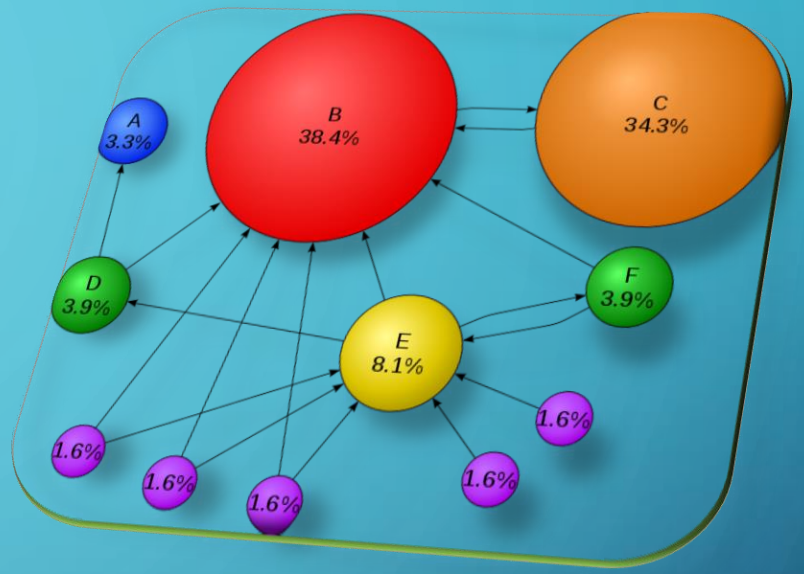
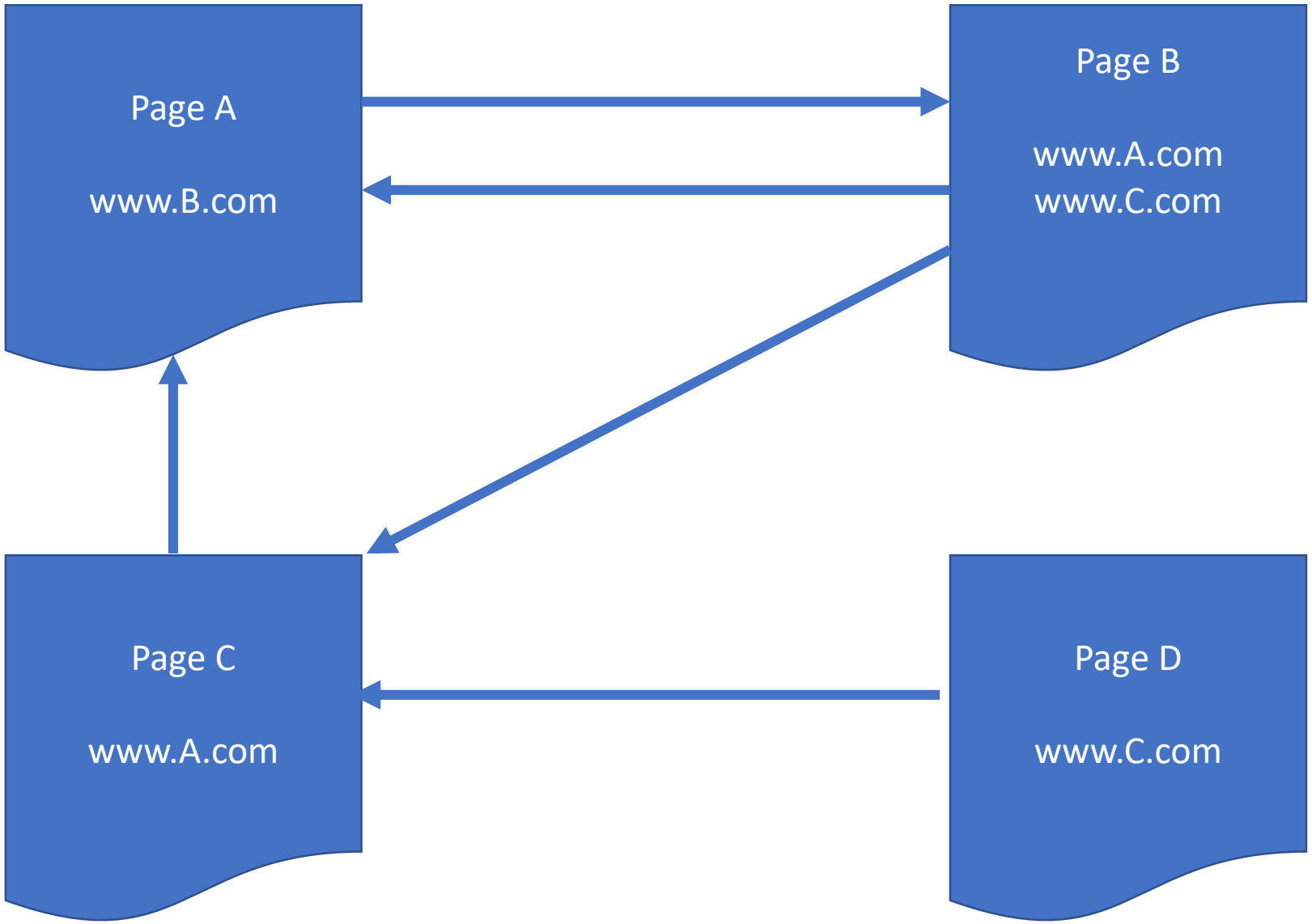


