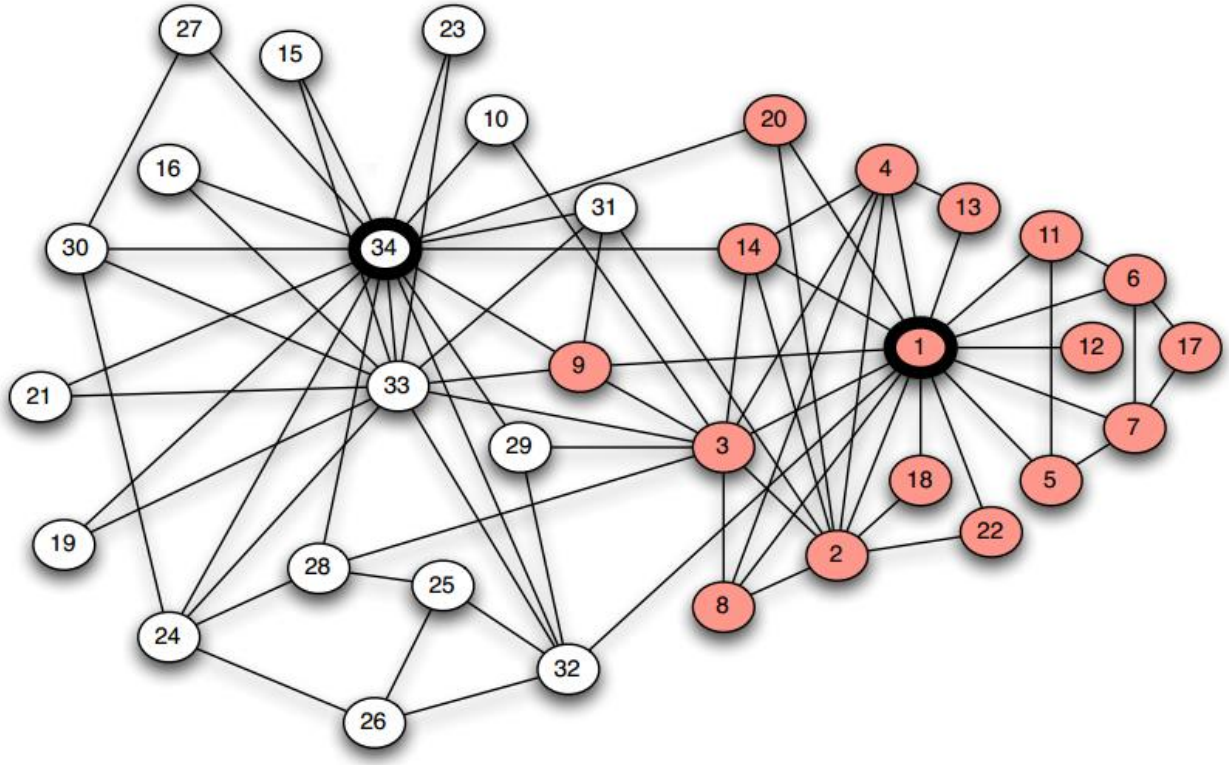
Gabriel Marquez
00978141

The focus of this assignment was understanding the Zachary Karate Club study, and using social network principles to see if the results could be predicted.

The Zachary Karate Club was the subject of a sociological study that took place in 1977. The Karate Club experienced a schism at a point in its existence that resulted in a split into two separate clubs. The resulting split is shown below:



After the split, the Karate Club was used as the subject of study in many fields to better understand social networking and human interaction.

In the assignment, the main task was to see if using methods such as Graph Partitioning and the Girvan-Newman Algorithm, we can create a mathematical model that mirrors the actual post-separation karate club. In order to accomplish this, the program rScript.r (obtained from Mohammed Aturban). This enabled step by step simulation of the split. The following details it:

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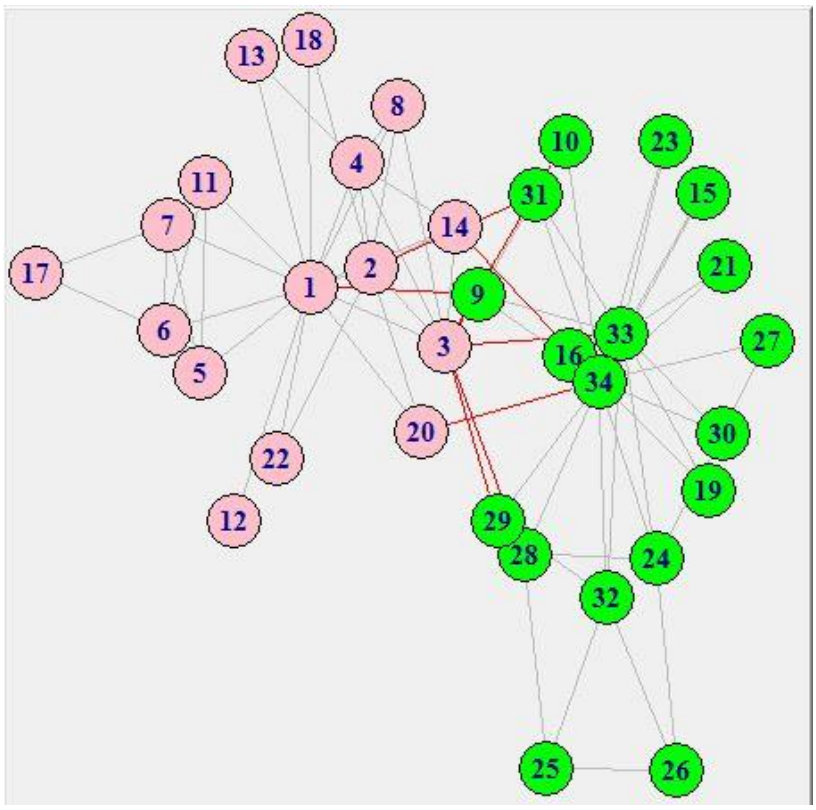

