# MAT 2002 DA-1

NAME: PRANAY AGRAWAL
REGISTRATION NO: 22MIS0172

Name: Pranay Agrawal
Registration No: 22MIS0172

# 1A)

1. Let $A=\begin{pmatrix} 3 & 1 & -1 \\ 1 & 3 & -1 \\ -1 & -1 & 5 \end{pmatrix}$

(a) Find characteristic equation of $A$(without using **poly** command).

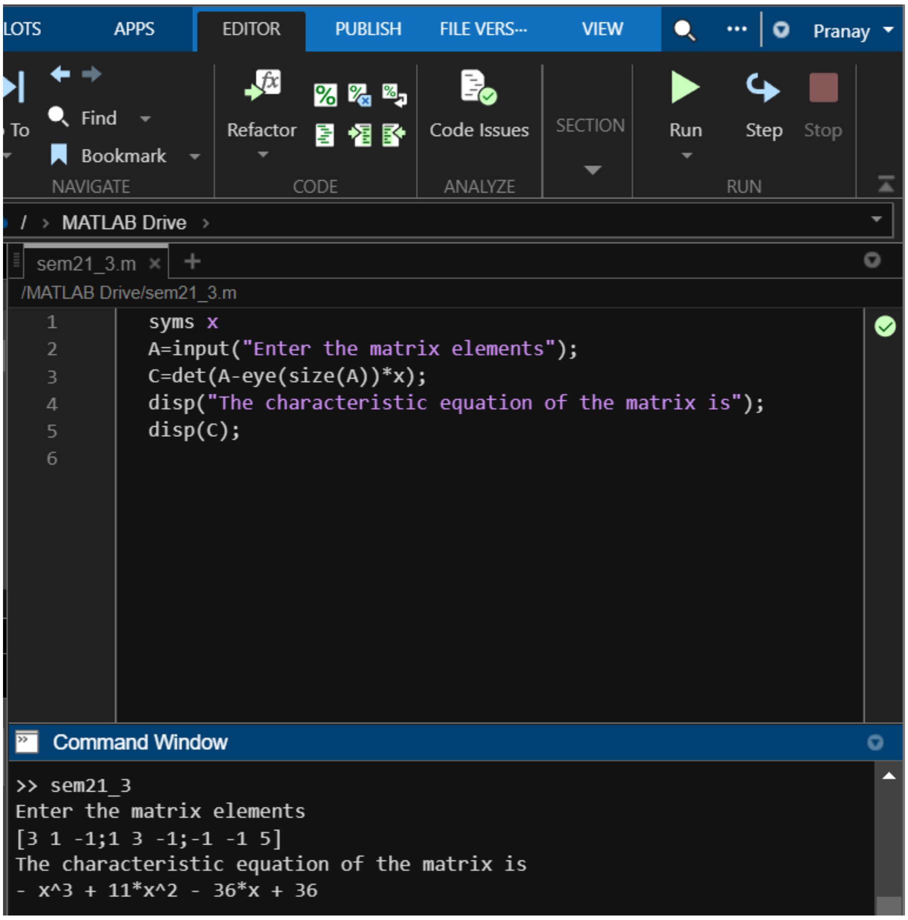
(b) Find eigen values by finding the roots of characteristic equation.

(c) Find eigen vector $X$ of $A$ by solving the equation $AX = \lambda X$.

(d) Verify the properties of Eigen values.