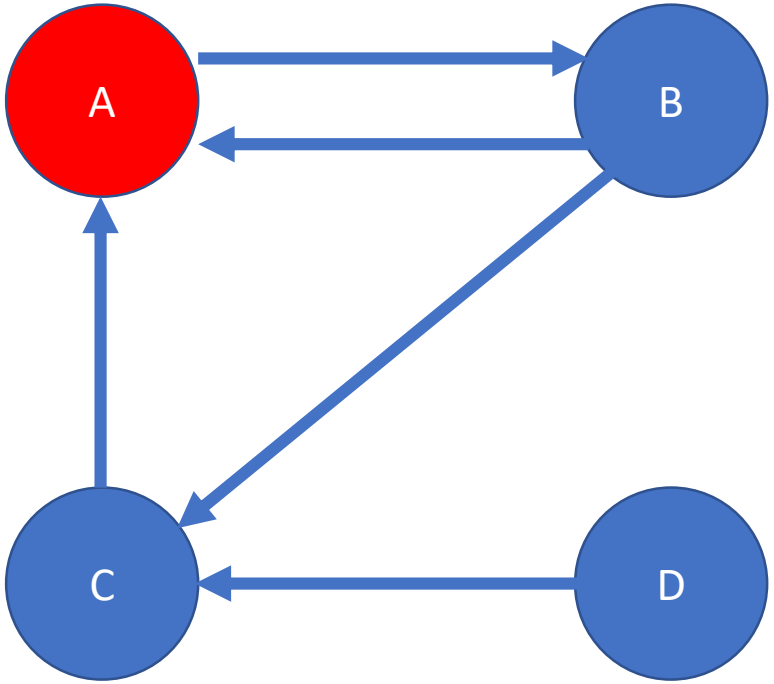
PAGERANK ALGORITHM

SEARCH ENGINE WEBSITE RANKING

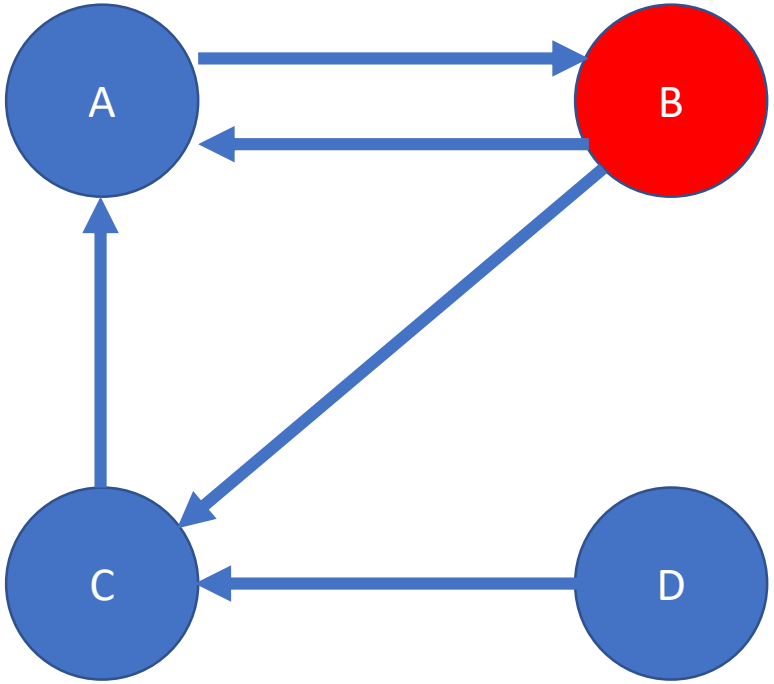

Page A
www.B.com
Page B
www.A.com
www.C.com
Page C
www.A.com
Page D
www.C.com

General Formula

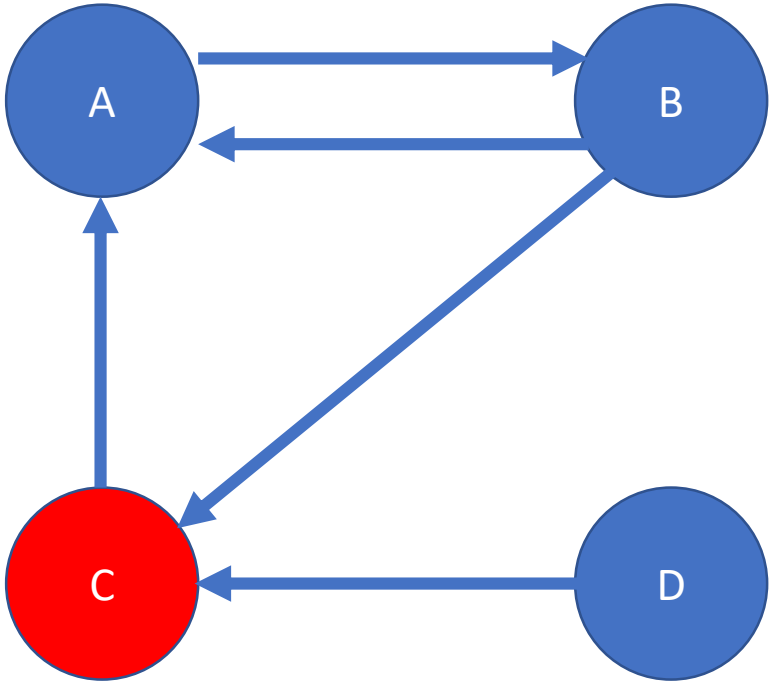
$$\text{PageRank}(A) = \frac{\text{PageRank}(B)}{\text{Outbound links}(B)} + \frac{\text{PageRank}(C)}{\text{Outbound links}(C)} + \frac{\text{PageRank}(D)}{\text{Outbound links}(D)} + \frac{\text{PageRank}(E)}{\text{Outbound links}(E)} + \cdots$$