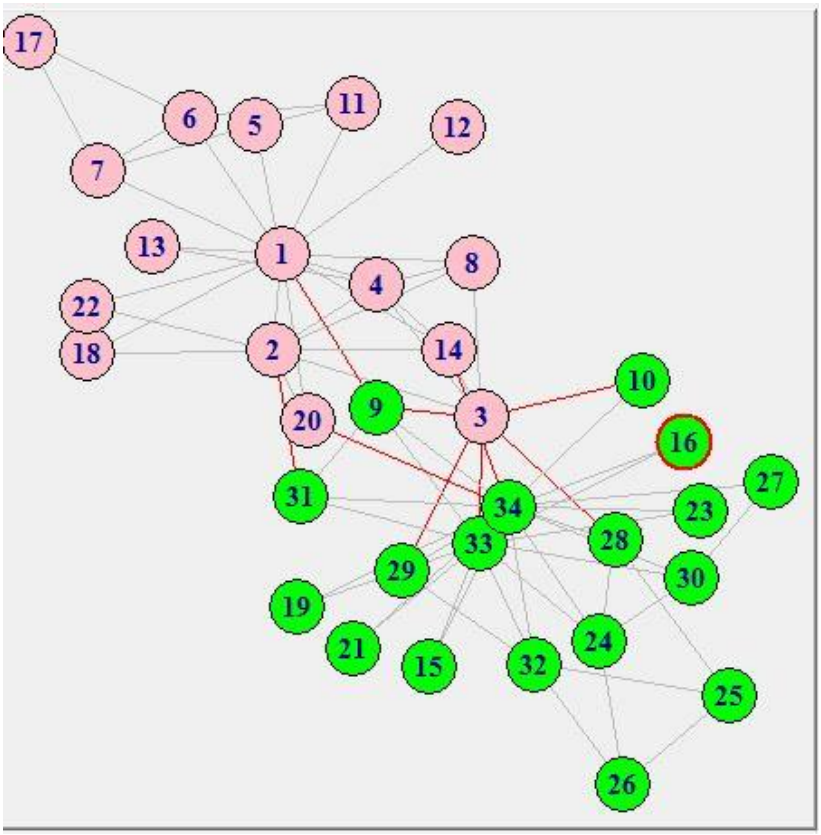

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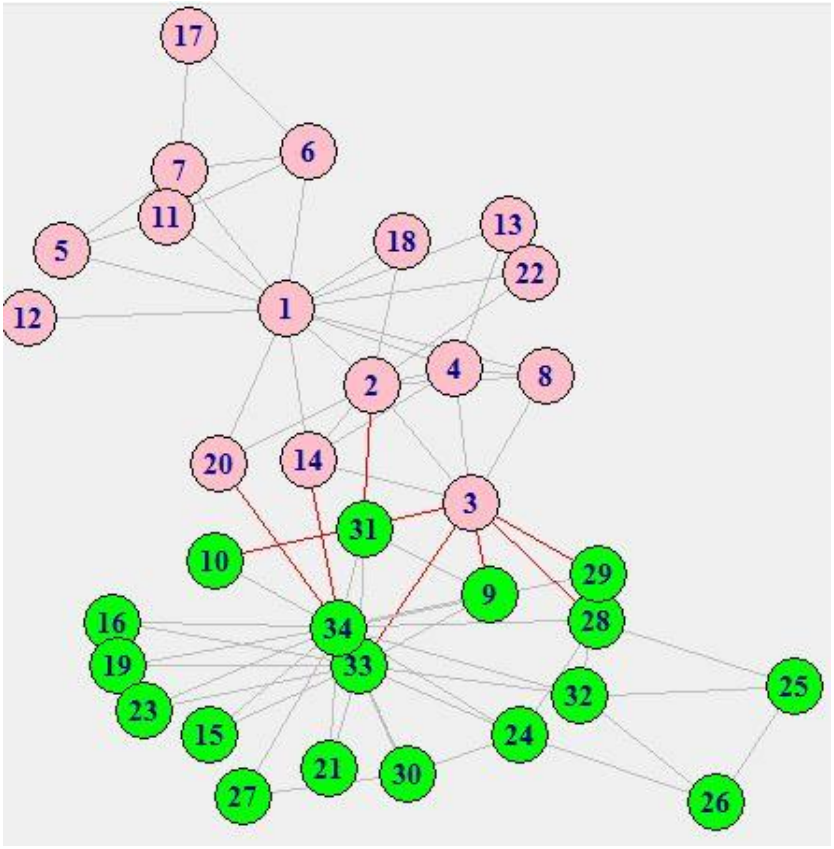

