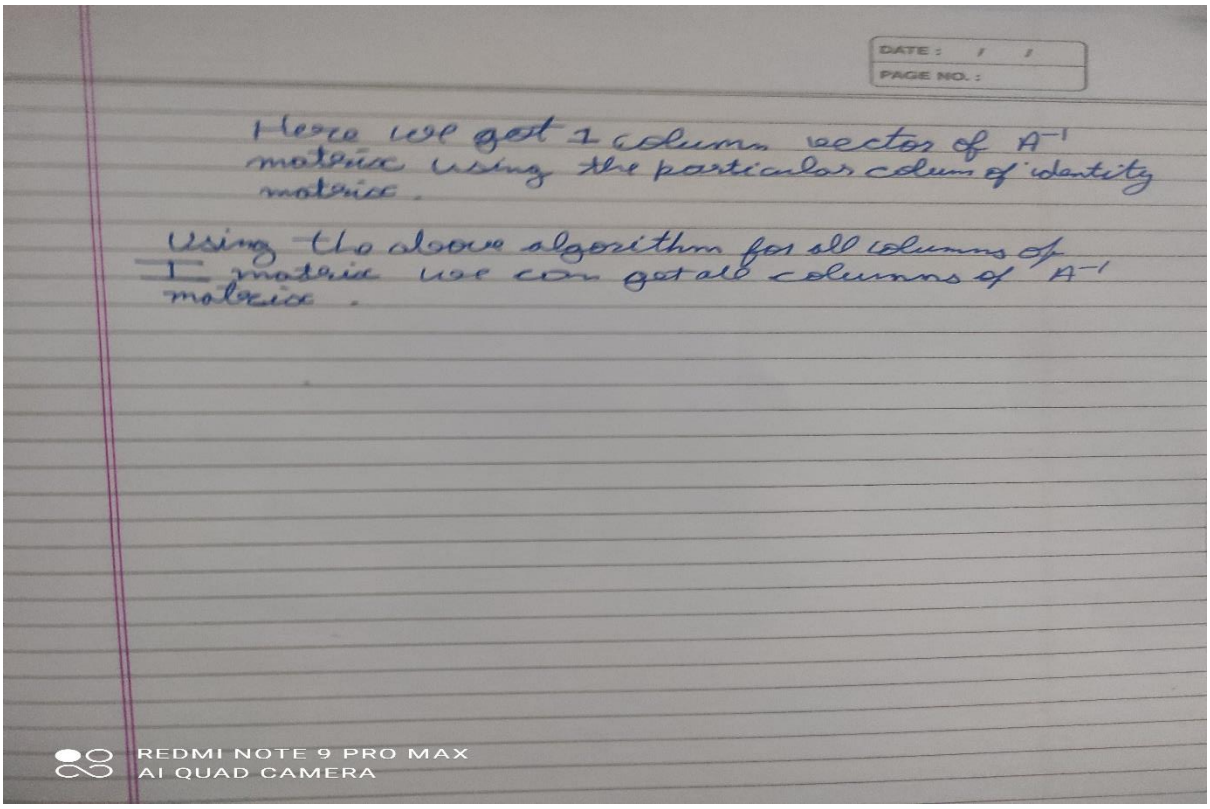
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Here we get 1 column vector of A⁻¹ matrix using the particular colum of identity matrix.
