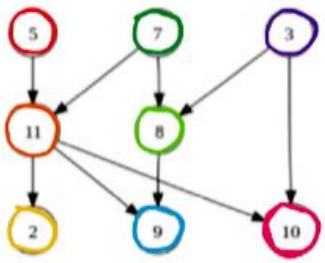
Q5[4]. Consider the following graph. Show the initial numbers and one iteration of applying the PageRank algorithm on the graph. Use the alternative derivation formula with d=0.9.



Initial Numbers:

$\#5 = 0.1 \times \frac{1}{8} + 0.9 \times 0 = 0.0125$

$\#11 = 0.1 \times \frac{1}{8} + 0.9 \times \left(\frac{1}{8} + \frac{1/8}{2}\right) = 0.18125$

$\#2 = 0.1 \times \frac{1}{8} + 0.9 \times \left(\frac{1/8}{3}\right) = 0.05$

$\#7 = 0.1 \times \frac{1}{8} + 0.9 \times 0 = 0.0125$

$\#8 = 0.1 \times \frac{1}{8} + 0.9 \times \left(\frac{1/8}{2} + \frac{1/8}{2}\right) = 0.125$

$\#9 = 0.1 \times \frac{1}{8} + 0.9 \times \left(\frac{1}{8} + \frac{1/8}{2}\right) = 0.1625$

$\#3 = 0.1 \times \frac{1}{8} + 0.9 \times 0 = 0.0125$

$\#10 = 0.1 \times \frac{1}{8} + 0.9 \times \left(\frac{1/8}{2} + \frac{1/8}{3}\right) = 0.10625$

sum = 0.6625

One - Iteration:

$\#5 = 0.1 \times \frac{1}{8} + 0.9 \times A = 0.029483$

$\#11 = 0.1 \times \frac{1}{8} + 0.9 \times \left(\frac{B}{8} + \frac{5/8}{2}\right) = 0.05865312 5$

$\#2 = 0.1 \times \frac{1}{8} + 0.9 \times \left(\frac{C/8}{3}\right) = 0.015533125$

$\#7 = 0.1 \times \frac{1}{8} + 0.9 \times D = 0.029483$

$\#8 = 0.1 \times \frac{1}{8} + 0.9 \times \left(\frac{E/8}{2} + \frac{E/8}{2}\right) = 0.033728 75$

$\#9 = 0.1 \times \frac{1}{8} + 0.9 \times \left(\frac{F}{8} + \frac{F/8}{2}\right) = 0.049291 5$

$\#3 = 0.1 \times \frac{1}{8} + 0.9 \times G = 0.029483$

$\#10 = 0.1 \times \frac{1}{8} + 0.9 \times \left(\frac{H/8}{2} + \frac{H/8}{3}\right) = 0.027535625$

$\#5 \rightarrow A = 0.0125 / 0.6625 = 0.01887$

$\#11 \rightarrow B = 0.18125 / 0.6625 = 0.2735$

$\#2 \rightarrow C = 0.05 / 0.6625 = 0.0755$

$\#7 \rightarrow D = 0.0125 / 0.6625 = 0.01887$

$\#8 \rightarrow E = 0.125 / 0.6625 = 0.1887$

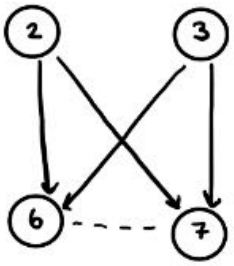
$\#9 \rightarrow F = 0.1625 / 0.6625 = 0.2453$

$\#3 \rightarrow G = 0.0125 / 0.6625 = 0.01887$

$\#10 \rightarrow H = 0.10625 / 0.6625 = 0.16038$

Q3[2]. Consider again the graph from Q2, but now suppose that each node represents a paper. What is the paper co-citation index of nodes 6 and 7?

