

Analysis of PageRank Results Across Various Graph Structures

Question 4

(c)

Question

Where did most of the score tend to end up in your experiments? Look at the nodes that have the highest or lowest scores; is there a consistent pattern among your trials? Include your analysis in the pdf write-up.

Answer

1 Graph Descriptions and PageRank Results

1.1 Graph 15.1 Left

This graph is a simple cyclic graph with an additional self-loop at one node:

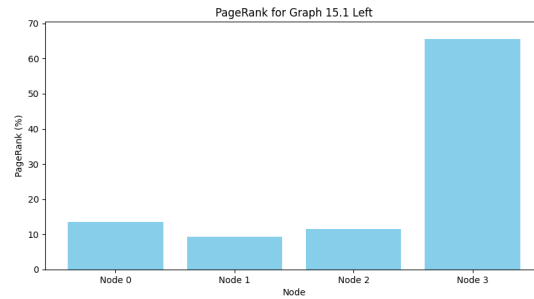
- Nodes: A, B, C, Z
- Edges: $A \rightarrow B$, $B \rightarrow C$, $C \rightarrow A$, $A \rightarrow Z$, $Z \rightarrow Z$

Results:

- Node 0 (A): 0.1352
- Node 1 (B): 0.0937
- Node 2 (C): 0.1160
- Node 3 (Z, with self-loop): 0.6551

As we can see, because of the graph construction, all the most of the flow eventually goes to Z but because of the the 3 cycle ABC transferring same "score to each other" however A always Set aside extra score for Z. and Z does not gives extra score to no one but himself.

As to the **Theorem 15.2** , the ε scaled page rank converges to a unique solution.



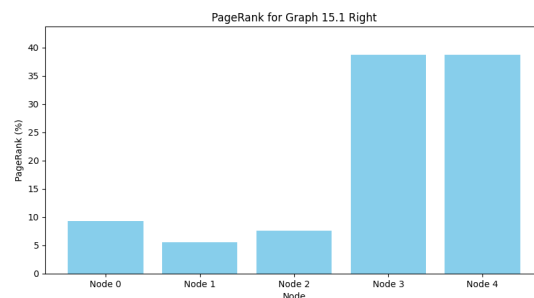
1.2 Graph 15.1 Right

This graph introduces an additional complexity with two interconnected nodes:

- Nodes: A, B, C, Z1, Z2
- Edges: $A \rightarrow B$, $B \rightarrow C$, $C \rightarrow A$, $A \rightarrow Z1$, $A \rightarrow Z2$, $Z1 \rightarrow Z2$, $Z2 \rightarrow Z1$

Results:

- Node 0 (A): 0.0937
- Node 1 (B): 0.0554
- Node 2 (C): 0.0760
- Node 3 (Z1): 0.3875
- Node 4 (Z2): 0.3875



As we can see, because of the graph construction, all the most of the flow eventually goes to Z1 and Z2 because of the the 3 cycle ABC transferring same "score to each other" however A always Set aside extra score for Z1 and Z2 while they are just **giving and taking** the same score out to each other. And not giving no body else score.

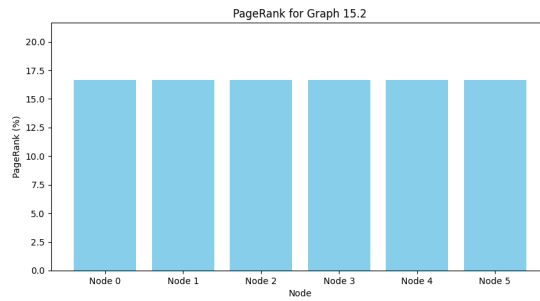
1.3 Graph 15.2

This graph consists of two separate cycles:

- Nodes: A, B, C, A', B', C'
- Edges: $A \rightarrow B$, $B \rightarrow C$, $C \rightarrow A$ and $A' \rightarrow B'$, $B' \rightarrow C'$, $C' \rightarrow A'$

Results:

- All nodes have equal PageRank values of 0.1667.