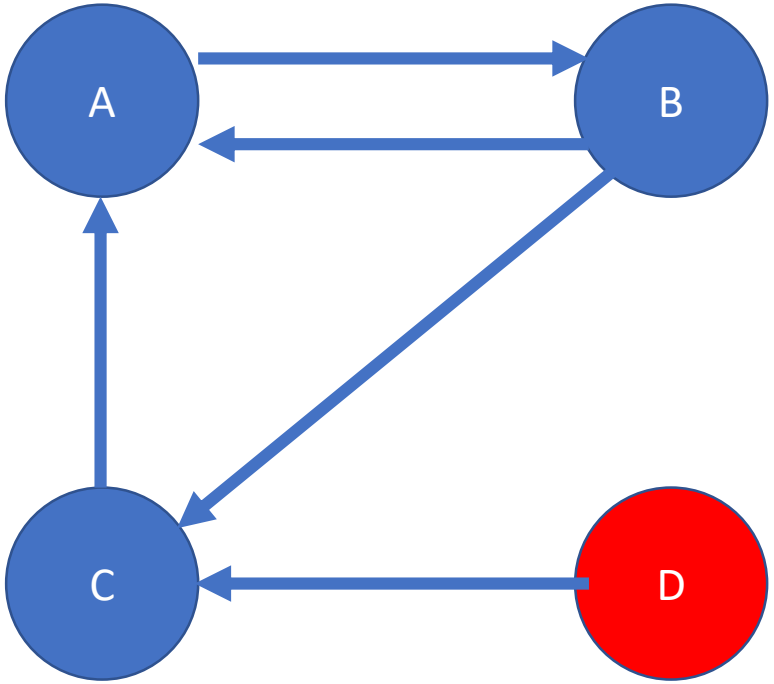
$$\text{PageRank}(A) = \frac{\text{PageRank}(B)}{\text{Count}(2)} + \frac{\text{PageRank}(C)}{\text{Count}(1)}$$



$$\text{PageRank}(B) = \frac{\text{PageRank}(A)}{\text{Count}(1)}$$



$$\text{PageRank}(C) = \frac{\text{PageRank}(B)}{\text{Count}(2)} + \frac{\text{PageRank}(D)}{\text{Count}(1)}$$



PageRank(D) = 0

Damping Factor

- The probability that a user will loose interest in following a chain of links and do another search.

