Betweenness Centrality

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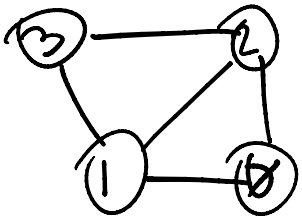

(I) Potential Paths:

$n < 4$ (ø through 3)

$$\frac{n(n-1)}{2} = \frac{4(3)}{2} = 6$$

(II) Betweenness Computations without Repetitions

Nodes	Shortest Paths
ø-1	(0,1)
ø-2	(0,2)
ø-3	(0,1,3) (0,2,3)
1-2	⟨1,2⟩
1-3	⟨1,3⟩
2-3	(2,3)

0	1	2	3
0	0	0	0
0	0	0	0
0	0.5	0.5	0
0	0	0	0
0	0	0	0
0	0	0	0
0	0.5	0.5	0

each row either ø or 1, thus split 0.5 for 2 geodesic paths

geodesics are split due to multiple paths

(III) Betweenness Centrality Final Computations

nodes	ø	1	2	3
sum	0	0.5	0.5	0

Formula for Denominator

$$\frac{(n-1)(n-2)}{2} = \frac{(4-1)(4-2)}{2} = \frac{(3)(2)}{2} = \frac{6}{2} = 3^{*}$$

* We do not repeate paths, thus 3 not 6.

III Final computation

nodes	0	1	2	3
numerator	0	0.5	0.5	0
denominator	3	3	3	3

$\frac{0}{3} + \frac{0.5}{3} + \frac{0.5}{3} + \frac{0}{3} = \frac{1}{3} = 0.33$ for whole graph

$0 + 0.17 + 0.17 + 0$ for each node

Results from Python

Node	Closeness	Betweenness
0	2	0.0
1	3	0.17
2	3	0.17
3	2	0.0