CS 432: Homework Number Five

Due on March 24, 2019 at 12:00 PM

Alexander Nwala

Tim Bruce

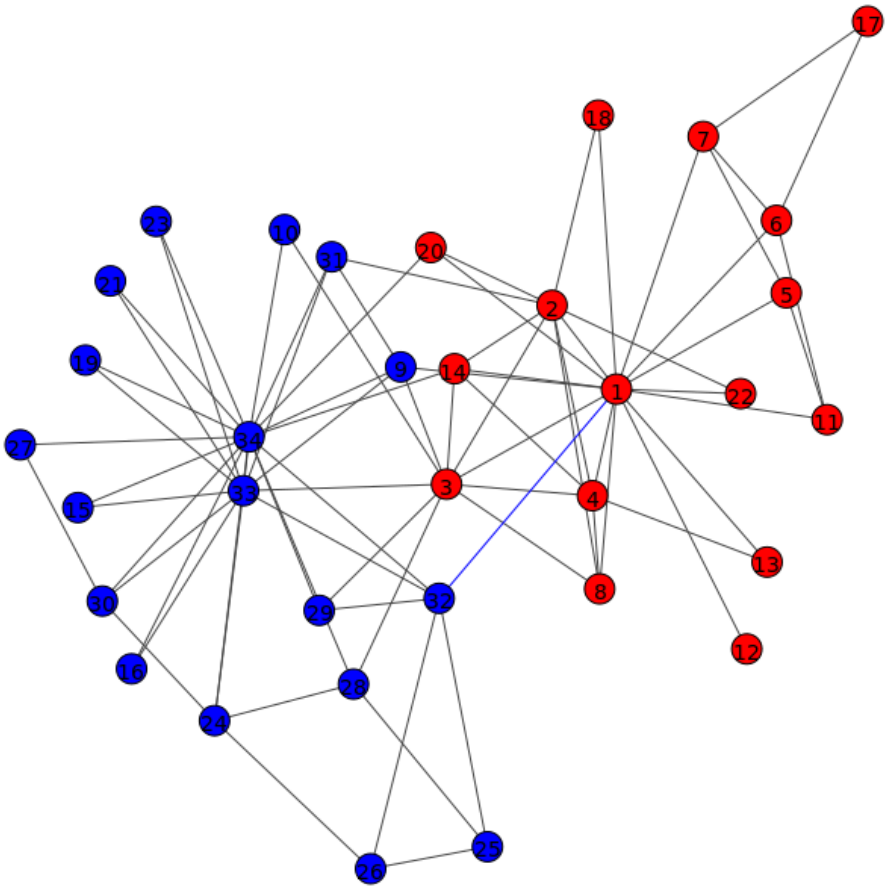
Problem 1

We know the result of the Karate Club (Zachary, 1977) split. Prove or disprove that the result of split could have been predicted by the weighted graph of social interactions. How well does the mathematical model represent reality?

Solution

I decided to use igraph early on in my solving of this problem, because it appeared to have function for finding the betweenness for an edge. This was a mistake. It just felt difficult to do anything except exactly their specified use case. Most of the time on this project was spent trying to first display graphs (fairly easy) and then get the betweenness for an edge (fairly hard for me apparently). I started by just plotting the chart. To do this I used the data from the class slides for week 6. Getting used to igraph was extremely difficult, because I hadn't yet figured out how data is added and manipulated in this package. Note that for all graphs, the colors represent the real results of the split.

Image 1: The base chart generated by the program.