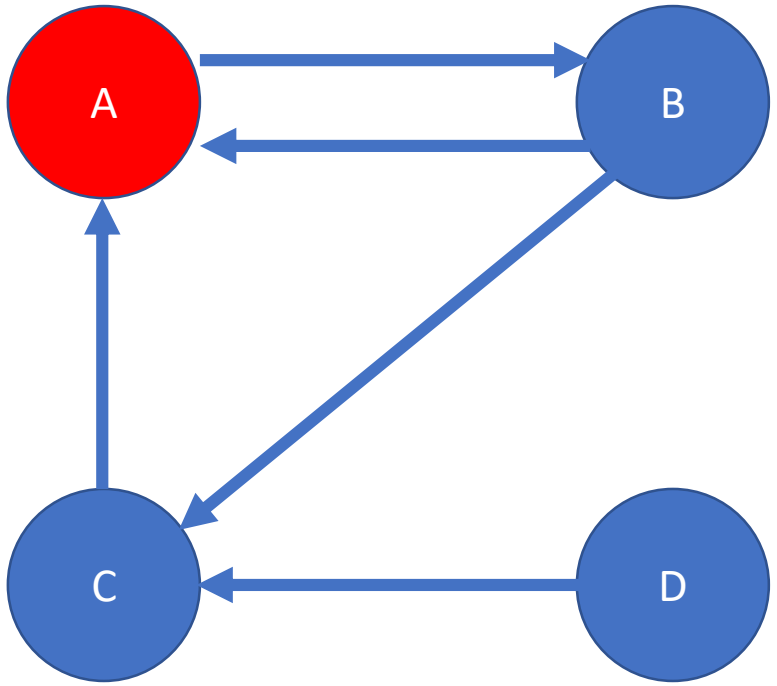
- The recommended default value is 0.85.

$$PR(A) = (1-d) + d * (PR(T1)/C(T1) + \ldots + PR(TN)/C(TN))$$

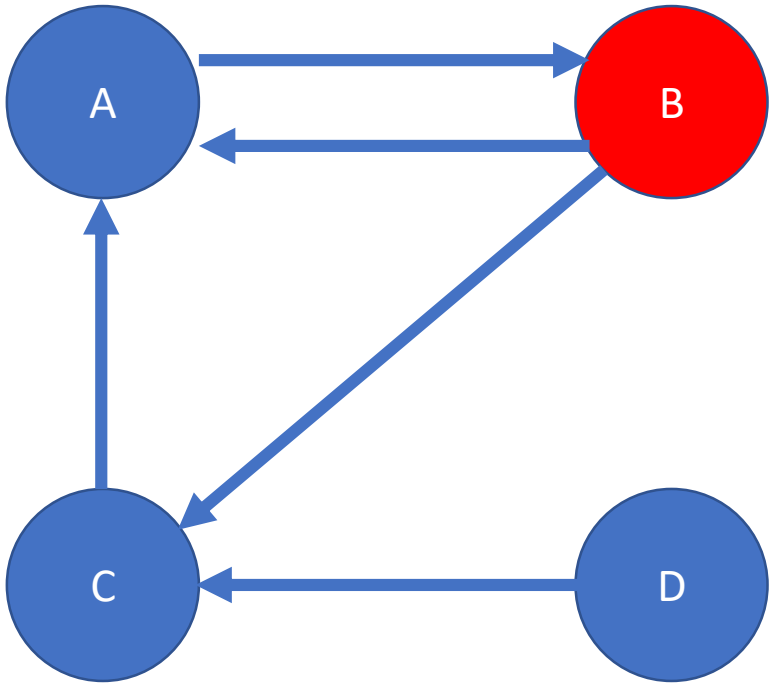
$$= (1-0.85) + 0.85 * (PR(B)/2 + PR(C)/1)$$

