EXPERIMENT1:THEORY AND PROPERTIES OF EIGENVALUE AND EIGENVECTORS

DEFINITION OF EIGENVALUE AND EIGENVECTORS:

A scalar λ is called an eigenvalue of the n × n matrix A is there is a nontrivial solution x of Ax = λx. Such an x is called an eigenvector corresponding to the eigenvalue λ.

PROPERTY 1:

The sum of eigen values of a square matrix is equal to trace of the matrix

PROPERTY 2:

The product of eigen values is equal to the determinant of the square matrix

PROPERTY 3:

If **λ1, λ2, λ3,…… λn** are eigen values of a matrix A then

1) **kλ1,k λ2,k λ3,……** kλn are eigen values of the matrix kA where k is a constant
2) for **λ**!=0 , for all i=1,2,3….n then **1/λ1,1/ λ2,1/ λ3,……** 1/λn are eigen values of the inverse of the matrix A^{-1}
3) **λ1^p, λ2^p, λ3^p,…… λn^p** are eigen values of a matrix A^p, where p is any positive integer
4) A-kI has eigen values **k- λ1,k- λ2,k- λ3,…… k-λn**

PROPERTY 4:

A square matrix A and its transpose A' have same eigen values

PROPERTY 5:

1)The eigenvalue of real symmetric matrix are real

2)The eigenvalue of skew symmetric matrix are purely imaginary or zero

Let a=[6 2 -2;-2 3 -1; 2 -1 3];

`MATLAB CODE:

EIGENVALUE AND EIGENVECTOR:

```
clear

clc

a=[6 2 -2;-2 3 -1; 2 -1 3];

disp("EIGENVALUE\n");

e=eig(a)

disp("EIGENVECTOR\n");

[V,D]=eig(a);

disp(V)
```

```
EIGENVALUE




e =




   5.0000 + 2.6458i

   5.0000 -
 2.6458i

   2.0000 + 0.0000i
```

```
EIGENVECTOR




   0.70711 + 0.00000i   0.70711 - 0.00000i  -
0.00000 + 0.00000i

  -0.17678 + 0.46771i  -0.17678 -
 0.46771i   0.70711 + 0.00000i

   0.17678 - 0.46771i   0.17678 + 0.46771i   0.70711 + 0.00000i
```

PROPERTY 1:

clear

clc

a=[6 2 -2;-2 3 -1; 2 -1 3];

e=eig(a)

s=sum(e)

t=trace(a)

```
e =




   5.0000 + 2.6458i


   5.0000 -
 2.6458i


   2.0000 + 0.0000i




s =  12


t =  12
```

PROPERTY 2:

```
clear

clc

a=[6 2 -2;-2 3 -1; 2 -1 3];

e=eig(a)

p=prod(e)

d=det(a)
```

```
e =

   5.0000 + 2.6458i

   5.0000 -
 2.6458i

   2.0000 + 0.0000i


p =  64

d =  64
```

PROPERY 3:

1)

```
clear

clc

a=[6 2 -2;-2 3 -1; 2 -1 3];
```

```
a1=2*[6 2 -2;-2 3 -1; 2 -1 3];

e=eig(a)

e1=eig(a1)
```

```
e =

   5.0000 + 2.6458i

   5.0000 -
 2.6458i

   2.0000 + 0.0000i


e1 =

   10.0000 +  5.2915i

   10.0000 -
  5.2915i

    4.0000 +  0.0000i
```

2)

```
clear

clc

a=[6 2 -2;-2 3 -1; 2 -1 3];

a1=inv(a);

e=eig(a)
```

e1=eig(a1)

```
e =

   5.0000 + 2.6458i

   5.0000 -
 2.6458i

   2.0000 + 0.0000i

e1 =

   0.15625 + 0.08268i

   0.15625 -
 0.08268i

   0.50000 + 0.00000i
```

3)

clear

clc

a=[6 2 -2;-2 3 -1; 2 -1 3];

a1=a^2;

e=eig(a)

e1=eig(a1)

```
e =

   5.0000 + 2.6458i

   5.0000 -
 2.6458i

   2.0000 + 0.0000i



e1 =

   18.0000 + 26.4575i

   18.0000 -
 26.4575i

    4.0000 +  0.0000i
```

4)

```
clear

clc

a=[6 2 -2;-2 3 -1; 2 -1 3];

a1=a-2*eye(3);

e=eig(a)

e1=eig(a1)
```

```
e =

```

```
   5.0000 + 2.6458i

   5.0000 -
 2.6458i

   2.0000 + 0.0000i



e1 =



   3.00000 + 2.64575i

   3.00000 -
 2.64575i

   0.00000 + 0.00000i
```