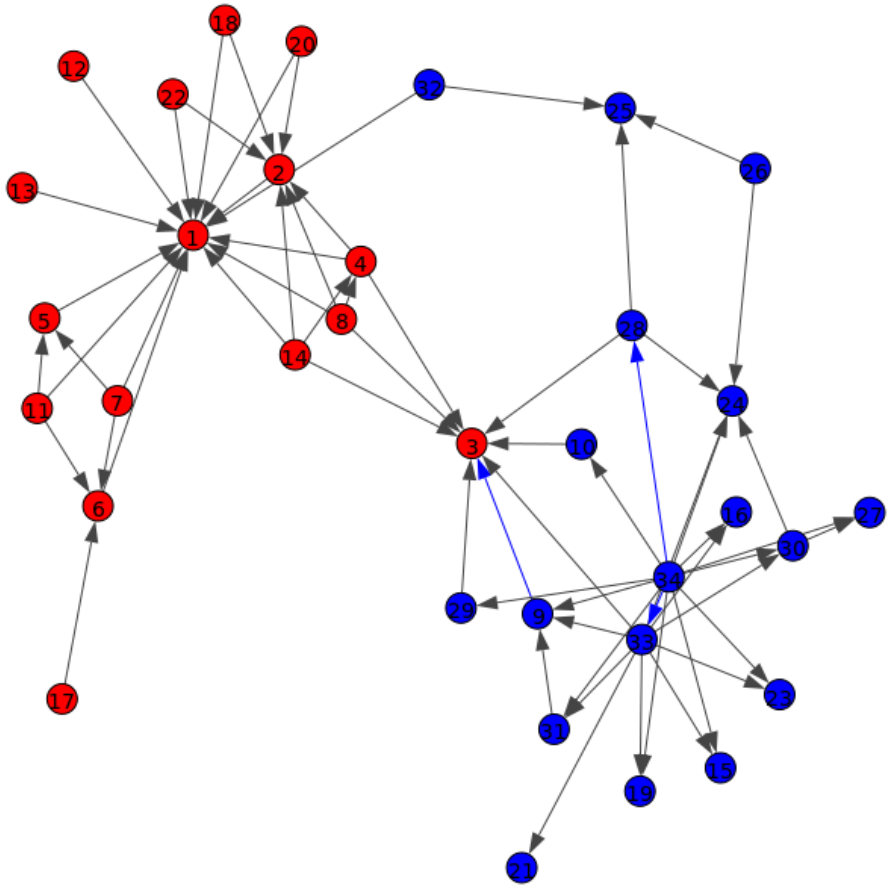


Note that the above plot has the 1-32 edge highlighted in blue. This represents that that is the edge with the highest betweenness. Betweenness was what really took time on this assignment. I had extreme difficulty trying to find a solution. Eventually, I was able to get it working with a directed graph, and implement everything else for the Girvan-Newman Algorithm, but I was confused when the results were downright incorrect. These false results, aside from being a jumbled mess, may give some insight into why society on the internet is such a mess.

Problem 1 continued on next page...

This entire paragraph is opinion and should be treated as such. You see, the incoherent output was correct, but the graph was still directed. It represents how the group may have split if all communication was one way.

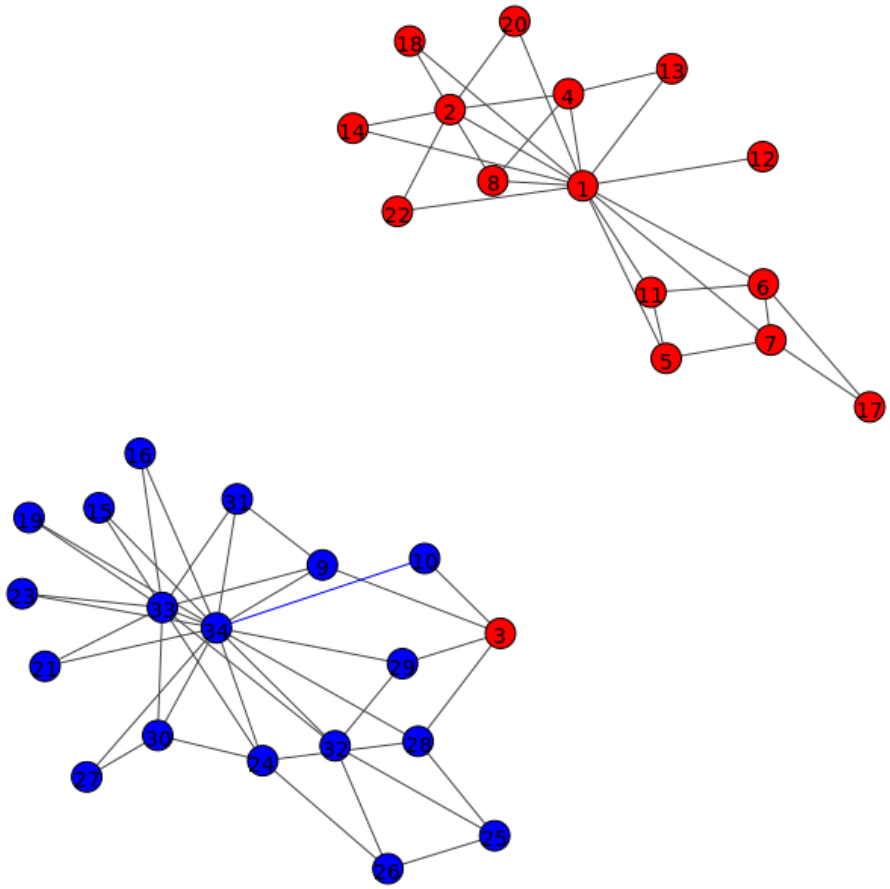
Image 2: The Final Directed Chart Generated Before the Program Crashed.



As you can see, this is more of a follower type of diagram, with the main viewed pages being 3, 1, and 2. This is largely because of how the dataset is laid out, but I do still think it is insightful. It shows how a division on the internet can lead to information being spread through very few sources as specific nodes see it. It is of course impossible to draw any conclusions like this, but I do feel that the lack of two way communication is something that can be extremely harmful in a community of any size.

Once I removed the "directed=True" tag from the Graph() initializer, I was back on track. The program works by using the igraph built in Edge.betweenness() function to calculate the betweenness of every edge on the graph. Then, the program finds the edge or edges with the highest betweenness highlights them blue, and then displays them in a window so the user can review it. After the window is closed, the program saves the cart and removes the edge. Repeating this process leads to two split graphs.

Image 3: The Final Chart Showing the Division Between the Groups if the Garvan-Newmann Algorithm was Completely Accurate.



Node three appears to have taken an odd choice, given the correctness of every other node, however, upon closer inspection, 3 had direct communication with node 1 and did not speak to node 34. This means to me that 1 and 3 probably talked to each other and came to an understanding. If you look closely, no blue node talked to 1 and not 34 except node 3, this may make them a unique exception that is beyond the scope of this problem. Later, I may try to weight the edges with 1 and 34 to see if the results come out perfectly.