$$= (1-0.85) + 0.85 * (1 / 2 + 1 / 1)$$

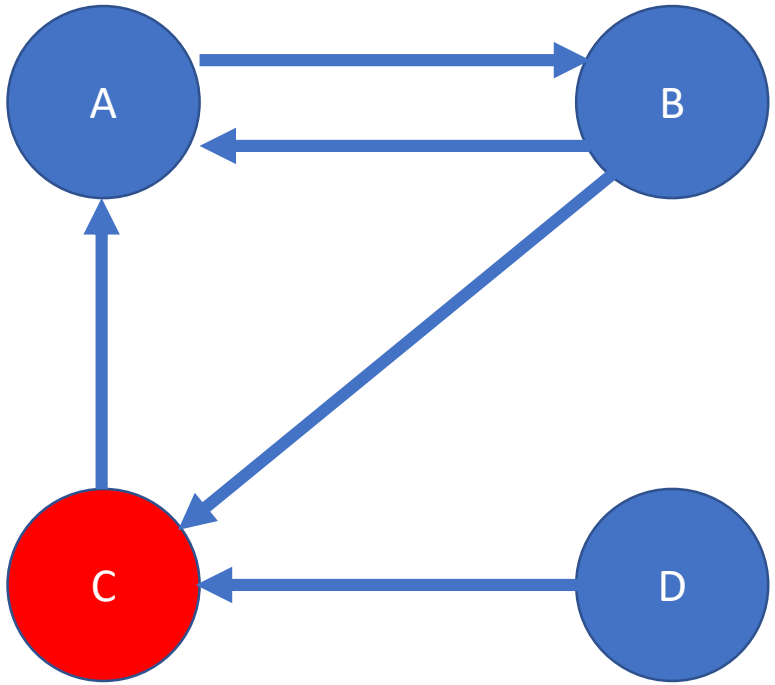
$$= 1.425$$



$$PR(B) = (1 - 0.85) + 0.85 * (PR(A) / 1)$$
$$= (1 - 0.85) + 0.85 * (1.425 / 1)$$
$$= 1.361$$

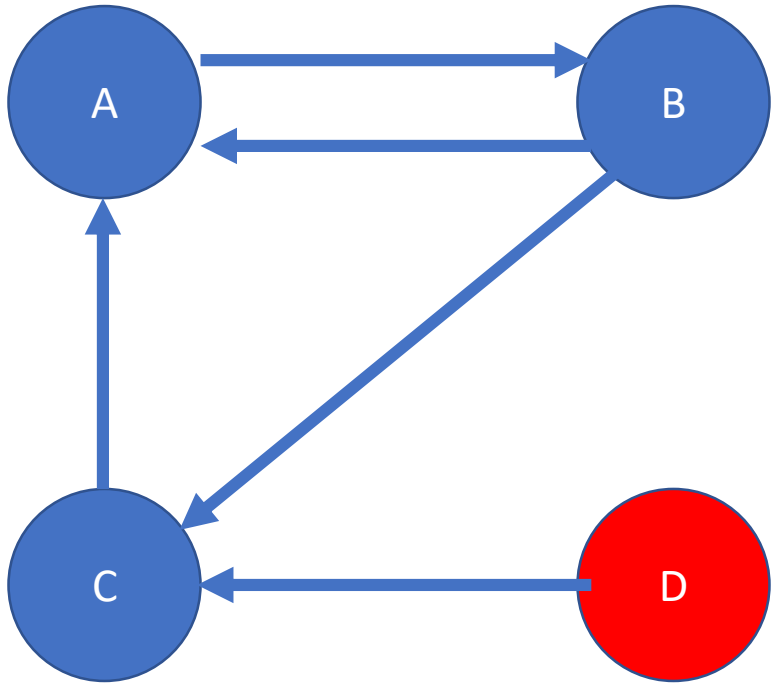


$$PR(C) = (1-0.85) + 0.85 * (PR(B)/2 + PR(D)/1)$$
$$= (1-0.85) + 0.85 * (1.361 / 2 + 1 / 1)$$
$$= 1.579$$



PR(D) = (1-0.85) + 0.85 * 0

= 0.15



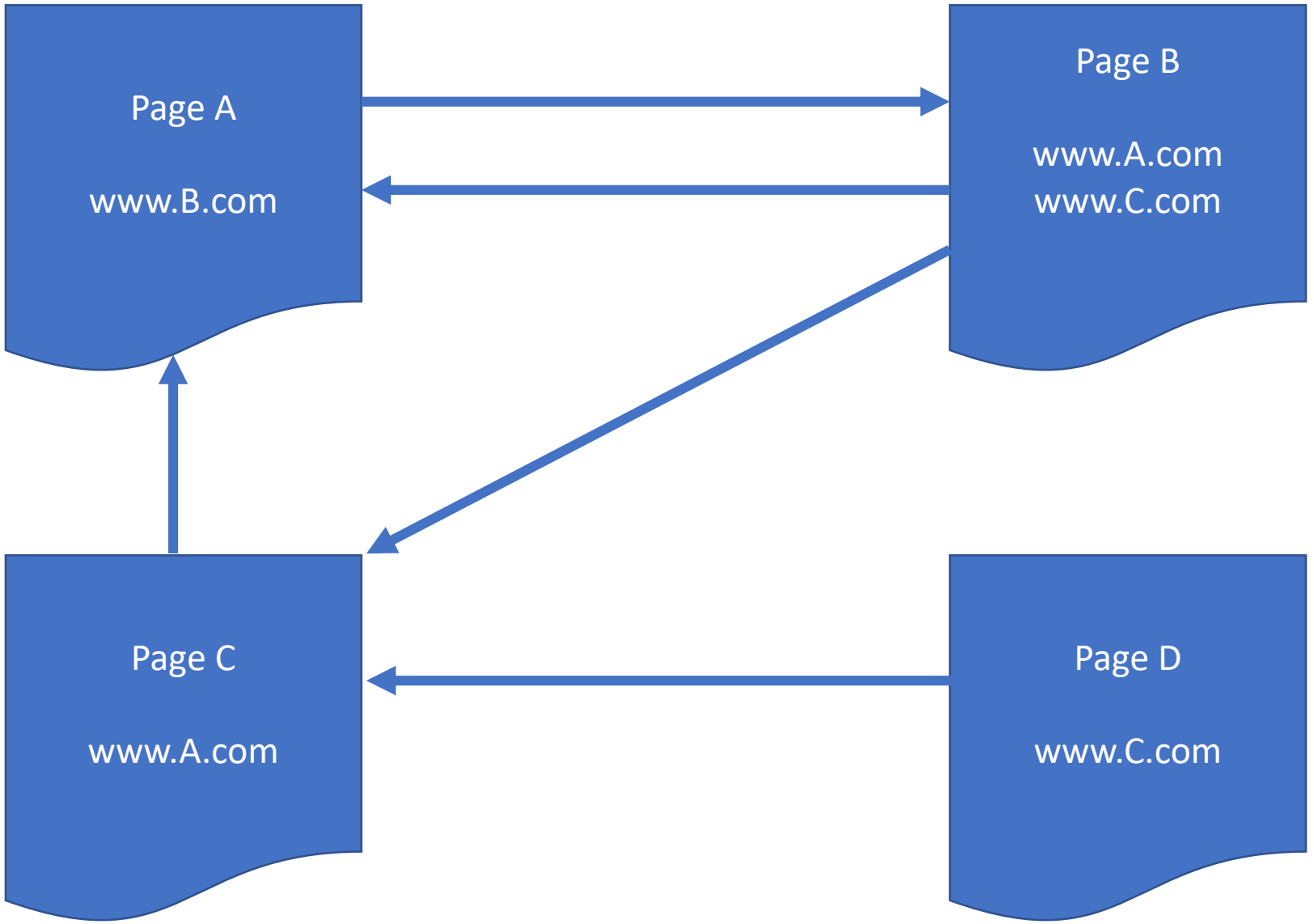
Iteration 1

PR(A) = 1.425

PR(B) = 1.361

PR(C) = 1.579

PR(D) = 0.15



```
1 ==========
pageA   previous 000001   current 01.425   diff 00.425   sum 00.425
pageB   previous 000001   current 01.361   diff 0.3612   sum 0.7862
pageC   previous 000001   current 01.579   diff 0.5785   sum 01.365
pageD   previous 000001   current 000.15   diff 000.85   sum 02.215
2 ==========
pageA   previous 01.425   current 002.07   diff 0.6453   sum 0.6453
pageB   previous 01.361   current 001.91   diff 0.5485   sum 01.194
pageC   previous 01.579   current 01.089   diff 0.4894   sum 01.683
pageD   previous 000.15   current 000.15   diff 000000   sum 01.683
3 ==========
