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School of Computer Science and Engineering

CSE-3021-Social Information and Networks

Winter Semester 2020-21
Slot – E1

REPORT

Under the guidance of
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Assistant Professor Senior Grade 1
SCOPE

TEAM MEMBERS:

Mihir Antwal (19BCE1641)

Sam Methuselah (19BCE1698)

Arjun Arora (19BCE1808)

Friendship Analysis

DECLARATION

We hereby declare that the project entitled “Friendship Analysis” submitted by 19BCE1641-Mihir Antwal, 19BCE1698-Sam Methuselah and 19BCE1808-Arjun Arora, for the project component of the Social and Information Networks to VIT is a record of bonafide carried out by us under the supervision of Dr. Jani Anbarasi, Assistant Professor Senior Grade 1, SCOPE, Vellore Institute of Technology, Chennai.

We further declare that the project report submitted has not been submitted and will not be submitted, either in a part or full for the award of any other degree or diploma in this institute or any other Institute or University.

PLACE: CHENNAI

SIGNATURE:



The image shows three handwritten signatures in black ink. From left to right: 'Samir' in cursive script, 'Mihir' in a stylized script with a small circle around the 'i', and 'Arjun' in a bold, blue-colored script. Below the signatures, there is a small, faint watermark-like text that reads 'CS Scanned with CamScanner'.

DATE: 25 MAY, 2021

CERTIFICATE

This is to certify that the project entitled "**Friendship Analysis**", submitted by Student Name and Register Number for the project component of the Social and Information Networks to VIT is a record of bona-fide work carried out by them under my supervision during the period, 01.02.2021 to 08.06.2020 as per the VIT code of academic and research ethics.

The contents of this report have not been submitted and will not be submitted either in part or in full, for the award of any other degree or diploma in this institute or any other institute or university. The project fulfils the requirements and regulations of the university and in my opinion meets the necessary standards for submission.

PLACE: CHENNAI

Signature of the guide

DATE: 25 MAY, 2021

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ABSTRACT

Social Network Analysis is a widely used approach in psychology, as in social science, economics and other fields. The peculiarity of this perspective is that it focuses not on individuals or other social units, but on the relationship between them. In this project, our aim is to give a general review of this perspective, giving a description of resources and principal topics covered by Social Network Analysis. Our project aims at analyzing various social media platforms and finding indicators of Centrality identify which are the most important vertices within a network.

INTRODUCTION

The study of social media networks has evolved in the last two decades into an interdisciplinary scientific area of research. Network analysis of social media data emerged toward the end of the twentieth century when, for the first time in history, immense social interactions were recorded and became available for researchers.

At that point in history, decades of social science literature, theoretical and empirical, about network analysis of small and medium-sized social (i.e., symbolic) networks intersected with a growing body of literature in hard sciences, from biology to computer science and physics, that examined much larger physical networks. Social scientists contributed the theoretical and conceptual foundations for understanding social network structures and the role of key players and communities in these communication networks, within the broader sociological, political, economic, and psychological levels, to name a few.

Social media is a computer-based technology that facilitates the sharing of ideas, thoughts, and information through the building of virtual networks and communities. By design, social media is Internet-based and gives users quick electronic communication of content which includes personal information, documents, videos, and photos. Users engage with social media via a computer, tablet, or smartphone via web-based software or applications. The project aims to analyse

various social media platforms like Whatsapp, Instagram, Snapchat and Facebook.

RELATED WORK-

The study of social media networks has evolved in the last two decades into an interdisciplinary scientific area of research.

Network analysis of social media data emerged toward the end of the twentieth century when, for the first time in history, immense social interactions were recorded and became available for researchers.

At that point in history, decades of social science literature, theoretical and empirical, about network analysis of small and medium-sized social (i.e., symbolic) networks intersected with a growing body of literature in hard sciences, from biology to computer science and physics, that examined much larger physical networks.

Social scientists contributed the theoretical and conceptual foundations for understanding social network structures and the role of key players and communities in these communication networks, within the broader sociological, political, economic, and psychological levels, to name a few.

PROPOSED SYSTEM-

Social media is a computer-based technology that facilitates the sharing of ideas, thoughts, and information through the building of virtual networks and communities. By design, social media is Internet-based and gives users quick electronic communication of content which includes personal information, documents, videos, and photos. Users engage with social media via a computer, tablet, or smartphone via web-based software or applications.