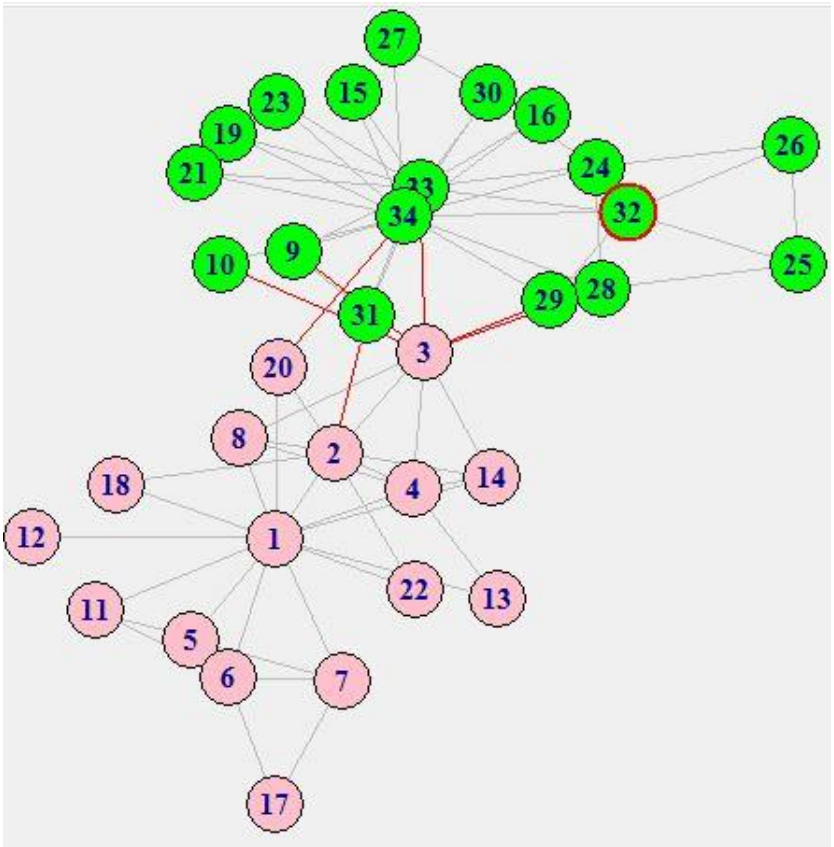

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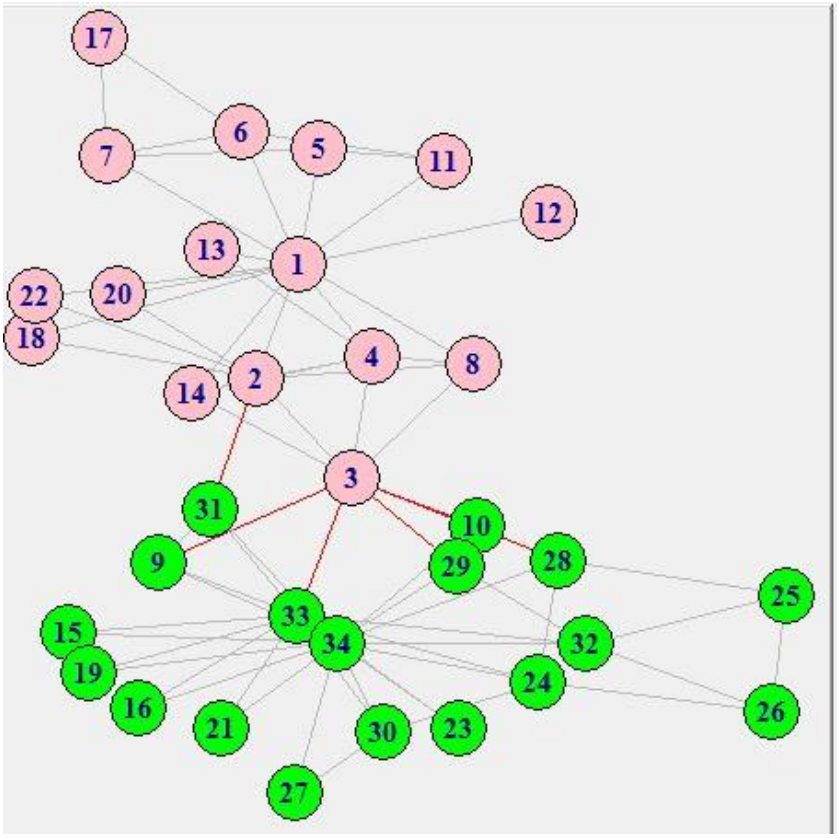