pageA   previous 002.07   current 01.887   diff 0.1829   sum 0.1829
pageB   previous 001.91   current 01.754   diff 0.1554   sum 0.3383
pageC   previous 01.089   current 01.023   diff 0.06606   sum 0.4044
pageD   previous 000.15   current 000.15   diff 000000   sum 0.4044
```

```
4 ==========
pageA   previous 01.887   current 01.765   diff 0.1222   sum 0.1222
pageB   previous 01.754   current 001.65   diff 0.1039   sum 0.2261
pageC   previous 01.023   current 0.9789   diff 0.04415   sum 0.2703
pageD   previous 000.15   current 000.15   diff 000000   sum 0.2703
5 ==========
pageA   previous 01.765   current 01.684   diff 0.08168   sum 0.08168
pageB   previous 001.65   current 01.581   diff 0.06943   sum 0.1511
pageC   previous 0.9789   current 0.9494   diff 0.02951   sum 0.1806
pageD   previous 000.15   current 000.15   diff 000000   sum 0.1806
6 ==========
pageA   previous 01.684   current 01.629   diff 0.05459   sum 0.05459
pageB   previous 01.581   current 01.535   diff 0.0464   sum 00.101
pageC   previous 0.9494   current 0.9297   diff 0.01972   sum 0.1207
pageD   previous 000.15   current 000.15   diff 000000   sum 0.1207
```