(e) Verify Cayley-Hamilton theorem and find inverse

## a) Code and Output:



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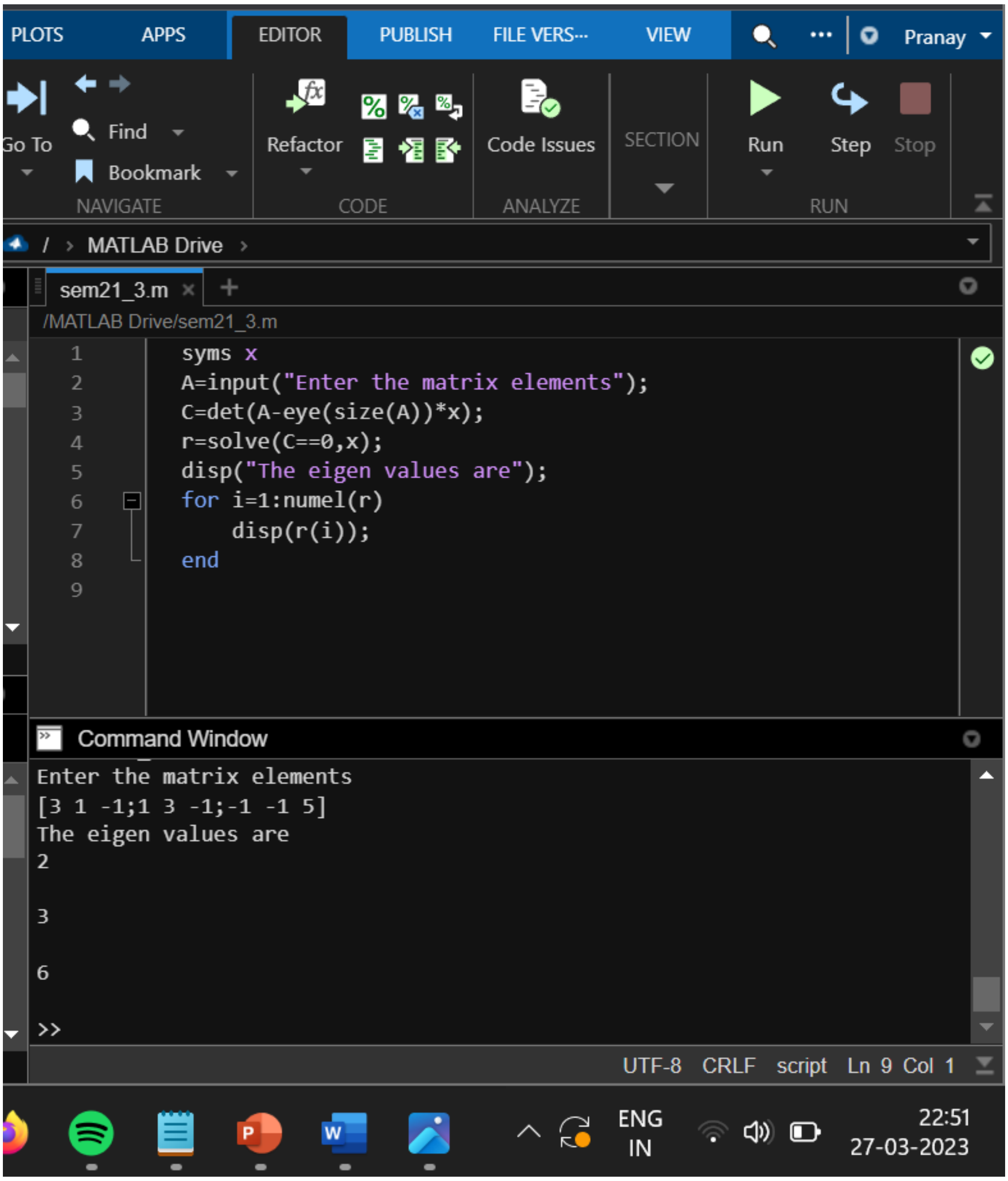
# b) Code and Output:



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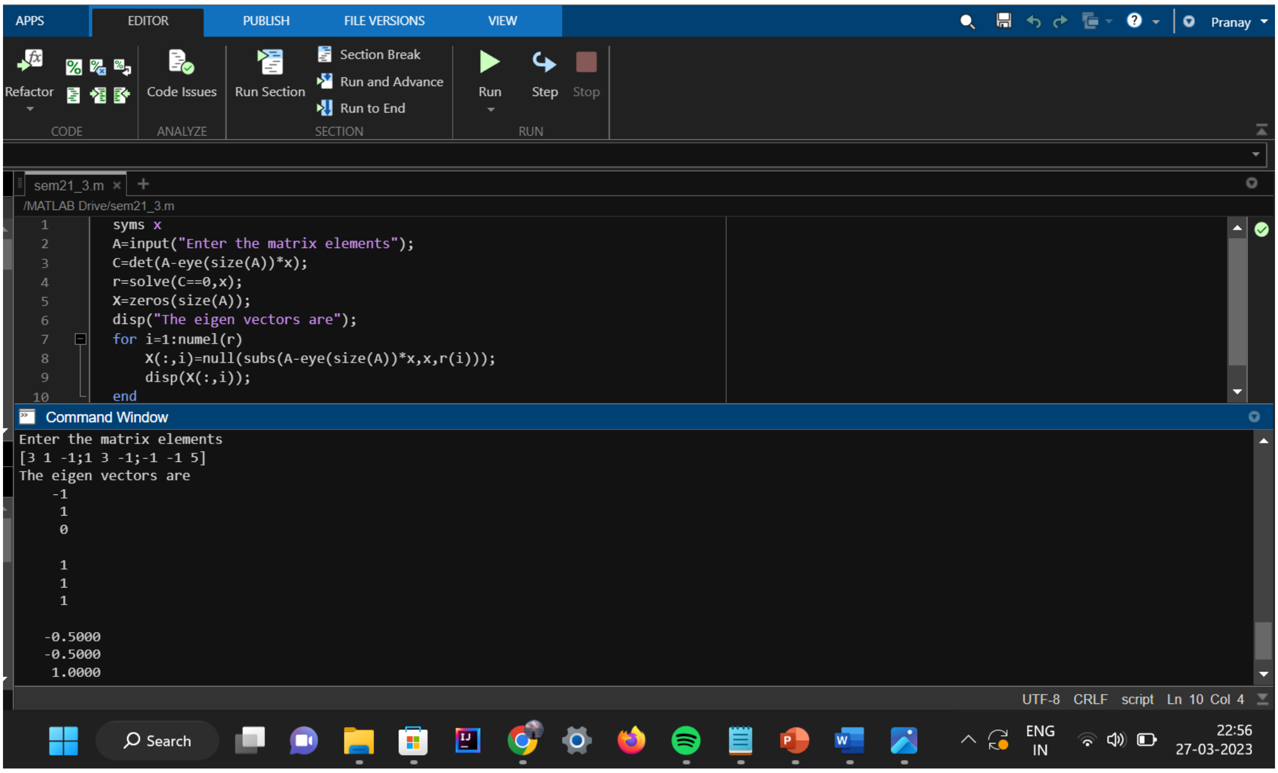
# c) Code and Output:



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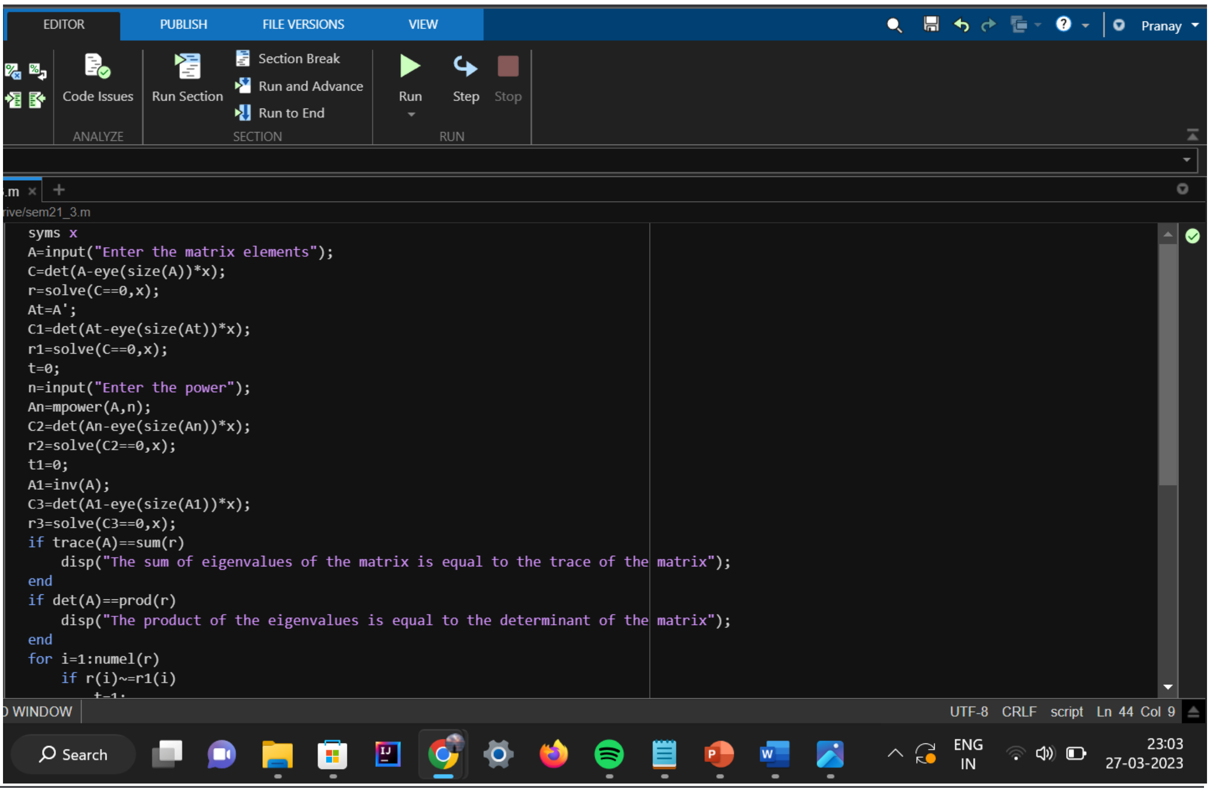
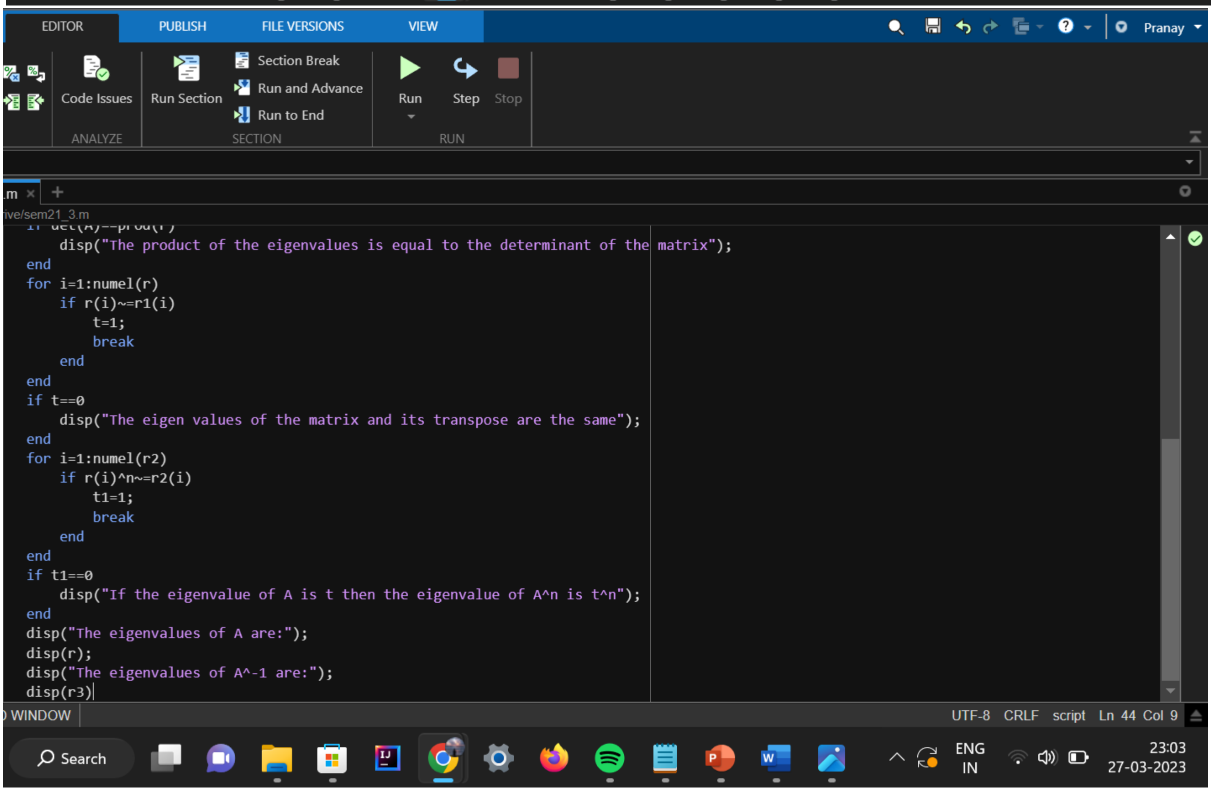
# d) Code and Output:



```
syms x
A=input("Enter the matrix elements");
C=det(A-eye(size(A))*x);
r=solve(C==0,x);
At=A';
C1=det(At-eye(size(At))*x);
r1=solve(C==0,x);
t=0;
n=input("Enter the power");
An=mpower(A,n);
C2=det(An-eye(size(An))*x);
r2=solve(C2==0,x);
t1=0;
A1=inv(A);
C3=det(A1-eye(size(A1))*x);
r3=solve(C3==0,x);
if trace(A)==sum(r)
    disp("The sum of eigenvalues of the matrix is equal to the trace of the matrix");
end
if det(A)==prod(r)
    disp("The product of the eigenvalues is equal to the determinant of the matrix");
end
for i=1:numel(r)
    if r(i)~=r1(i)
```



```
    disp("The product of the eigenvalues is equal to the determinant of the matrix");
end
for i=1:numel(r)
    if r(i)~=r1(i)
        t=1;
        break
    end
end
if t==0
    disp("The eigen values of the matrix and its transpose are the same");
end
for i=1:numel(r2)
    if r(i)^n~=r2(i)
        t1=1;
        break
    end
end
if t1==0
    disp("If the eigenvalue of A is t then the eigenvalue of A^n is t^n");
end
disp("The eigenvalues of A are:");
disp(r);
disp("The eigenvalues of A^-1 are:");
disp(r3)
```