PROPERTY 4:

```
clear

clc

a=[6 2 -2;-2 3 -1; 2 -1 3];

a1=a';

e=eig(a)

e1=eig(a1)
```

```
e =
```

```
   5.0000 + 2.6458i

   5.0000 -
 2.6458i

   2.0000 + 0.0000i




e1 =




   5.0000 + 2.6458i

   5.0000 -
 2.6458i

   2.0000 + 0.0000i
```

PROPERTY 5:

1) clc

clear all

a=[1 2 3;2 2 4;3 4 5];

eig(a)

```
ans =




  -
0.78765
```

```
  -
0.54420


   9.33185
```

2)

```
clc

clear all

a=[0 -2 -3;2 0 -4;3 4 0];

eig(a)
```

```
ans =




  -
0.00000 + 0.00000i

   0.00000 + 5.38516i

   0.00000 - 5.38516i
```

Let a=[1 3 7;-3 4 -7 ;4 7 -7];

EIGENVALUE AND EIGENVECTOR:

```
clear

clc

a=[1 3 7;-3 4 -7 ;4 7 -7];

disp("EIGENVALUE\n");
```

```
e=eig(a)

disp("EIGENVECTOR\n");

[V,D]=eig(a);

disp(V)
```

```
EIGENVALUE


e =




  -
8.0562 + 0.0000i


   3.0281 + 6.2145i


   3.0281 -
 6.2145i




EIGENVECTOR


   0.64293 + 0.00000i  -0.19749 - 0.59229i  -
0.19749 + 0.59229i

  -0.25861 + 0.00000i   0.67671 + 0.00000i   0.67671 -
 0.00000i

  -0.72095 + 0.00000i   0.17860 - 0.34693i   0.17860 + 0.34693i
```

PROPERTY 1:

```
clear

clc

a=[1 3 7;-3 4 -7 ;4 7 -7];

e=eig(a)
```

```
s=sum(e)

t=trace(a)
```

```
s = -
2.0000


t = -2
```

PROPERTY 2:

```
clear

clc

a=[1 3 7;-3 4 -7 ;4 7 -7];

e=eig(a)

p=prod(e)

d=det(a)
```

```
e =




  -
8.0562 + 0.0000i


   3.0281 + 6.2145i


   3.0281 -
 6.2145i




p = -
385.00


d = -385
```

PROPERTY 3:

1)

```
clear

clc

a=[1 3 7;-3 4 -7 ;4 7 -7];

a1=2*a;

e=eig(a)
```

```
e1=eig(a1)
e =


  -
8.0562 + 0.0000i


   3.0281 + 6.2145i


   3.0281 -
 6.2145i



e1 =


  -
16.1123 +  0.0000i


    6.0562 + 12.4290i


    6.0562 - 12.4290i
```

2)

```
clear
```

```
clc

a=[1 3 7;-3 4 -7 ;4 7 -7];

a1=inv(a);

e=eig(a)

e1=eig(a1)
e =

  -
8.0562 + 0.0000i

   3.0281 + 6.2145i

   3.0281 -
 6.2145i


e1 =

   0.06336 + 0.13004i

   0.06336 -
 0.13004i

  -0.12413 + 0.00000i
```

3)

```
clear

clc
```

```
a=[1 3 7;-3 4 -7 ;4 7 -7];

a1=a^2;

e=eig(a)

e1=eig(a1)
e =

  -
8.0562 + 0.0000i

   3.0281 + 6.2145i

   3.0281 -
 6.2145i

e1 =

  -
29.451 + 37.636i

  -29.451 -
 37.636i

   64.902 +  0.000i
```

4)

```
clear

clc

a=[1 3 7;-3 4 -7 ;4 7 -7];

a1=a-2*eye(3);
```

e=eig(a)

```
e1=eig(a1)
e =


  -
8.0562 + 0.0000i


   3.0281 + 6.2145i


   3.0281 -
 6.2145i



e1 =


  -
10.0562 +  0.0000i


    1.0281 +  6.2145i


    1.0281 -  6.2145i
```

PROPERTY 4:

clear

clc

a=[1 3 7;-3 4 -7 ;4 7 -7];

a1=a';

e=eig(a)

```
e1=eig(a1)
e =

  -
8.0562 + 0.0000i

   3.0281 + 6.2145i

   3.0281 -
 6.2145i


e1 =

  -
8.0562 + 0.0000i

   3.0281 + 6.2145i

   3.0281 - 6.2145i
```

PROPERTY 5:

1)

clc

clear all

a=[2 5 7;5 3 9;7 9 4];

eig(a)

```
ans =


   -
5.8682

   -
2.4156

   17.2838
```

2)

clc

clear all

a=[0 -5 -7;5 0 -9;7 9 0];

eig(a)

```
ans =


    0.00000 +  0.00000i

    0.00000 + 12.44990i

    0.00000 - 12.44990i
```

BY

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15BCE0517

L7+L8