7 ==========
pageA previous 01.629 current 01.592 diff 0.03648 sum 0.03648
pageB previous 01.535 current 01.504 diff 0.03101 sum 0.06749
pageC previous 0.9297 current 0.9165 diff 0.01318 sum 0.08067
pageD previous 000.15 current 000.15 diff 000000 sum 0.08067
8 ==========
pageA previous 01.592 current 01.568 diff 0.02438 sum 0.02438
pageB previous 01.504 current 01.483 diff 0.02072 sum 0.0451
pageC previous 0.9165 current 0.9077 diff 0.008808 sum 0.05391
pageD previous 000.15 current 000.15 diff 000000 sum 0.05391
9 ==========
pageA previous 01.568 current 01.552 diff 0.01629 sum 0.01629
pageB previous 01.483 current 01.469 diff 0.01385 sum 0.03014
pageC previous 0.9077 current 0.9018 diff 0.005886 sum 0.03603
pageD previous 000.15 current 000.15 diff 000000 sum 0.03603

10 ==========
pageA previous 01.552 current 01.541 diff 0.01089 sum 0.01089
pageB previous 01.469 current 001.46 diff 0.009256 sum 0.02015
pageC previous 0.9018 current 0.8979 diff 0.003934 sum 0.02408
pageD previous 000.15 current 000.15 diff 000000 sum 0.02408
11 ==========
pageA previous 01.541 current 01.534 diff 0.007278 sum 0.007278
pageB previous 001.46 current 01.454 diff 0.006186 sum 0.01346
pageC previous 0.8979 current 0.8953 diff 0.002629 sum 0.01609
pageD previous 000.15 current 000.15 diff 000000 sum 0.01609
12 ==========
pageA previous 01.534 current 01.529 diff 0.004864 sum 0.004864
pageB previous 01.454 current 01.449 diff 0.004134 sum 0.008998
pageC previous 0.8953 current 0.8935 diff 0.001757 sum 0.01075
pageD previous 000.15 current 000.15 diff 000000 sum 0.01075