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```
Enter the matrix elements
[3 1 -1;1 3 -1;-1 -1 5]
Enter the power
3
The sum of eigenvalues of the matrix is equal to the trace of the matrix
The product of the eigenvalues is equal to the determinant of the matrix
The eigen values of the matrix and its transpose are the same
If the eigenvalue of A is t then the eigenvalue of A^n is t^n
The eigenvalues of A are:
2
3
6

The eigenvalues of A^-1 are:
1/6
1/3
1/2
```

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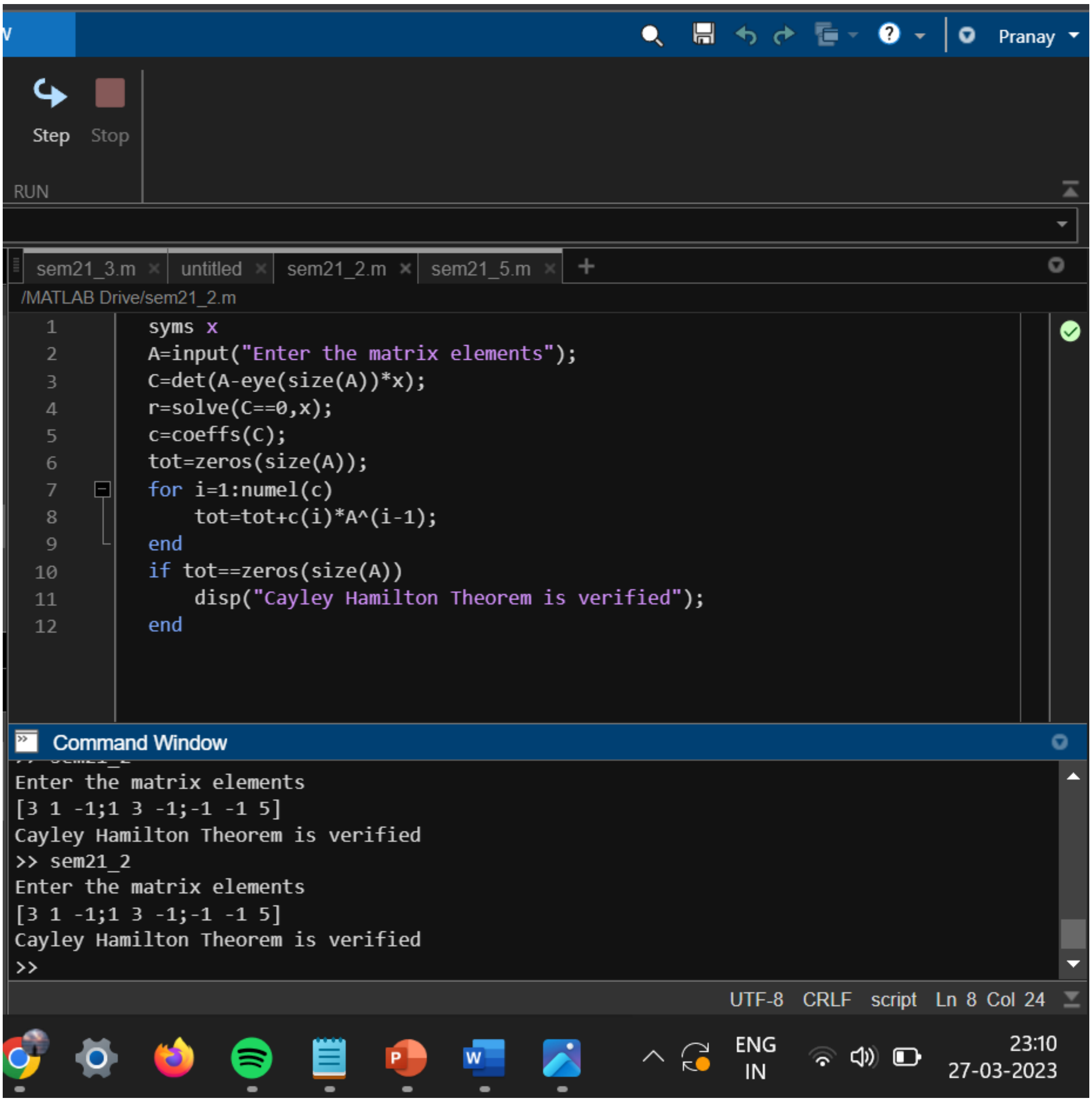
# e) Code and Output:



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# 1B)

## 1)

1. Diagonalize $A=\begin{pmatrix} 1 & 6 & 1 \\ 1 & 2 & 0 \\ 0 & 0 & 3 \end{pmatrix}$ by similarity transformation.

# Code and Output:

```
syms x
A=input("Enter the matrix elements");
C=det(A-eye(size(A))*x);
r=solve(C==0,x);
X=zeros(size(A));
for i=1:numel(r)
    X(:,i)=null(subs((A-eye(size(A))*x),x,r(i)));
end
D=X^-1*A*X;
t=0;
d=diag(r);
for i=1:numel(r)
    if(D(i,i)==d(i,i))
        t=1;
    else
        t=0;
    end
end
if t==1
    disp("The matrix is diagonalizable");
    disp("The diagonalized matrix of A is:");
    disp(D)
end
```