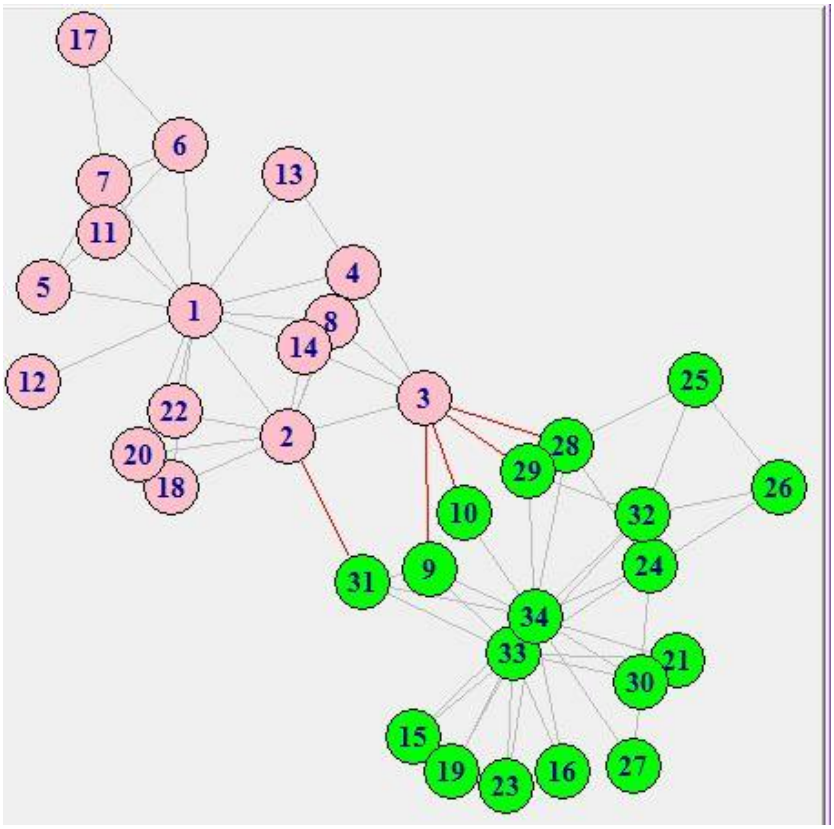

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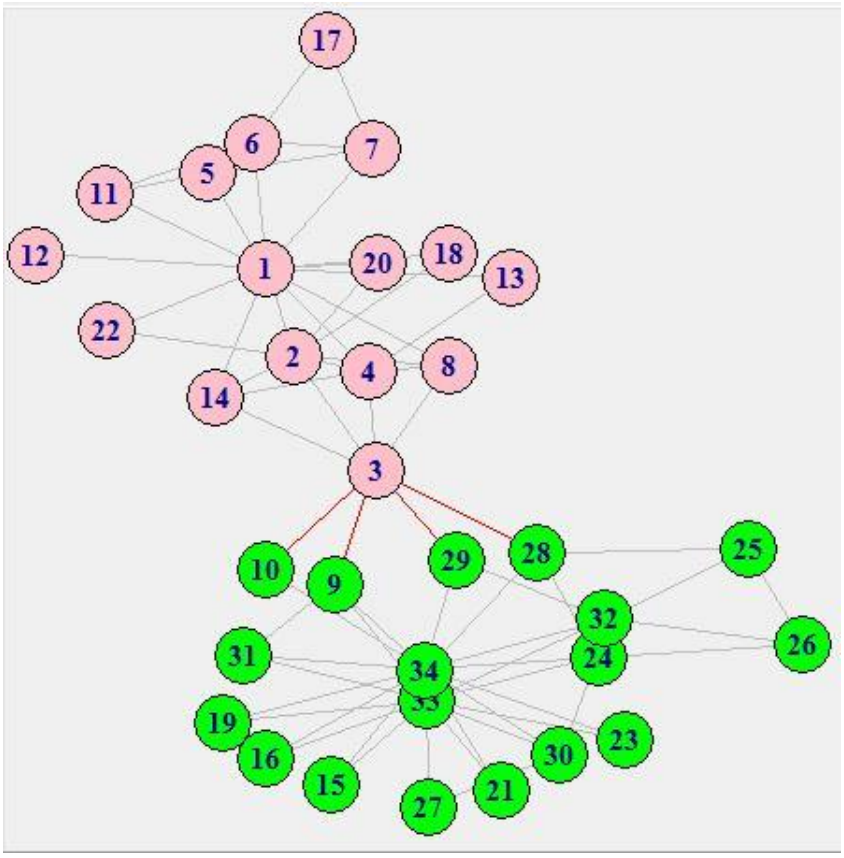

