Assignment 8: Social Network Analysis

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1.

Below is the structure of the graph:
(1,5)
(2,1), (2,5), (2,6), (2,10)
(4,7), (4,8), (4,9)
(6,1), (6,2), (6,7) (7,3)
(11,2) (12,1), (12,10), (12,13) (13,3) (14,3) (15,3), (15,4), (15,9).
Then implement HITS algorithm, below is the source code on matlab:

```
function HITS(A,iter)
n=length(A);
pre_a=ones(1,n);
pre_a(:)=1/n;
pre_h=ones(1,n);
pre_h(:)=1/n;
[a, h]=computeHITS(A,pre_a,pre_h);
i=1;
while(i<=iter&&~(isConvergenceA(A,pre_a,a)&&isConvergenceH(A,pre_h,h)))
fprintf('%d:\n',i);
pre_a=a;
pre_h=h;
[a, h]=computeHITS(A,pre_a,pre_h);
 a=round(a,3);
h=round(h,3);
fprintf('\tauthorithy score:\t%3.2f,%3.2f,%3.2f,%3.2f,%3.2f,%3.2f,%3.2f,%3.2f,%3.2f,%3.2f,%
3.2f,%3.2f,%3.2f,%3.2f:\n',a(1),a(2),a(3),...
a(4),a(5),a(6),a(7),a(8),a(9),a(10),a(11),a(12),a(13),a(14),a(15));
fprintf('\thubscore:\t\t%4.2f,%4.2f,%4.2f,%4.2f,%4.2f,%4.2f,%4.2f,%4.2f,%4.2f,%4.2f
,%4.2f,%4.2f,%4.2f,%4.2f:\n',h(1),h(2),h(3),...
h(4),h(5),h(6),h(7),h(8),h(9),h(10),h(11),h(12),h(13),h(14),h(15));

function [newa, newh]=computeHITS(A,a,h)
n=length(A);%number of nodes;
newa=a;
newh=h;
   for i=1:n
      suma=0;
      sumh=0;
      for j=1:n
if(A(i,j)==1)%i->j suma=suma+a(j);
end if(A(j,i)==1)%j->i
sumh=sumh+h(j);
end end
newa(i)=sumh;
newh(i)=suma;
end
newa=process(newa);
```

```
newh=process(newh);
end


function flag=isConvergenceA(A,v,pre_v)
if(v'==A'*A*pre_v')
flag=1;
else
flag=0;
   end
end
function flag=isConvergenceH(A,v,pre_v)
 if(v'==A*A'*pre_v')
      flag=1;
   else
     flag=0;
   end
end
function y=process(x)
MinValue=min(x);
MaxValue=max(x);
y=x/MaxValue;
end
```

And then, we can get the answer after running the following code:

```
A=zeros(15);
A(12,10)=1;A(12,1)=1; A(12,13)=1;
A(14,3)=1;A(15,3)=1;A(15,4)=1;A(15,9)=1;A(13,3)=1;A(4,9)=1;A(4,8)=1;A(4,7)= 1;A(2,10)=1;
A(2,1)=1;A(2,5)=1;A(2,6)=1;A(6,2)=1;A(6,7)=1;A(6,1)=1;A(5,10)=1;A(5,8)=1;A(1,5)=1;
HITS(A,1000)
```

above figure is to assign that the distance of all links are 1.

Below is the result of HITS algorithm:

Command Window

```
  996:
  authorithy score:       1.00,0.24,0.05,0.04,0.50,0.42,0.36,0.31,0.16,0.95,0.00,0.00,0.34,0.00,0.00:
  hub score:              0.17,1.00,0.00,0.29,0.44,0.56,0.00,0.00,0.00,0.00,0.00,0.80,0.02,0.02,0.09:
  997:
  authorithy score:       1.00,0.24,0.05,0.04,0.50,0.42,0.36,0.31,0.16,0.95,0.00,0.00,0.34,0.00,0.00:
  hub score:              0.17,1.00,0.00,0.29,0.44,0.56,0.00,0.00,0.00,0.00,0.00,0.80,0.02,0.02,0.09:
  998:
  authorithy score:       1.00,0.24,0.05,0.04,0.50,0.42,0.36,0.31,0.16,0.95,0.00,0.00,0.34,0.00,0.00:
  hub score:              0.17,1.00,0.00,0.29,0.44,0.56,0.00,0.00,0.00,0.00,0.00,0.80,0.02,0.02,0.09:
  999:
  authorithy score:       1.00,0.24,0.05,0.04,0.50,0.42,0.36,0.31,0.16,0.95,0.00,0.00,0.34,0.00,0.00:
  hub score:              0.17,1.00,0.00,0.29,0.44,0.56,0.00,0.00,0.00,0.00,0.00,0.80,0.02,0.02,0.09:
  1000:
  authorithy score:       1.00,0.24,0.05,0.04,0.50,0.42,0.36,0.31,0.16,0.95,0.00,0.00,0.34,0.00,0.00:
  hub score:              0.17,1.00,0.00,0.29,0.44,0.56,0.00,0.00,0.00,0.00,0.00,0.80,0.02,0.02,0.09:
```

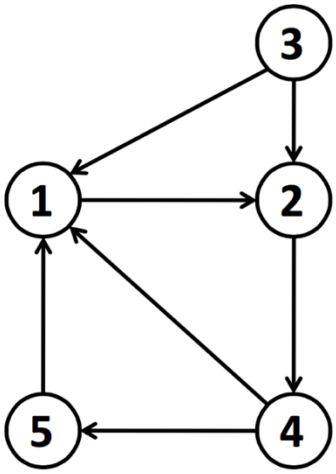
The authority scores and hub scores:

```
authorithy score:       1.00,0.24,0.05,0.04,0.50,0.42,0.36,0.31,0.16,0.95,0.00,0.00,0.34,0.00,0.00
hub score:              0.17,1.00,0.00,0.29,0.44,0.56,0.00,0.00,0.00,0.00,0.00,0.80,0.02,0.02,0.09
```

2. For this question, we should figure out which node belongs to authority or hub or both. If the node belongs to both, it is not consistent with the notion of authority and hub.

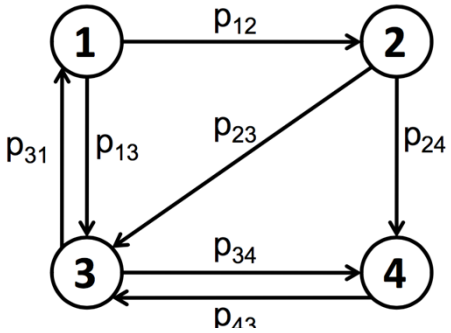
For graph 1:

Node 1: both authority and hub;
Node 2: both authority and hub;
Node 3: only hub;
Node 4: both authority and hub;
Node 5: both authority and hub;
So, it is obvious that only node 3 is the hub,
because it is consistent with the notions of Hubs and Authorities.



Graph 1

All nodes are authorities and hubs,
they are all not consistent with the
notions of Hubs and Authorities.



Graph 2