The project aims to analyse various social media platforms like Whatsapp, Instagram, Snapchat and Facebook. The aim is to take an existing network of friends on these platforms and perform social network analysis using centrality measures. We intend to include Degree Centrality, Betweenness Centrality, Closeness Centrality, Clustering, Clique, Shortest paths and many more i.e. if time permits.

In Network Analysis, indicators of Centrality identify the most important vertices within a network.

Its applications include identifying, for example,

- The most influential people in a social network,
- Key infrastructure nodes in urban networks,
- Important pages on the web,
- nodes that spread information across the network,
- nodes that can cause/prevent epidemics,
- and nodes that are crucial to keep the network from breaking up.

LITERATURE SURVEY-

- **COURSERA- Applied Social Network Analysis in Python**

This course will introduce the learner to network analysis through tutorials using the NetworkX library. The course begins with an understanding of what network analysis is and motivations for why we might model phenomena as networks. The second week introduces the concept of connectivity and network robustness. The third week will explore ways of measuring the importance or centrality of a node in a network. The final week will explore the evolution of networks over time and cover models of network generation and the link prediction problem. This course should be taken after: Introduction to Data Science in Python, Applied Plotting, Charting & Data Representation in Python, and Applied Machine Learning in Python.

Link- <https://www.coursera.org/learn/python-social-network-analysis>

- **UDEMY- Learn graphs and Social Network Analysis using Python**

Learn Graphs and Social Network Analytics .Become a graph and social analyst today. This is a comprehensive course, simple and straight forward for python enthusiast and those with little python background. You want to learn about how to draw graphs and analyse them, this is the course for you. This course will contain some quizzes, test and some homework assignments, as well as some real world assignment projects. There is over 55 lectures and about 6hours to complete the course. This course

comes with live coding screenshots using iPython Notebook . Below is the list of the course summary.

Link- <https://www.udemy.com/course/graphs-and-social-network-analytics-for-dummies-using-python/>

- **Social relations and life satisfaction: the role of friends-**

Social capital is defined as the individual's pool of social resources found in his/her personal network. A recent study on Italians living as couples has shown that friendship relationships, beyond those within an individual's family, are an important source of support. Here, we used data from Aspects of Daily Life, the Italian National Statistical Institute's 2012 multipurpose survey, to analyse the relation between friendship ties and life satisfaction. Our results show that friendship, in terms of intensity (measured by the frequency with which individuals see their friends) and quality (measured by the satisfaction with friendship relationships), is positively associated to life satisfaction.

- **An analysis of friendship networks, social connectedness, homesickness, and satisfaction levels of international students-**

International students continue to grow in number worldwide, prompting researchers to look for ways to make the study abroad experience more fruitful. One avenue of research has focused on friendship formation, the significant role it plays in the study abroad experience, and the unique friendship combinations made possible by the study abroad experience. International students form friendships with individuals from their own country, from

other countries, and from the host country. Research has found that international students often have more friends from their home country; however, research has also demonstrated a relationship between having more host country friends and satisfaction, contentment, decreased homesickness, and social connectedness. The current study looks to further explore these relationships through a social network lens by examining friendship network ratios, strength, and variability of the three friendship groups. A friendship network grid was developed to assess where international students' friends are from and how strong those friendships are. Eighty four international students completed a survey examining the relationship between friendship networks, social connectedness, homesickness, contentment, and satisfaction. Contrary to prior research, international students did not report having a higher ratio of individuals from their home country in their friendship networks. However, international students with a higher ratio of individuals from the host country in their network claimed to be more satisfied, content, and less homesick. Furthermore, participants who reported more friendship variability with host country individuals described themselves as more satisfied, content, and more socially connected. Implications and directions for future research are discussed.

- **Smoke Rings: social network analysis of friendship groups, smoking and drug-taking-**

Social network analysis is applied at the first two time points of a longitudinal study which examines how smoking and drug use in adolescence is associated with social position within peer group structures. One hundred and fifty secondary second grade students in one school named up to six best friends. This allowed

for the categorization of each adolescent as a group member, a group peripheral, or a relative isolate. It was found that risk-taking behaviour occurred across all social positions. At both time points of the study the behaviour of pupils on the periphery of peer groups reflected both the gender and the behaviour of the groups themselves. At the second time point of the study there were far more pupils on the periphery of risk-taking groups than on the periphery of non-risk-taking groups. The relationship appears to verify that risk-taking and non-risk-taking behaviour is learned predominantly in the context of peer clusters, and that risk-taking peer clusters act as a greater focus of influence and selection of peripheral pupils at a key stage in their development than do non-risk-taking peer clusters. Our findings are relevant in the debate about peer pressure in relation to smoking and drug use.