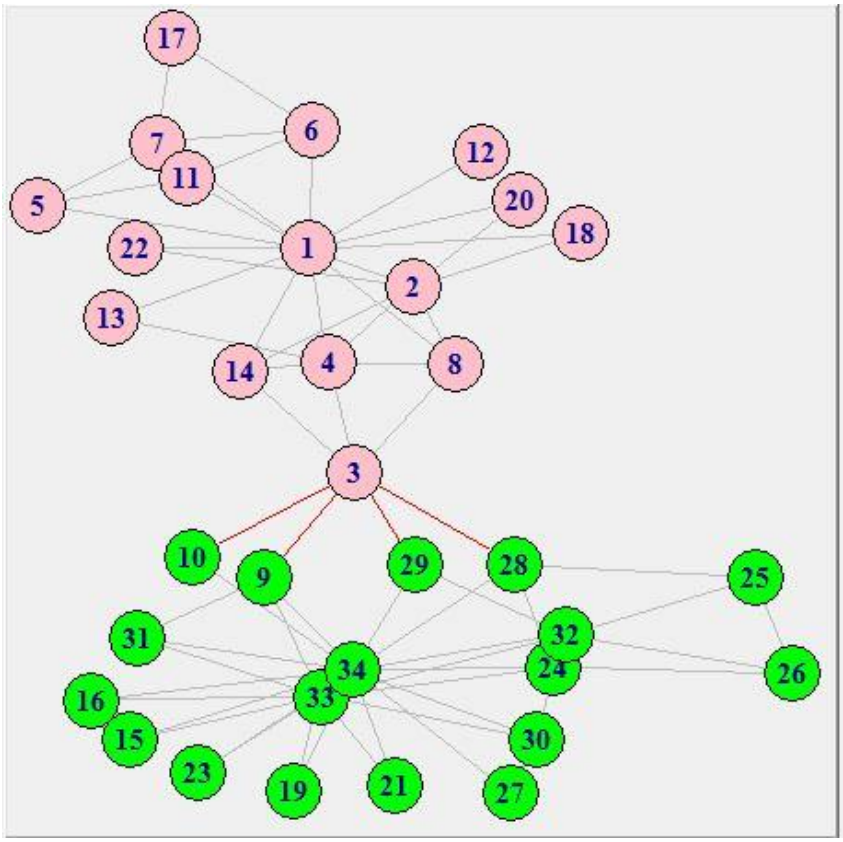

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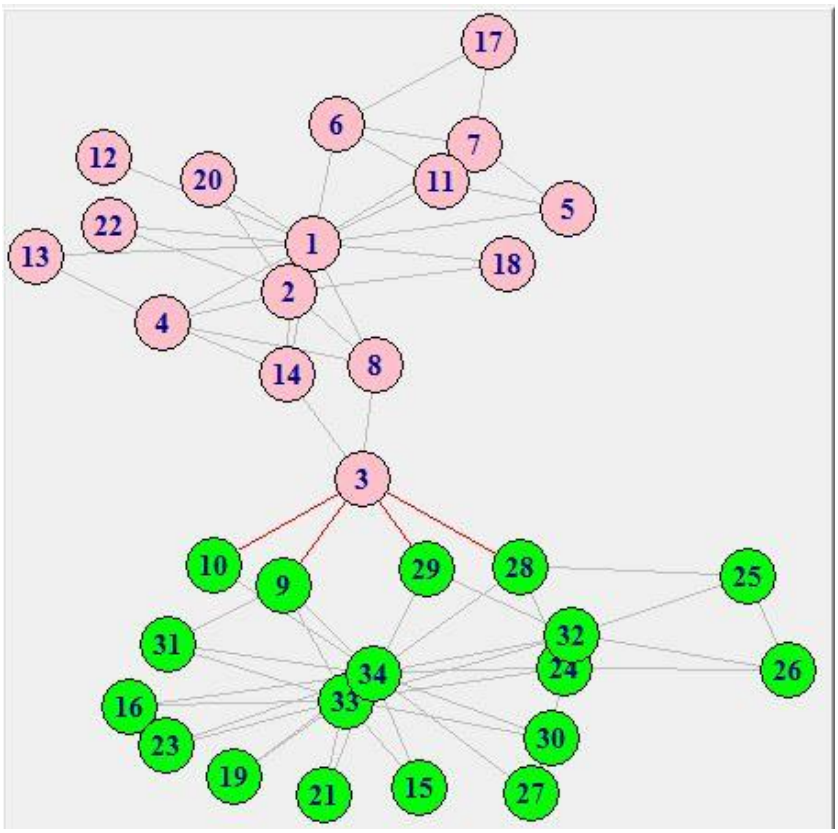

