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 → B, B → C, C → A, A → Z, Z → 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.
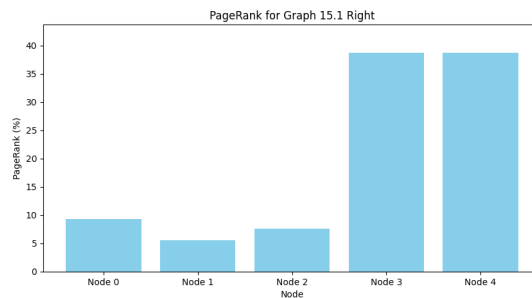
PageRank for Graph 15.1 Left
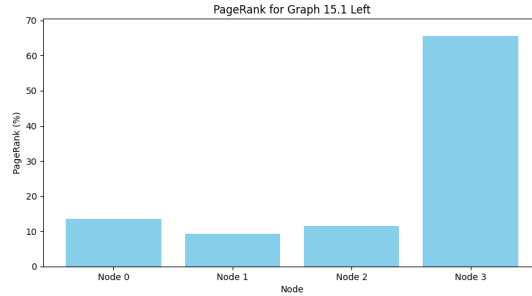
1.2 Graph 15.1 Right

This graph introduces an additional complexity with two interconnected nodes:

- Nodes: A, B, C, Z1, Z2

- Edges: A → B, B → C, C → A, A → Z1, A → Z2, Z1 → Z2, Z2 → 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

PageRank for Graph 15.1 Right

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.
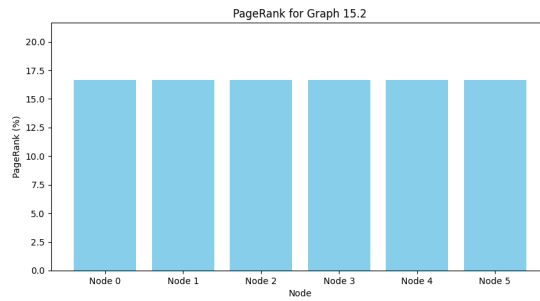
1.3 Graph 15.2

This graph consists of two separate cycles:

- Nodes: A, B, C, A', B', C'

- Edges: A → B, B → C, C → A and A' → B', B' → C', C' → A'

Results:

- All nodes have equal PageRank values of 0.1667.

PageRank for Graph 15.2

As we can see, because of the graph construction, it is constructed by to 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.

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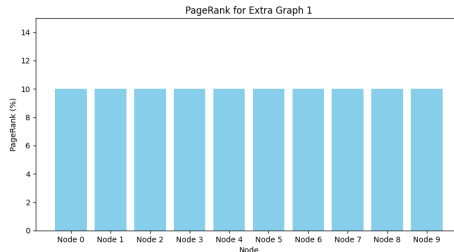
As we can see, because of the graph construction, it is the same logic as graph 15.2 however there is a 1 perfect cycle of size 10.

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 witch make him give to others "less of his score".
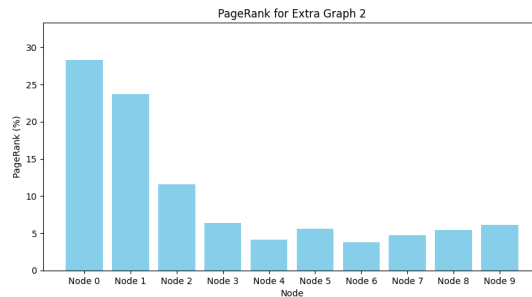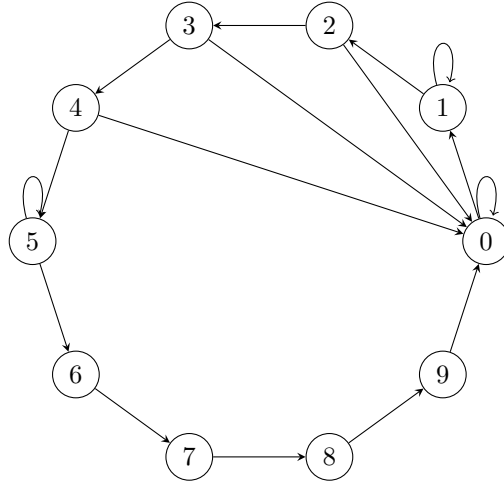
Conclusion

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