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CMSC284

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MATLAB assignment 5

%================================Problem1===============================%

A = [1 5 -6 -7; 2 4 5 2; 0 0 -7 -4; 0 0 3 1]

A =

1 5 -6 -7

2 4 5 2

0 0 -7 -4

0 0 3 1

%a)Find eigen values and a basis for each eigenspace of A

eig(A)

ans =

-1

6

-5

-1

%-1

null(A+1\*eye(4), 'r')

ans =

-2.5000

1.0000

0

0

%6

null(A-6\*eye(4), 'r')

ans =

1

1

0

0

%-5

null(A+5\*eye(4), 'r')

ans =

-1.9318

1.3182

-2.0000

1.0000

%b) matrix is diagonalizable if all the eigenvalues are linearly independent, meaning there are no same eigenvalues

% 0 means that the length of the vector with eigenvalues is smaller than the number of unique elements in eigenvalues vector

% Therefore, matrix is not diagonalizable

isequal(length(eig(A)), length(unique(eig(A))))

ans =

logical

0

%===============================Problem2================================%

B = [0, 0, -2; 1 2 1; 1 0 3]

B =

0 0 -2

1 2 1

1 0 3

%Calculate BP and PD to check

[P, D] = eig(B)

P =

0 -0.8165 0.7066

1.0000 0.4082 0.0395

0 0.4082 -0.7066

D =

2 0 0

0 1 0

0 0 2

%BP

B\*P

ans =

0 -0.8165 1.4131

2.0000 0.4082 0.0790

0 0.4082 -1.4131

%PD

P\*D

ans =

0 -0.8165 1.4131

2.0000 0.4082 0.0790

0 0.4082 -1.4131

%===============================Problem3================================%

C = [5 -2; 1 3]

C =

5 -2

1 3

%Find eigenvalues and eigenvectors. Diagonal entries of D are eigenvalues and columns of P are eigenvectors

[P, D] = eig(C)

P =

0.8165 + 0.0000i 0.8165 + 0.0000i

0.4082 - 0.4082i 0.4082 + 0.4082i

D =

4.0000 + 1.0000i 0.0000 + 0.0000i

0.0000 + 0.0000i 4.0000 - 1.0000i

%=================================Problem4==============================%

M = [.4 .3; -.5, 1.2]

M =

0.4000 0.3000

-0.5000 1.2000

%a) Find eigenvalues and eigenvectors. Diagonal entries of D are eigenvalues and columns of P are eigenvectors

[P, D] = eig(M)

P =

-0.7071 -0.5145

-0.7071 -0.8575

D =

0.7000 0

0 0.9000

% b) what is the long term outcome of this system

% Both predators and prey will die out because the eigenvalues are less than one so the difference equation is approaching zero