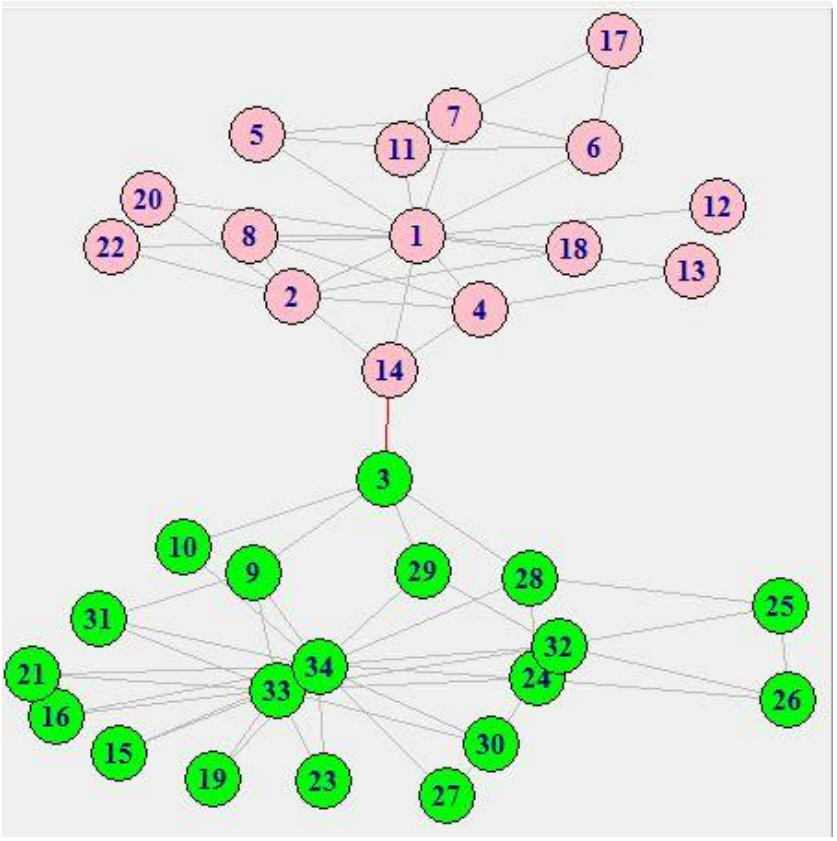

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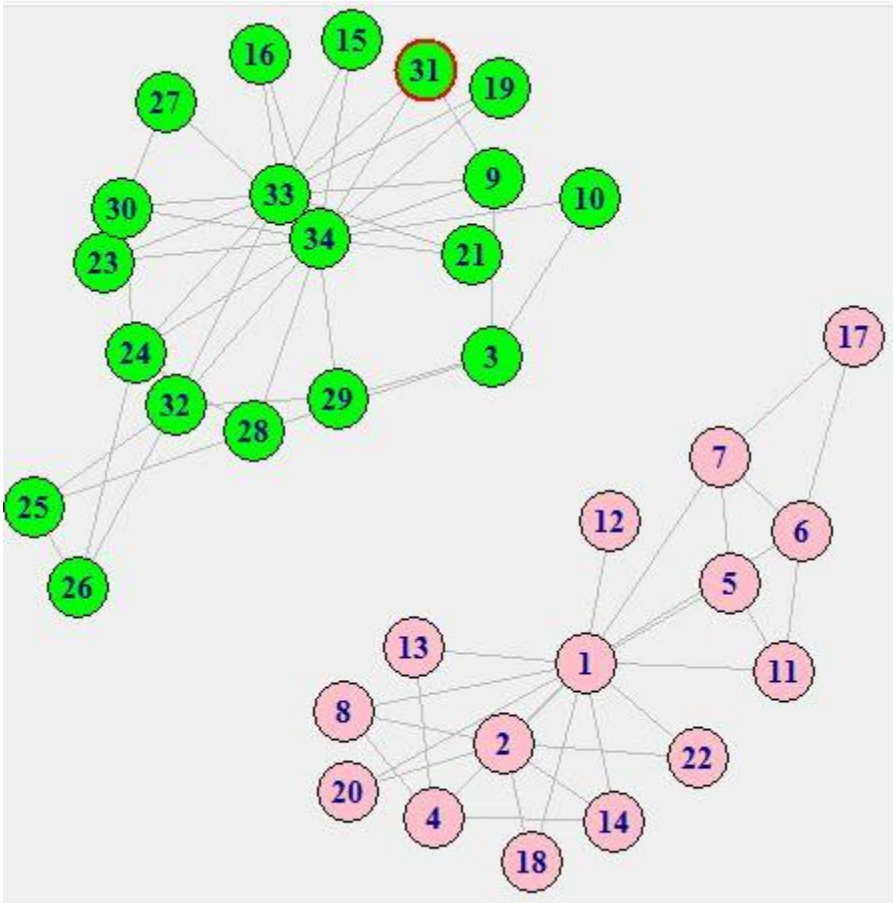

The following calculatios were derived concerning the edges:

[1] "Edges will be deleted in the following order : "

[1] "1 -> 32 -- Betweenness = 71.3928571428571"

[1] "1 -> 3 -- Betweenness = 66.8951770451771"

[1] "1 -> 9 -- Betweenness = 77.3173992673993"

[1] "14 -> 34 -- Betweenness = 82.0029059176118"

[1] "20 -> 34 -- Betweenness = 123.232917082917"

[1] "3 -> 33 -- Betweenness = 100.205555555556"

[1] "2 -> 31 -- Betweenness = 143.626984126984"

[1] "2 -> 3 -- Betweenness = 109.25"

[1] "3 -> 4 -- Betweenness = 107.666666666667"

[1] "3 -> 8 -- Betweenness = 142.75"

[1] "3 -> 14 -- Betweenness = 285"

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Observation shows that this schism was the result of the initial Karate Club having internal cliques centered around nodes 1, 33, and 34, which had the most connections. These nodes acted as nuclei as bridges with high betweenness that connected the two groups collapsed, eventually isolating both clubs.

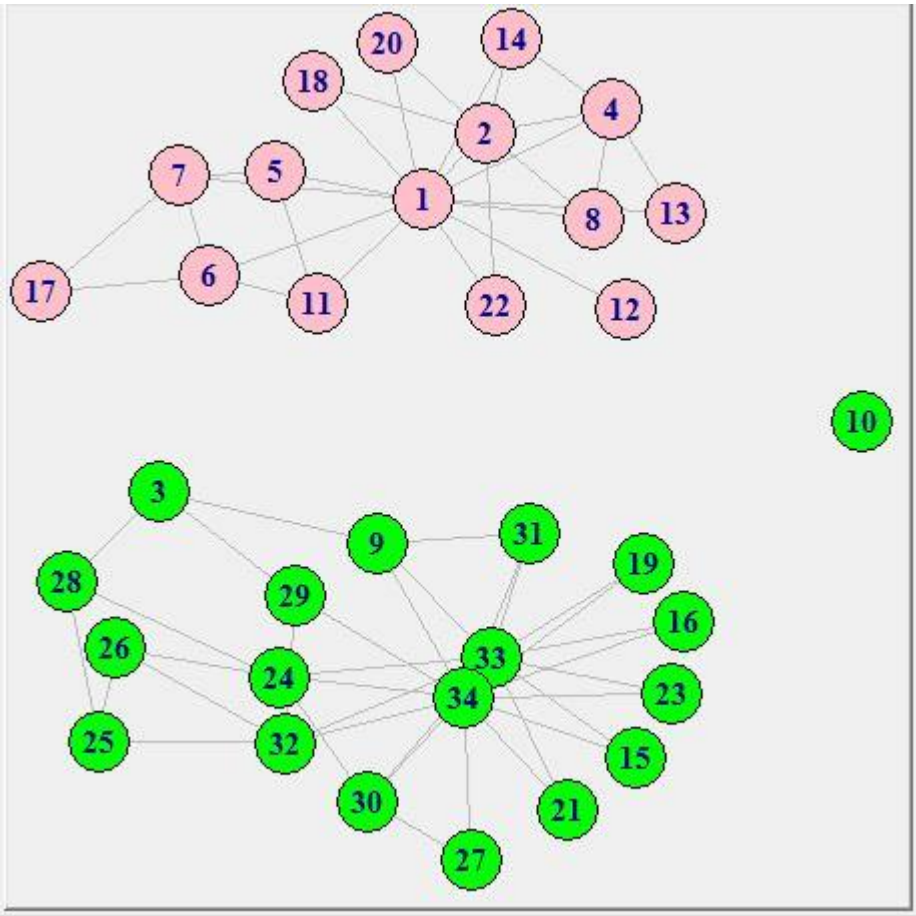
After comparing the results with the actual events, it can be said that the collapse of the Karate Club could be accurately modeled and predicted, if all relationships are properly identified and quantified.