- **Understanding friendship and learning networks of international and host students using longitudinal Social Network Analysis-**

While the number of international students travelling abroad for higher education constantly increases, it has been recognized among educators that international students have difficulty adjusting to their host educational environment. Past research indicates that international students' personal ties with other international, home and host students can influence their cross-cultural adjustment to their new environment. Drawing from cross-cultural, educational science and social network research, we conducted a longitudinal study using dynamic social network analyses into how 485 international and 107 host students build learning and work relationships at both bachelor and post-graduate level.

Results indicate that students from different cultural backgrounds develop dissimilar co-national and international friendships and learning relationships over time. Additionally, in contrast to previous findings our MRQAP and multiple regression analyses indicate that social interactions among international and host students did not become more intertwined over time. However, active (mixed) group activities (temporarily) increase cross-cultural interaction, indicating that institutions can play an active role in improving cross-cultural adjustment.

- **Friendship and Organizational Analysis: Toward a Research Agenda-**

Recent developments in organizational analysis have done much to fill out the dry, textbook image of rational, formal structures. Yet on one of the commonest kinds of organizational experience—friendship—organizational analysis has remained virtually silent. By contrast, within the wider social science literature some writers have recently accorded greater importance to friendship as a social phenomenon. This article suggests that organizational analysis would be well served by doing the same. To this end, the article explores what this might entail and identifies some of the issues that it could illuminate, both empirically and theoretically. In particular, it presents friendship as a folk concept, which recognizes the situational variability of its form, experience, and connectedness with other forms of relationship. In doing so, the article will help define and open up a focus for future research into friendship and organizational analysis.

- **A Net of Friends: Investigating Friendship by Integrating Attachment Theory and Social Network Analysis-**

The current article focuses on attachment style—an individual difference widely studied in the field of close relationships—and its application to the study of social networks. Specifically, we investigated whether attachment style predicts perception and management of social networks. In Study 1, we examined the associations of attachment style with perceptions of network tie strength and multiplexity. In Studies 2a and 2b, we investigated the association between attachment style and network management skills (initiating, maintaining, and dissolving ties) and whether network management skills mediated the associations of attachment style with network tie strength and multiplexity. In Study 3, experimentally enhancing attachment security made people more likely to initiate and less likely to dissolve social ties (for the latter, especially among those high on avoidance or anxiety). As for maintenance, security priming also increased maintenance; however, mainly among people high on attachment anxiety or low on attachment avoidance.

- **Connected to create: A social network analysis of friendship ties and creativity-**

The purpose of this article was to examine the relationship between friendship ties and creativity. Based on the homophily hypothesis, we predicted friendship ties would more likely occur between people similar to each other on creativity-related attributes. We also predicted students would be more likely to report friendship ties with peers who have higher creativity scores in general. Across a pilot and primary study, we examined the relationship between friendship strength among

high school students in a pilot study (Study 1) and friendship nominations among elementary school students in a primary study (Study 2) with creativity. In Study 2, but not Study 1, we found that friendship nominations were more likely to occur when scores on a creativity task were similar. In both studies, we found that popularity was positively related to originality (Study 1) and creativity (Study 2). The results indicate that elementary school students nominated peers as friends who are similar to them when it comes to creativity and that there is a positive relationship between popularity and creativity. (PsycInfo Database Record (c) 2020 APA, all rights reserved).

- **Journal of Social and Personal Relationships-**

Friendships are an important source of happiness, well-being, physical health, and longevity. Researchers have often linked uni-dimensional friendship quality to life satisfaction and positive affect, which are hedonic forms of well-being. Aristotle presented an expanded view of friendship with three general characteristics: Utility, Pleasure, and Virtue. Following his theory, we expected Pleasure and Utility characteristics to be primarily related to hedonic well-being (HWB). In contrast, we expected Virtue characteristics to be more strongly related to eudemonic well-being (EWB), which includes meaning, personal growth, and positive relationships in this study. This exploratory study assessed Aristotle's theory about friendship and well-being with 375 participants. Two exploratory structural equation models were tested. There was an indirect relationship between Utility characteristics and HWB through Help Received. A friend's Virtue characteristics had an indirect relationship with EWB through the reliability of the friendship. These findings indicate that friendship characteristics related to utility and virtue friendships appear to have differential

implications for understanding the role of friends in happiness and flourishing.