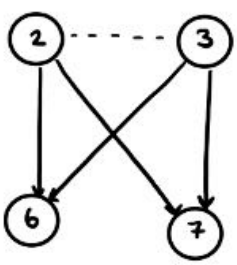
↳ combination # of how many things refrence both 6 and 7 (inclusive)
* when they are cited by the same papers



The paper co-citation is 2

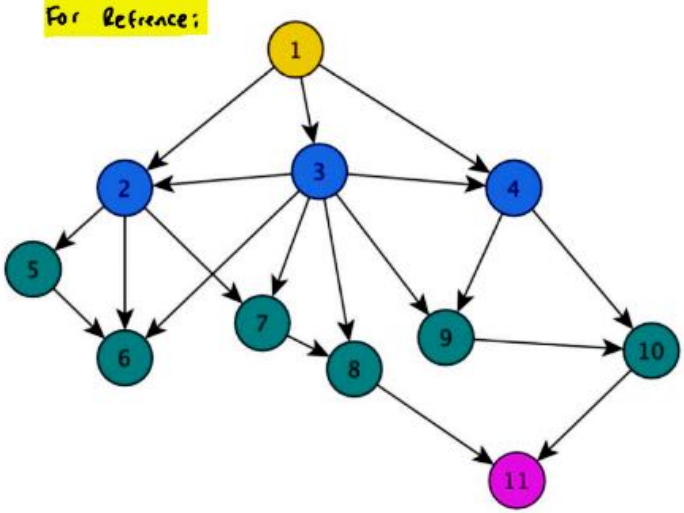
Q4[2]. Consider again the graph from Q2, but now suppose that each node represents a paper. What is the bibliographic coupling of nodes 2 and 3?

↳ # of papers they both cite (coupled from there)
* when they cite the same papers

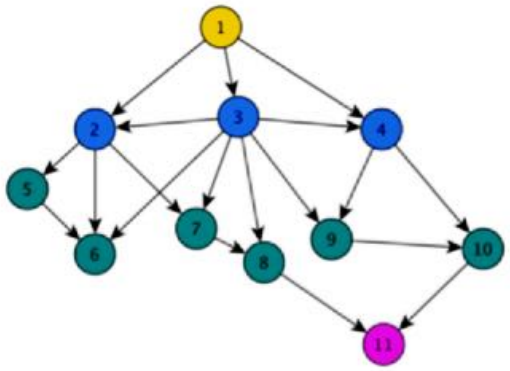


The bibliographic coupling is 2

For Refrence:



Q2[4]. Consider the following graph.



#1 2 3 2

#2 0

#3 1 2

#4 1

#5 0

#6 ↗

a[2]) What is the degree prestige of node 3?

$$P_D(N_3) = \frac{1}{11-1} = \frac{1}{10} = 0.10$$

Note: degree is typically measured on a 1.0 scale

SO degree is LOW here

b[2]) What is the proximity prestige of node 9?

$$P_D(N_9) = \frac{0.3}{1.83} = 0.1639$$

Distance To get to Node 9:

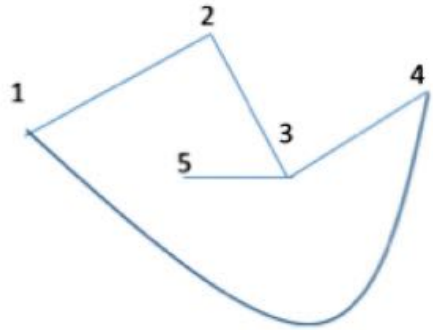
N1 → 2, 3, 2

N3 → 1, 2

N4 → 1

≈ (2 + 3 + 2 + 1 + 2 + 1)/6 = 1.83

Q1[6]. Consider the following graph.



a[2]) What is the degree centrality of node 3?

$$C_D(N_3) = \frac{3}{5-1} = \frac{3}{4} = 0.75$$

* Note: degree is typically measured on a 1.0 scale

SO degree is HIGH here

b[2]) What is the closeness centrality for node 3?

$$C_C(N_3) = \frac{5-1}{(1+1+1+2)} = \frac{4}{5} = 0.80$$

Shortest Path:

$N_3 \rightarrow N_5 = 1$

$N_3 \rightarrow N_4 = 1$

$N_3 \rightarrow N_2 = 1$

$N_3 \rightarrow N_1 = 2$

* Note closeness is typically measured on a 1.0 scale

SO closeness is HIGH here

c[2]) What is the betweenness centrality for node 3?

$$C_B(N_3) = \frac{1/2 + 1/1 + 1/1 + 2/2}{6} = \frac{3.5}{6} = 0.583$$

Path Connections:

$N_2 \rightarrow N_3 \rightarrow N_4 = 1/2$

$N_2 \rightarrow N_3 \rightarrow N_5 = 1/1$

$N_4 \rightarrow N_3 \rightarrow N_5 = 1/1$

$N_1 \rightarrow N_2 \rightarrow N_3 \rightarrow N_5 = 2/2$

Total Connection

$(5-1) * (5-2)/2 = 6$

# of shortest paths that pass through node 3 / # of 'shortest' path's available through node 3