Using the above algorithm for all columns of I matrix we can get all columns of A⁻¹ matrix.
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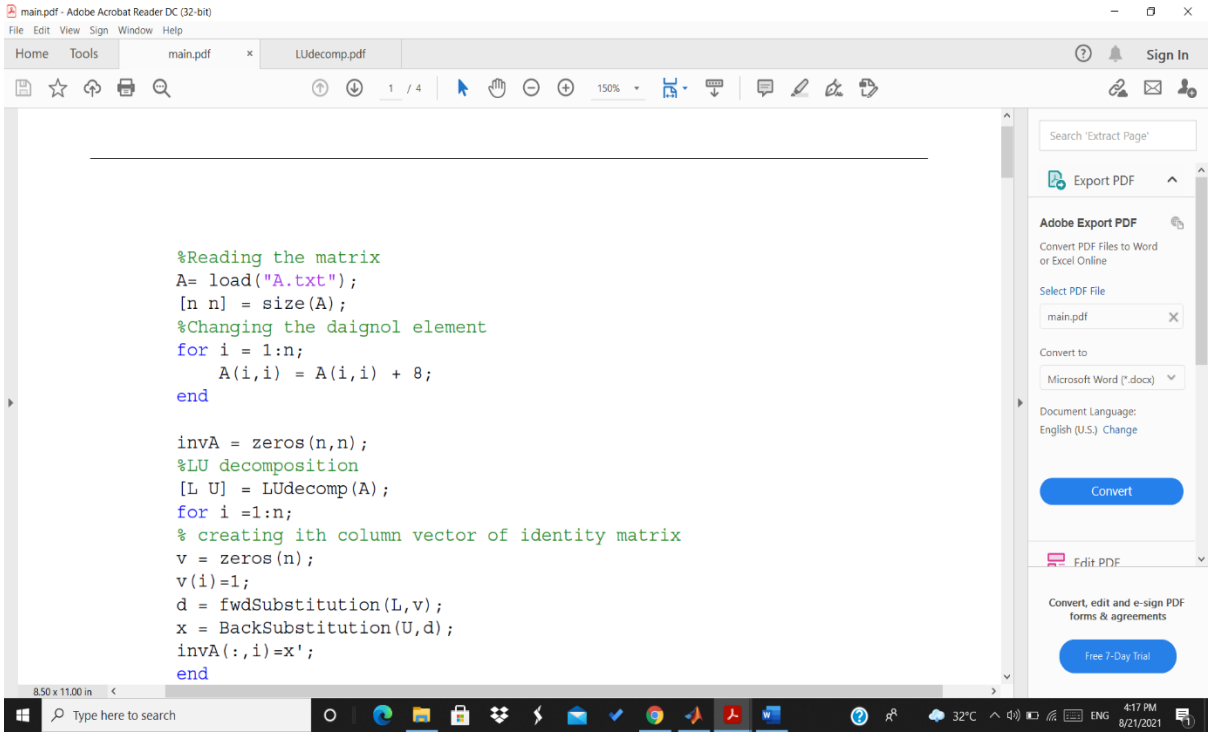
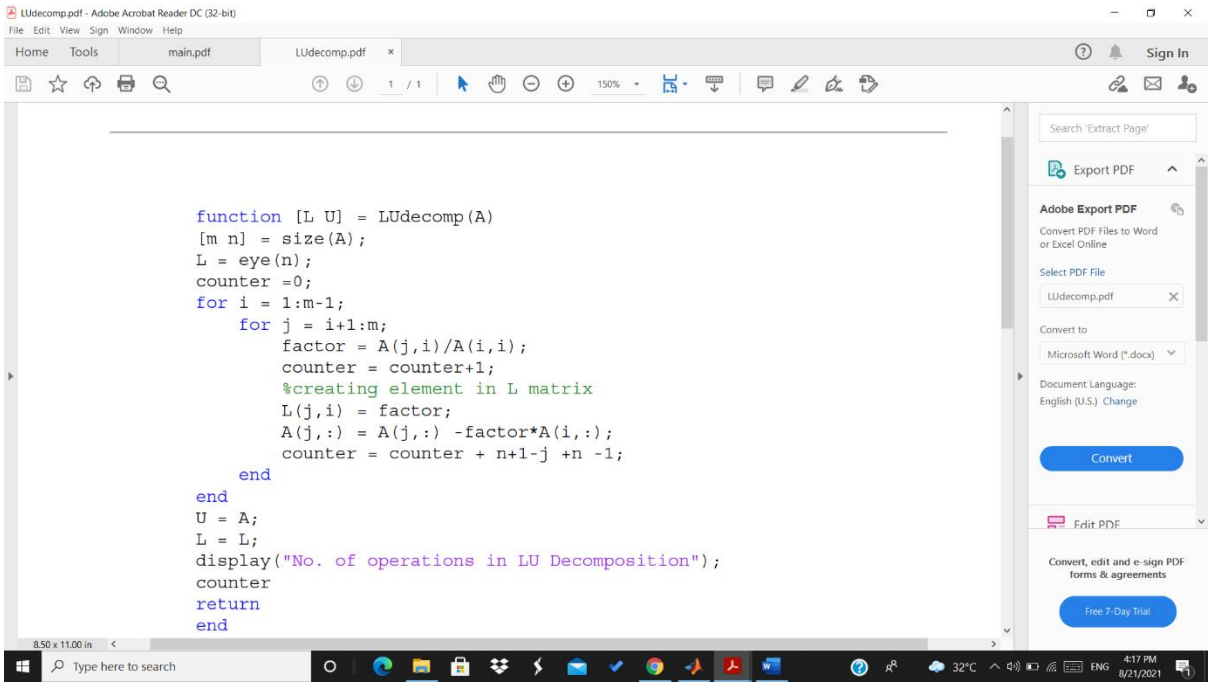
MATLAB code