This assignment proved the ability of mathematical modeling in predicting the outcome of social structure development in humans. One can only wonder about the limits of the prediction capability if used in larger scale experiments on a national or even international level.

Extra Credit-

After running the rScript.r with instructions to break apart the initial club into more sub-clubs, the following results were derived.

Three Groups



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[1] "1 -> 3 -- Betweenness = 66.8951770451771"

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[1] "3 -> 33 -- Betweenness = 100.205555555556"

[1] "2 -> 31 -- Betweenness = 143.626984126984"

[1] "2 -> 3 -- Betweenness = 109.25"

[1] "3 -> 4 -- Betweenness = 107.666666666667"

[1] "3 -> 8 -- Betweenness = 142.75"

[1] "3 -> 14 -- Betweenness = 285"

[1] "10 -> 34 -- Betweenness = 16.8333333333333"

[1] "28 -> 34 -- Betweenness = 18.1833333333333"

[1] "3 -> 10 -- Betweenness = 18"

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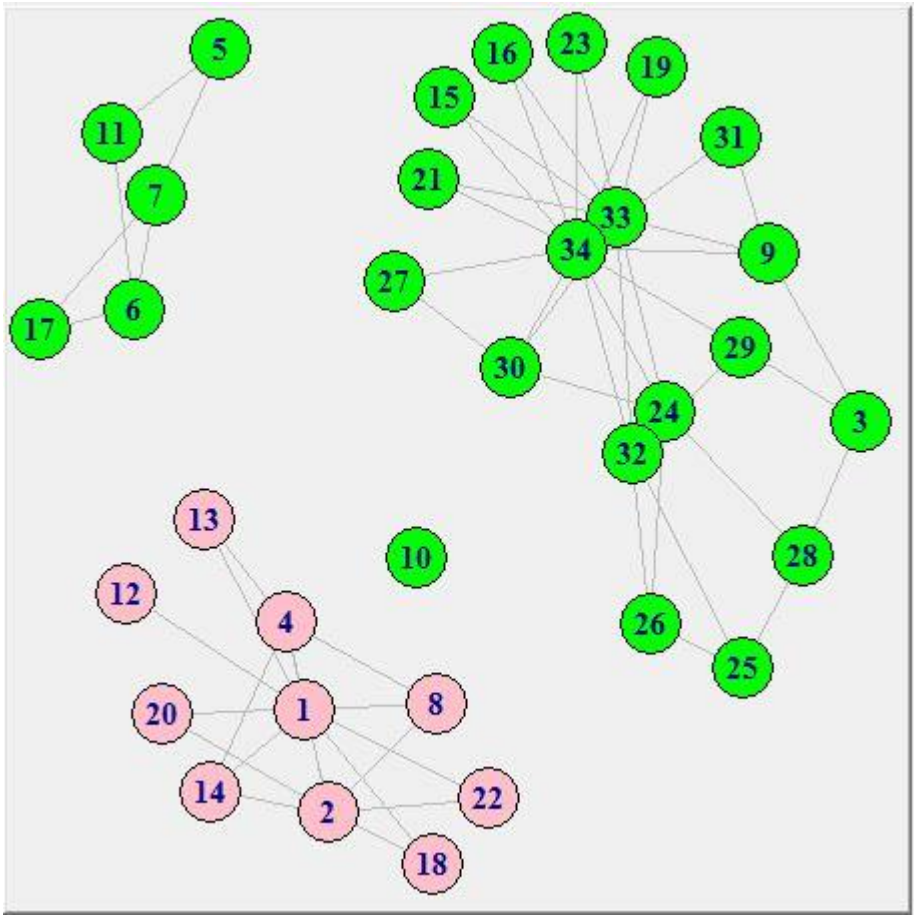
Four Groups



[1] "Edges will be deleted in the following order : "

[1] "1 -> 32 -- Betweenness = 71.3928571428571"

[1] "1 -> 3 -- Betweenness = 66.8951770451771"

[1] "1 -> 9 -- Betweenness = 77.3173992673993"

[1] "14 -> 34 -- Betweenness = 82.0029059176118"

[1] "20 -> 34 -- Betweenness = 123.232917082917"