BEFORE WE START,

- The scope of this study is restricted to SNA of a group of friends connected on social media platforms.
- In no way does it convey that a person is entitled to only the number of connections portrayed in these networks. They might have many connections out of the scope of this study.
- This study is done purely out of academic interest.
- BLUE – A SECTION
- GREEN – B SECTION
- YELLOW – C SECTION

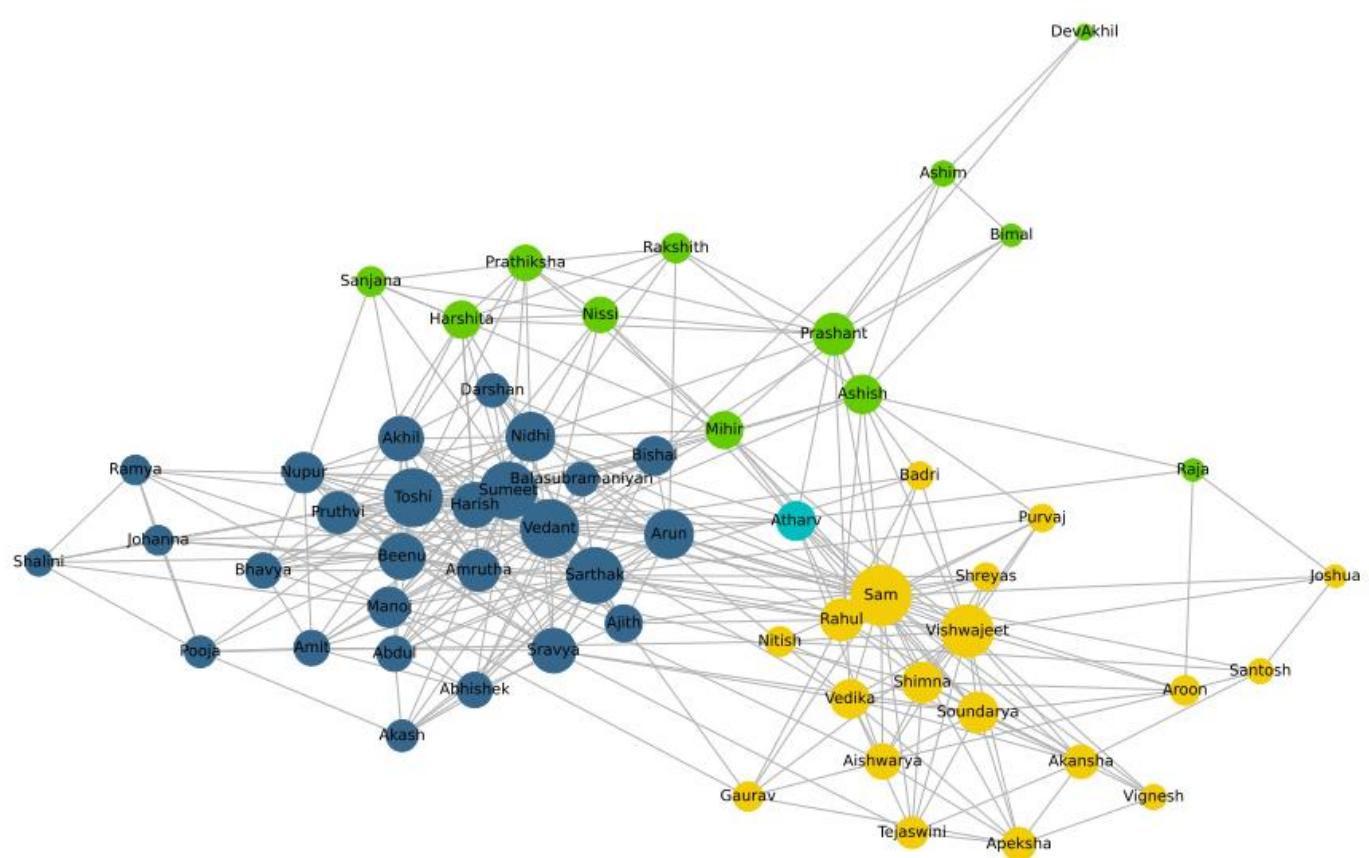
WHATSAPP NETWORK-

Number of nodes: 59

- A section – 27
- B section – 12
- C section – 19
- Atharv (most popular)