```
Enter the matrix elements
[1 6 1;1 2 0;0 0 3]
The matrix is diagonalizable
The diagonalized matrix of A is:
   -1.0000    0.0000    0.0000
         0    3.0000         0
         0         0    4.0000
```

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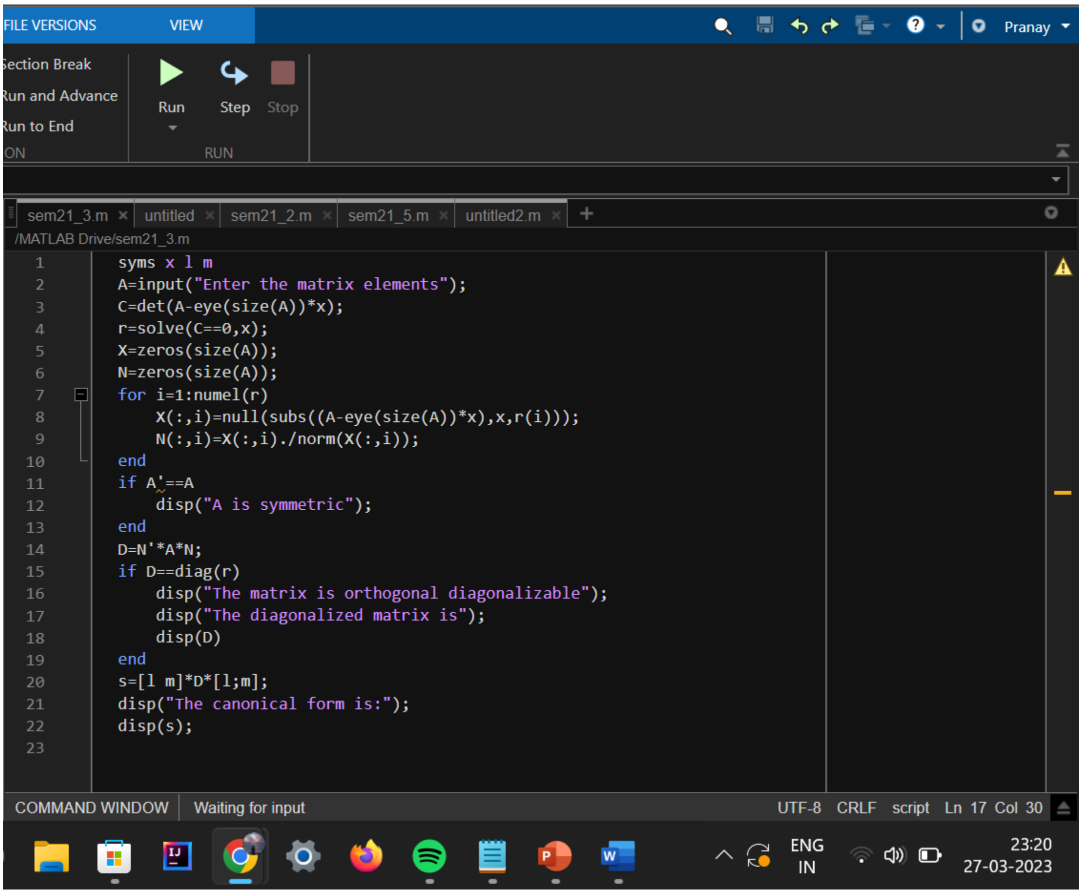
# 2)

2. Transform the quadratic form $13x^2 - 10xy + 13y^2$ to canonical form and specify the matrix of transformation.

# Code and Output:




```
Enter the matrix elements
[13 -5;-5 13]
A is symmetric
The matrix is orthogonal diagonalizable
The diagonalized matrix is
    8.0000         0
         0   18.0000

The canonical form is:
8*l^2 + 18*m^2
```

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