Main.m file

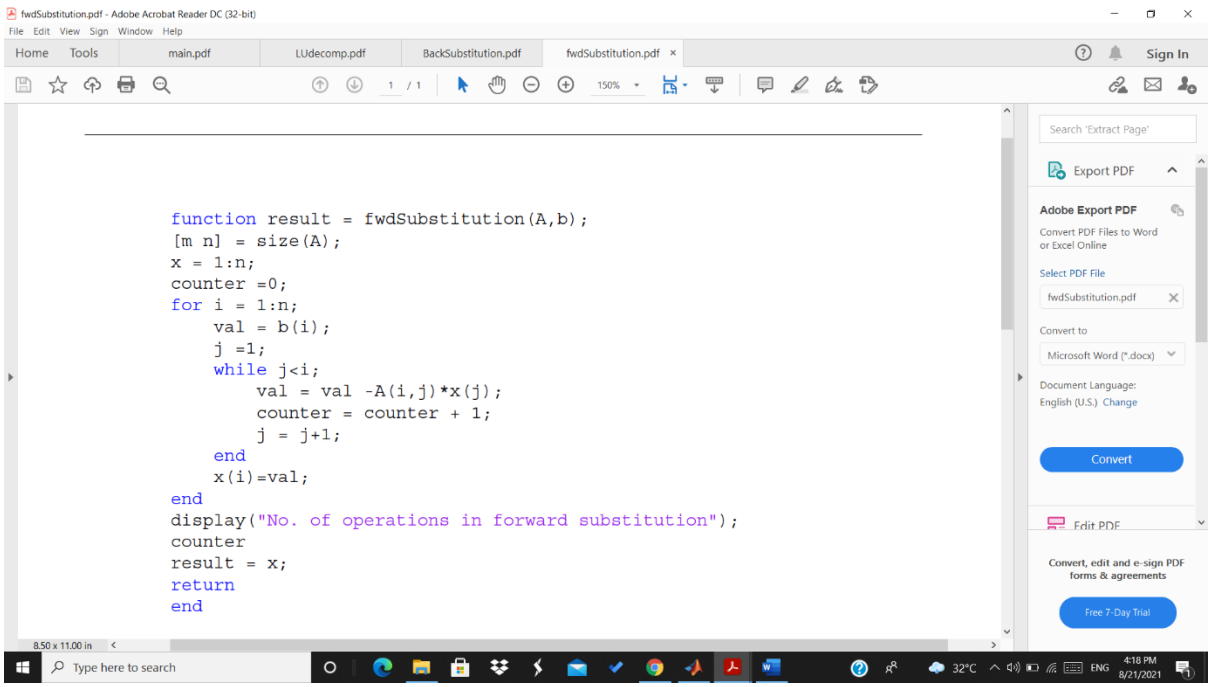


LUdecomp.m file



```
function [L U] = LUdecomp(A)
[m n] = size(A);
L = eye(n);
counter =0;
for i = 1:m-1;
    for j = i+1:m;
        factor = A(j,i)/A(i,i);
        counter = counter+1;
        %creating element in L matrix
        L(j,i) = factor;
        A(j,:) = A(j,:) -factor*A(i,:);
        counter = counter + n+1-j +n -1;
    end
end
U = A;
L = L;
display("No. of operations in LU Decomposition");
counter
return
end
```

fwdSubstitution.m file



```
function result = fwdSubstitution(A,b);
[m n] = size(A);
x = 1:n;
counter =0;
for i = 1:n;
    val = b(i);
    j =1;
    while j<i;
        val = val -A(i,j)*x(j);
        counter = counter + 1;
        j = j+1;
    end
    x(i)=val;
end
display("No. of operations in forward substitution");
counter
result = x;
return
end
```

BackSubstitution.m file