[1] "3 -> 33 -- Betweenness = 100.205555555556"

[1] "2 -> 31 -- Betweenness = 143.626984126984"

[1] "2 -> 3 -- Betweenness = 109.25"

[1] "3 -> 4 -- Betweenness = 107.666666666667"

[1] "3 -> 8 -- Betweenness = 142.75"

[1] "3 -> 14 -- Betweenness = 285"

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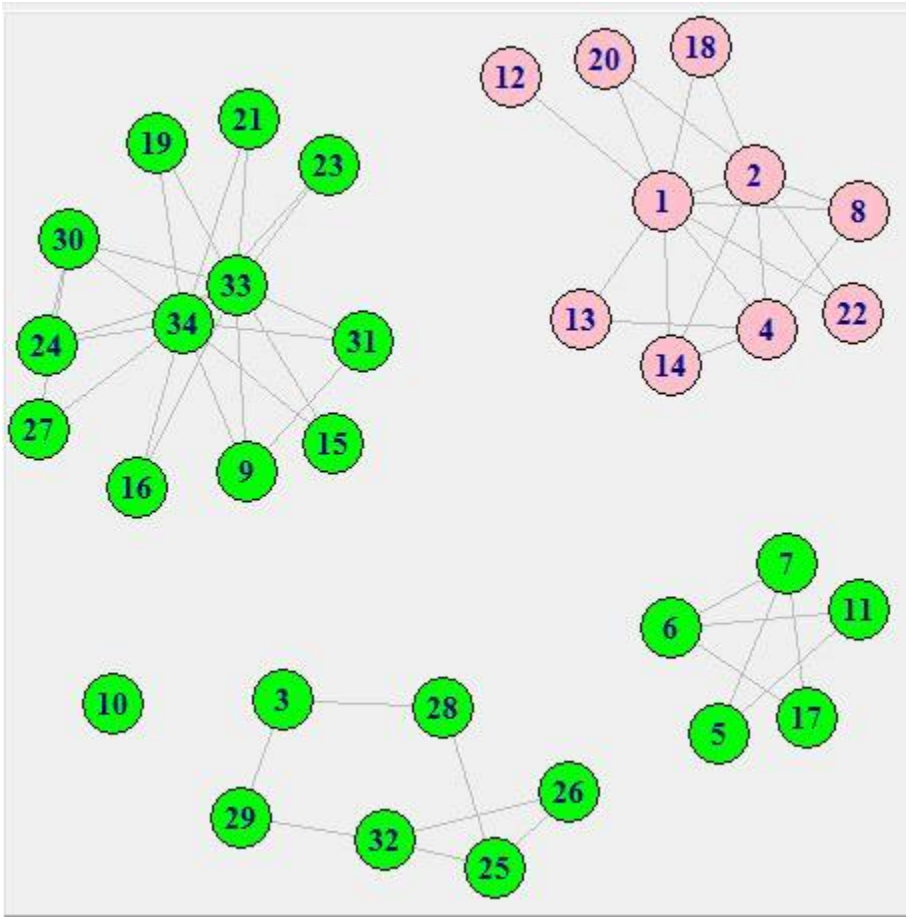
[1] "10 -> 34 -- Betweenness = 16.8333333333333"

[1] "28 -> 34 -- Betweenness = 18.1833333333333"

[1] "3 -> 10 -- Betweenness = 18"

Five Groups



[1] "Edges will be deleted in the following order : "

[1] "1 -> 32 -- Betweenness = 71.3928571428571"

[1] "1 -> 3 -- Betweenness = 66.8951770451771"

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[1] "2 -> 31 -- Betweenness = 143.626984126984"

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[1] "2 -> 3 -- Betweenness = 109.25"

[1] "3 -> 4 -- Betweenness = 107.666666666667"

[1] "3 -> 8 -- Betweenness = 142.75"

[1] "3 -> 14 -- Betweenness = 285"

[1] "10 -> 34 -- Betweenness = 16.8333333333333"

[1] "28 -> 34 -- Betweenness = 18.1833333333333"

[1] "3 -> 10 -- Betweenness = 18"

[1] "1 -> 6 -- Betweenness = 15.3333333333333"

[1] "1 -> 7 -- Betweenness = 25.3333333333333"

[1] "1 -> 5 -- Betweenness = 25"

[1] "1 -> 11 -- Betweenness = 50"

[1] "32 -> 34 -- Betweenness = 14.5"

[1] "32 -> 33 -- Betweenness = 22.3690476190476"

[1] "29 -> 34 -- Betweenness = 25.6166666666667"

[1] "24 -> 26 -- Betweenness = 29.65"

[1] "24 -> 28 -- Betweenness = 40.6666666666667"

[1] "3 -> 9 -- Betweenness = 72"

It can be said that 34 and 33 consistently maintained a large group. 10 became isolated in each instance, possibly due to equal conflict between joining each group.

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Aturban, M. (2013). Maturban/cs595-f13. Retrieved March 03, 2016, from https://github.com/maturban/cs595-f13/blob/master/assignment9/latex/Mohamed_Aturban_Assignment_9.tex

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I. (n.d.). Connected components of a graph. Retrieved March 3, 2016, from http://igraph.org/r/doc/components.html

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T. (n.d.). The igraph library. Retrieved March 3, 2016, from http://cneurocvs.rmki.kfki.hu/igraph/screenshots2.htm