Birzeit University
Department of Electrical and Computer Engineering
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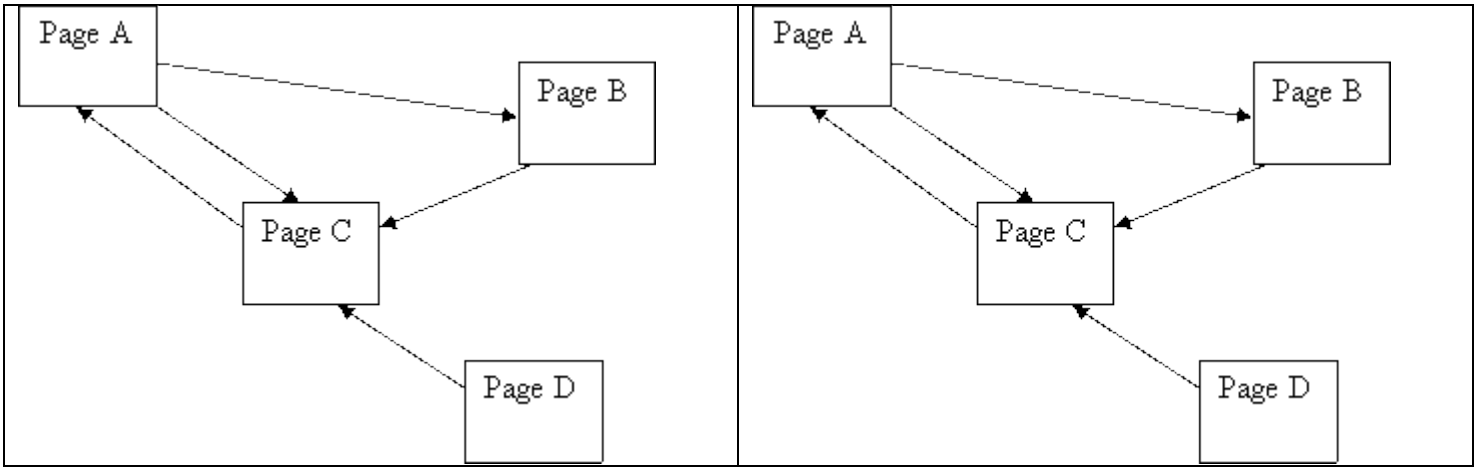
ENCS 539: Information Retrieval and Web Search, Quiz , January 13, 2018
Student Name: _____Sample Solution_____ Student Number: _____

We have 4 web pages with their connections as shown on the figure below.
Assume that the initial values for Hub, Authority and PageRank for all pages are 1.
That is $a_i(0)=1$, $h_i(0)=1$, $PR_i(0)=1$ for all $i\epsilon\{1,\ldots4\}$.
Fill the table below with the values of a,h, PR for 3 iterations at most.



Page→ a/h/PR↓	A: h(A)=a(B)+a(C) a(A)=h(C)	B: h(B)=a(C) a(B)=h(A)	C: h(C)=a(A) a(C)=h(A)+ h(B)+h(D)	D: h(A)=a(C) a(D)=0
a(0)	1	1	1	1
h(0)	1	1	1	1
a(1)	1(1)	1(1)	3(3)	0(0)
h(1)	2(4)	1(3)	1(1)	1(3)
a(2)	1(1)	2(4)	2+1+1=4(10)	0(0)
h(2)	4(14)	3(10)	1(1)	3(10)
a(3)	4(1)	4(14)	1+3+3=7(34)	0(0)
h(3)	2+4=6 (38)	4(24)	1(1)	4(34)
PR(0)	1: PR(A)=PR(C)	1: PR(B)=0.5*PR(A)	1: PR(C)=0.5*PR(A)+ PR(B)+PR(D)	1: PR(D)=0
PR (1)	1	0.5	0.5+1+1=2.5	0
PR (2)	2.5	0.5	0.5+0.5+0=1	0
PR (3)	1	1.25	1.25+0.5+0=1.75	0

Note that for the Authority and Hub we provided two cases: one is the correct where we use the previous stage values (to compute h(i) we use a(i-1) and to compute a(i) we use h(i-1)). The less correct -in ()- is when we the above in the table values of the other parameter: for a's use preceding h in the table and for h's use preceding a's in the table. This doesn't change the a's for the first iteration but changes later iterations. The order of computing (a then h or h then a becomes relevant). You use the first (correct one) if asked to compute a's and h's.

Also when computing PageRank, if teleporting with X% is used then each node gets an extra (X/N)% plus what it gets from the remaining part of the PR of the source nodes of incoming links. N is the total number of nodes in the graph. In our example, if we teleport with 40% then each node gets 10% from the teleport plus the proportion it gets from incoming links.