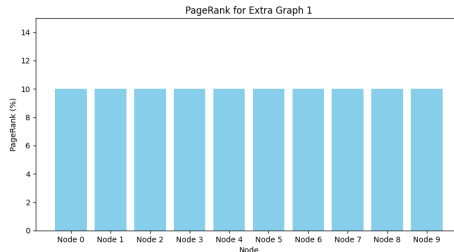
As we can see, because of the graph construction, it is constructed by two perfect cycles of 3, therefore there is no transferring each score from one cycle to other cycle.

Also for each node in the cycle, the score that he is "getting" is the score that he is "transferring" because we are in a cycle and every node has 1 degree in and 1 degree out.

1.4 Extra Graph 1

A perfect cycle with 10 nodes.

- Results: Each node has a PageRank of 0.1000.



As we can see, because of the graph construction, it is the same logic as graph 15.2 however there is a 1 perfect cycle of size 10.

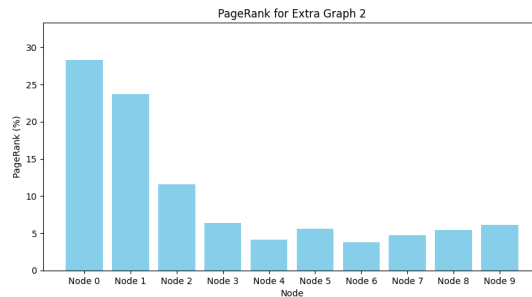
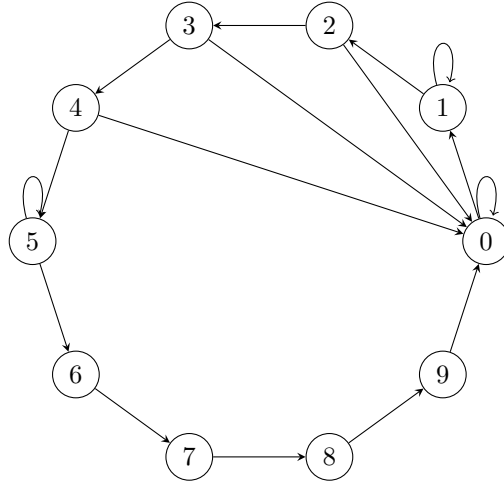
1.5 Extra Graph 2

A complex structure with self-loops and multiple edges to one node.

- Node 0, which has multiple incoming edges, shows the highest PageRank at 0.2831.
- after Node 0, Node 1 shows the highest PageRank at 0.2373.
- all of the other nodes are eventually taking much less percentage in the page rank

As we can see, because of the graph construction, the Node 0 as a lot in degree, has a loop to himself, and an edge to 1 therefore, he is getting "a lot of score" and giving "keeping to himself score because of the loop" therefore he has a bigger pageRank score than others.

Also the Node 1 gets relatively big score because he receives relatively big score from 0 who has a big score, and also has an inner loop which make him give to others "less of his score".



1.6 Facebook graph

In the facebook graph there are 4039 nodes, after doing the PageRank algorithm, we have seen that the Node 0 had the most Rank of **0.0062 percent**.

His inner degree (and outer because it is a non directed graph) was the highest by far then the others with in degree of 347.

From the other hand the node with the least rating was node number 2079 with PageRank 0.0000 and innerDegree 1.

(d)

Question

Intuitively explain your results in terms of a measure of influence in a social network. Do you think that this is an accurate measurement? How could we try to improve it (for instance, by incorporating link strengths or other measures of popularity)? Include your answers in the pdf write-up.

Answer

explanation and conclusion

what have we seen in patterns in all of the graphs, is that **inner loops** are increasing score, also that in cycles, it is relatively the same score if not the same in some cases.

This makes sense because if there is a site that a lot of other sites are connected to it (you can reach them easily from their site, or it is recommended to go there) its popularity can increase drastically and therefore its pageRank is elevating .

While on the other hand , if no other site (node) points to a specific site (node) its popularity and **exposure** can be really low.

How could we improve it

I don't know yet...