<!---Question 1--->

powerIteration with scaling

>> A = [0 0 0 (1/3) 0; .5 0 (1/3) 0 0; .5 .5 0 (1/3) 0;0 0 (1/3) 0 1; 0 .5 (1/3) (1/3) 0]

% Finds dominant eigenvalue (stochastic matrix will always be 1)

% matrix A, initial (nonzero, random) vector x,

% calculate eigenvalue and eigenvector

% make sure to find probabilistic interpretation by scaling to add to 1

function [lam,u]=powerIt(A,x,k)

for j=1:k

u=x/norm(x);

x=A\*u;

lam=u'\*x;

end

u=x/sum(x);

end

Input: [lam, u] = powerIt(A,[.5;.5;.5;.5;.5],10000)

<!---Question 2--->

>> C = [0 0 1 0 0 0 0;1 0 0 0 0 0 0; 0 1 0 1 0 0 0; 0 0 1 0 0 0 1; 0 0 0 1 0 1 0; 0 0 0 0 1 0 1; 0 0 0 1 1 0 0 ];

>> d = [1 1 2 3 2 1 2]';

>> D = eye(7).\*d;

>> G = C\*inv(D);

>> B = [0 1 0 0 0 0 0; 0 0 1 0 0 0 0 ; .5 0 0 .5 0 0 0 ; 0 0 (1/3) 0 (1/3) 0 (1/3); 0 0 0 0 0 .5 .5; 0 0 0 0 1 0 0 ; 0 0 0 .5 0 .5 0]'

[lam, u] = powerIt(B,[.5;.5;.5;.5;.5;.5;.5],10000)

u =

0.0455

0.0455

0.0909

0.1364

0.2727

0.2273

0.1818

<!---Question 4a--->

>> A = [0 0 0 1 0; 1 0 1 0 0; 1 1 0 1 0; 0 0 1 0 1; 0 1 1 1 0];

>> Ahat= .15\*eye(5)+(1-.15)\*A;

>> Dtest = eye(5).\*[sum(Ahat(:,1)),sum(Ahat(:,2)),sum(Ahat(:,3)),sum(Ahat(:,4)),sum(Ahat(:,5))]' %needs to be D matrix of new A

>> G1 = Ahat\*inv(DTest)

u =

0.1036

0.1244

0.2118

0.3025

0.2577

<!---Question 4b--->

>> Ahat= .05\*eye(5)+(1-.05)\*A;

>> Dtest = eye(5).\*[sum(Ahat(:,1)),sum(Ahat(:,2)),sum(Ahat(:,3)),sum(Ahat(:,4)),sum(Ahat(:,5))]';

>> G9 = Ahat\*inv(Dtest);

>> [lam, u] = powerIt(G9,[.5;.5;.5;.5;.5],10000)

u =

0.1040

0.1248

0.2165

0.3093

0.2453

<!---Question 5--->

>> A1 = [0 0 0 1 0; 2 0 2 0 0; 1 1 0 1 0; 0 0 1 0 1; 0 1 1 1 0];

>> Ahat= .15\*eye(5)+(1-.15)\*A1;

>> Dtest = eye(5).\*[sum(Ahat(:,1)),sum(Ahat(:,2)),sum(Ahat(:,3)),sum(Ahat(:,4)),sum(Ahat(:,5))]';

>> G9 = Ahat\*inv(Dtest);

>> [lam, u] = powerIt(G9,[.5;.5;.5;.5;.5],10000)

u =

0.0932

0.1702

0.2041

0.2795

0.253

<!---Question 6--->

>> A = [0 0 0 1 ; 1 0 1 0 ; 1 1 0 1 ; 0 0 1 0 ];

>> Ahat= .15\*eye(4)+(1-.15)\*A;

>> Dtest = eye(4).\*[sum(Ahat(:,1)),sum(Ahat(:,2)),sum(Ahat(:,3)),sum(Ahat(:,4))]';

>> G9 = Ahat\*inv(Dtest);

>> [lam, u] = powerIt(G9,[.5;.5;.5;.5],10000)

u =

0.1031

0.2786

0.4123

0.2061

<!---Question 7--->

function [B] = RandMatrix(a)

%creates a random matrix and turns it into 0 and 1s, with the diagonal

%empty

B = rand(a);

for i = 1:a

for j = 1:a

if B(i,j) > .5

B(i,j) = 1;

else

B(i,j) = 0;

end

end

end

for i = 1:a

for j = 1:a

if i == j

B(i,j) = 0;

end

end

end

end

function [M,list] = checkStructure(k)

%k is the size to check

%M is the cell array for the matrices tested

%list is the q probabilities for each M

M = cell(20,1);

list = ones(20);

for i = 1:20

A = RandMatrix(k);

M{i} = A;

u = pageRank(A,0);

count = 1;

for j = .05:.05:.95

v = pageRank(A,j);

list(i,count) = sqrt(sum((v-u).^2)/(size(v,1)-1));

count = count + 1;

end

end

end

function [u]=pageRank(A,q)

k = 1000;

x = rand(size(A,1),1);

Ahat= q\*eye(size(A,1))+(1-q)\*A;

Dtest = eye(size(A,1)).\*sum(A)';

G = Ahat\*inv(Dtest);

for j=1:k

u=x/norm(x);

x=G\*u;

lam=u'\*x;

end

u=x/sum(x);

end