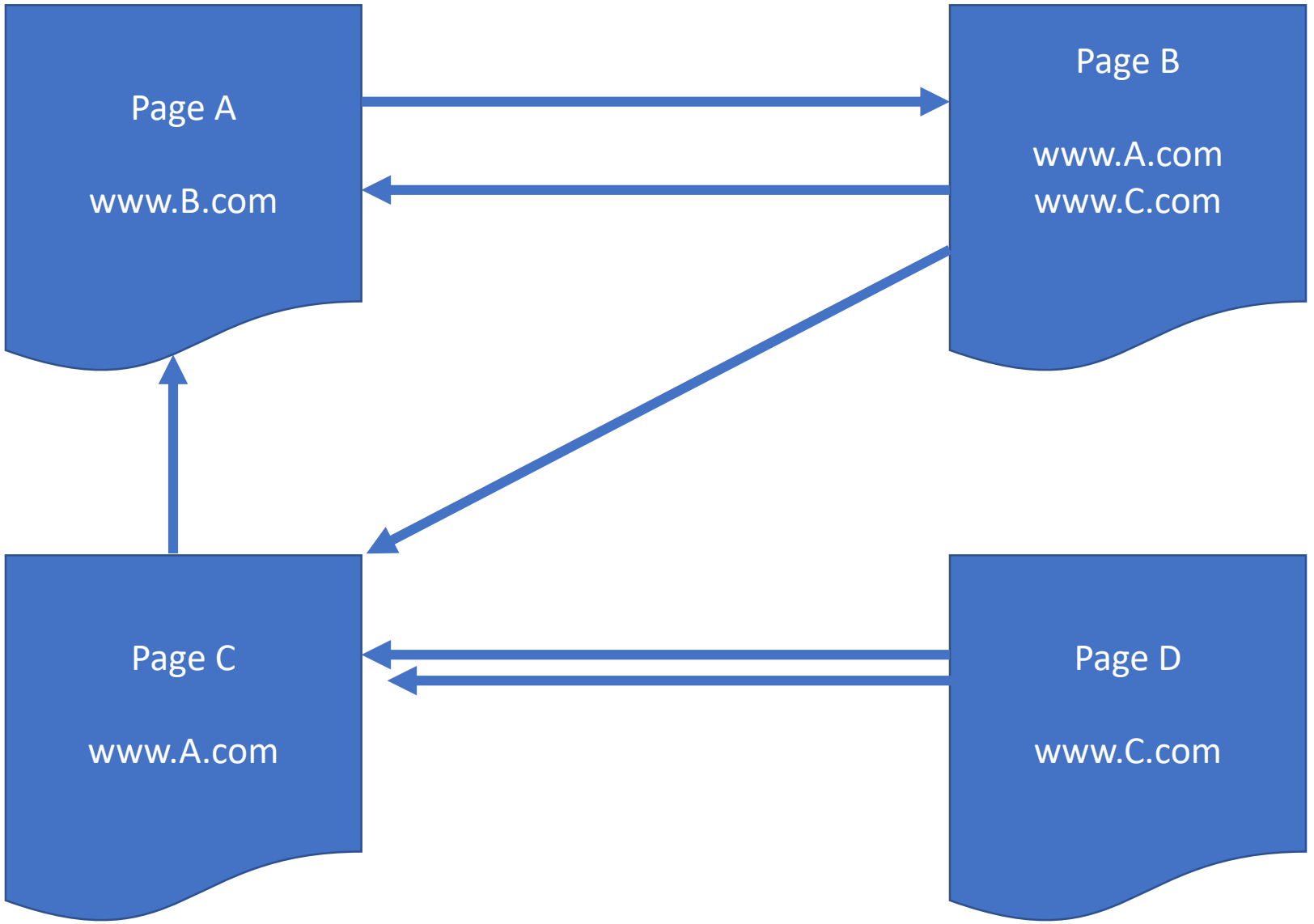
13 ==========
pageA previous 01.529 current 01.525 diff 0.00325 sum 0.00325
pageB previous 01.449 current 01.447 diff 0.002763 sum 0.006013
pageC previous 0.8935 current 0.8923 diff 0.001174 sum 0.007188
pageD previous 000.15 current 000.15 diff 000000 sum 0.007188
14 ==========
pageA previous 01.525 current 01.523 diff 0.002172 sum 0.002172
pageB previous 01.447 current 01.445 diff 0.001846 sum 0.004019
pageC previous 0.8923 current 0.8915 diff 0.0007848 sum 0.004804
pageD previous 000.15 current 000.15 diff 000000 sum 0.004804
15 ==========
pageA previous 01.523 current 01.522 diff 0.001452 sum 0.001452
pageB previous 01.445 current 01.444 diff 0.001234 sum 0.002686
pageC previous 0.8915 current 00.891 diff 0.0005245 sum 0.00321
pageD previous 000.15 current 000.15 diff 000000 sum 0.00321

16 ==========
pageA previous 01.522 current 01.521 diff 0.0009703 sum 0.0009703
pageB previous 01.444 current 01.443 diff 0.0008247 sum 0.001795
pageC previous 00.891 current 0.8907 diff 0.0003505 sum 0.002145
pageD previous 000.15 current 000.15 diff 000000 sum 0.002145
17 ==========
pageA previous 01.521 current 001.52 diff 0.0006484 sum 0.0006484
pageB previous 01.443 current 01.442 diff 0.0005512 sum 0.0012
pageC previous 0.8907 current 0.8904 diff 0.0002342 sum 0.001434
pageD previous 000.15 current 000.15 diff 000000 sum 0.001434
18 ==========
pageA previous 001.52 current 001.52 diff 0.0004334 sum 0.0004334
pageB previous 01.442 current 01.442 diff 0.0003684 sum 0.0008017
pageC previous 0.8904 current 0.8903 diff 0.0001566 sum 0.0009583
pageD previous 000.15 current 000.15 diff 000000 sum 0.0009583

Equilibrium

PR(A) = 1.52

PR(B) = 1.442

PR(C) = 0.8904

PR(D) = 0.15