***Report (Project One)***

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Employing Brandes' algorithm, I calculated the betweenness centrality for each node in the graph. Subsequently, I computed the PageRank centrality for every node using the PageRank algorithm, with an alpha value of 0.85 and a beta value of 0.15. Based on the betweenness and PageRank centrality scores, I identified and showcased the top 10 most prominent nodes.

## ***Task 1***

* For the betweenness centrality, we use brandes’s algorithm to calculate each node cores. The betweenness centrality for each nodes is the probability that a shortest through each nodes.

*deonotes the number of shortest oaths form vertex s to t.*

*indicates the number of shortest paths from s to t that pass through .*

*indicates the dependence of s to .*

*is the set of predecessors of 𝑤 in the shortest paths from node 𝑠 to node 𝑤. This set includes all possible direct predecessor nodes on the shortest paths.*

* Top 10 nodes with betweenness centrality scores:

1. Node 107: 7833120.288881498
2. Node 1684: 5506573.373816568
3. Node 3437: 3849012.3031429905
4. Node 1912: 3737836.424513574
5. Node 1085: 2429155.5167209613
6. Node 0: 2384992.226158789
7. Node 698: 1880048.4929644
8. Node 567: 1569993.8111882566
9. Node 58: 1375189.966749334
10. Node 428: 1048328.1355515153

* Node 107 has the highest betweenness centrality score, indicating that it plays a crucial role in connecting different parts. Nodes with lower betweenness centrality scores may not be as central in connecting different parts.

## ***Task 2***

* For page rank we use PageRank algorithm to calculate each node scores. And using power iteration methon to reach the converges.

The damping factor denotes the probability of reaching a page through links.

The teleportation factor denotes the probability of directly accessing a page.

A is the adjacency matrix.

D is the degree matrix.

* Top 10 nodes with betweenness centrality scores:

1. Node 107: 0.0002702498010070472
2. Node 3437: 0.0002700483616089346
3. Node 0: 0.0002682070253608347
4. Node 1684: 0.0002663040554941442
5. Node 1912: 0.00025975501705967737
6. Node 348: 0.0002545025006358817
7. Node 414: 0.00025387055269356795
8. Node 3980: 0.00025376700461764314
9. Node 686: 0.0002534589825043283
10. Node 698: 0.0002511840706442171

* Node 107 has the highest PageRank centrality score, indicating that it is highly influential or central in terms of being visited by random walkers. Nodes with lower PageRank scores may not be influential.

## ***Summary***

Summarize your work, highlights and further discussions if applicable.

## ***Reference***

1. Some concepts and formulas from lecture’s slides, and some codes from tutorial’s slides.
2. ChatGPT helped me polish the writing part.