Number of edges: 340

Average degree: 11.525



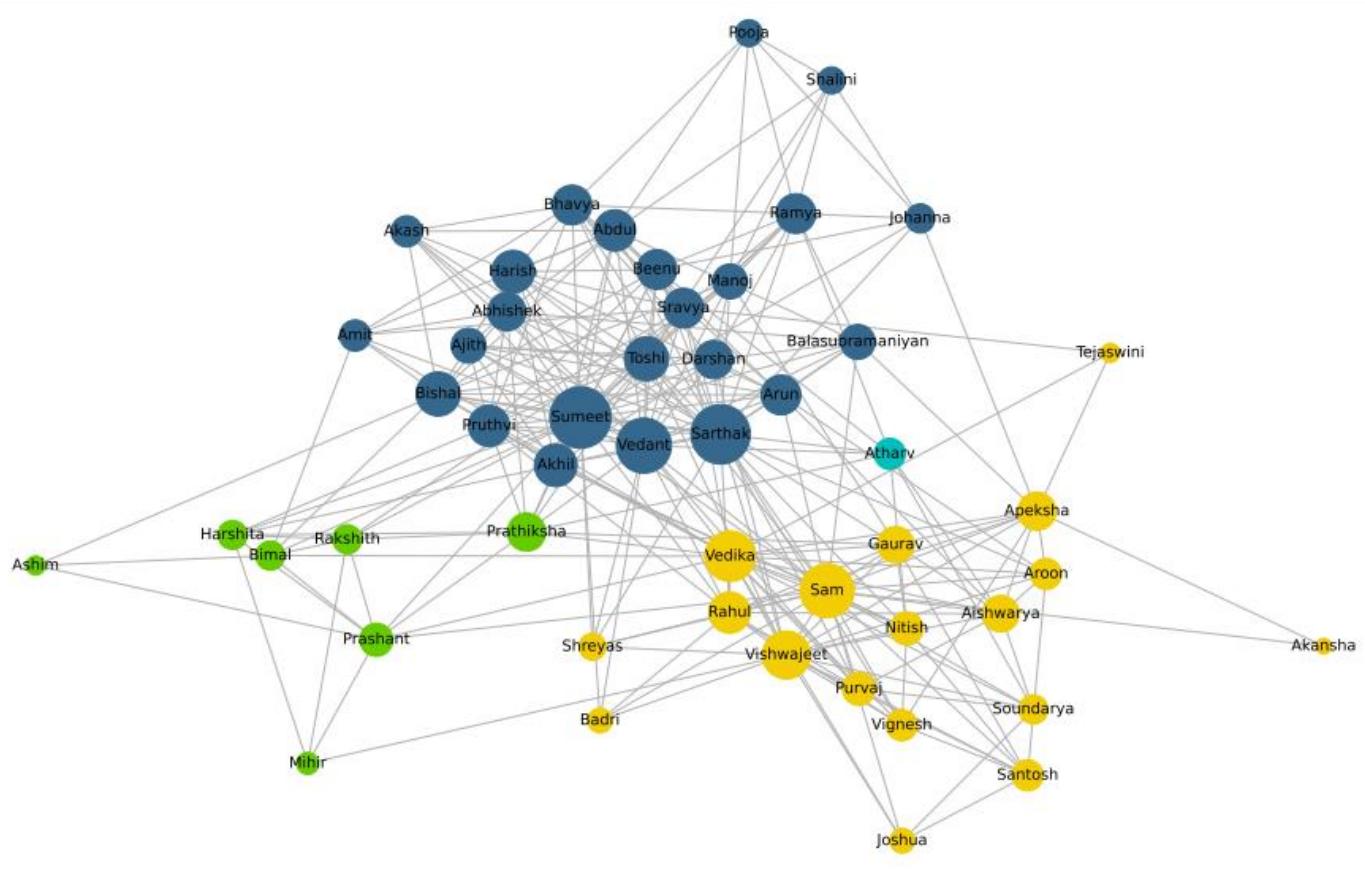
INSTAGRAM NETWORK-

Number of nodes: 50

- A section – 26
- B section – 7
- C section – 17

Number of edges: 189

Average degree: 7.56



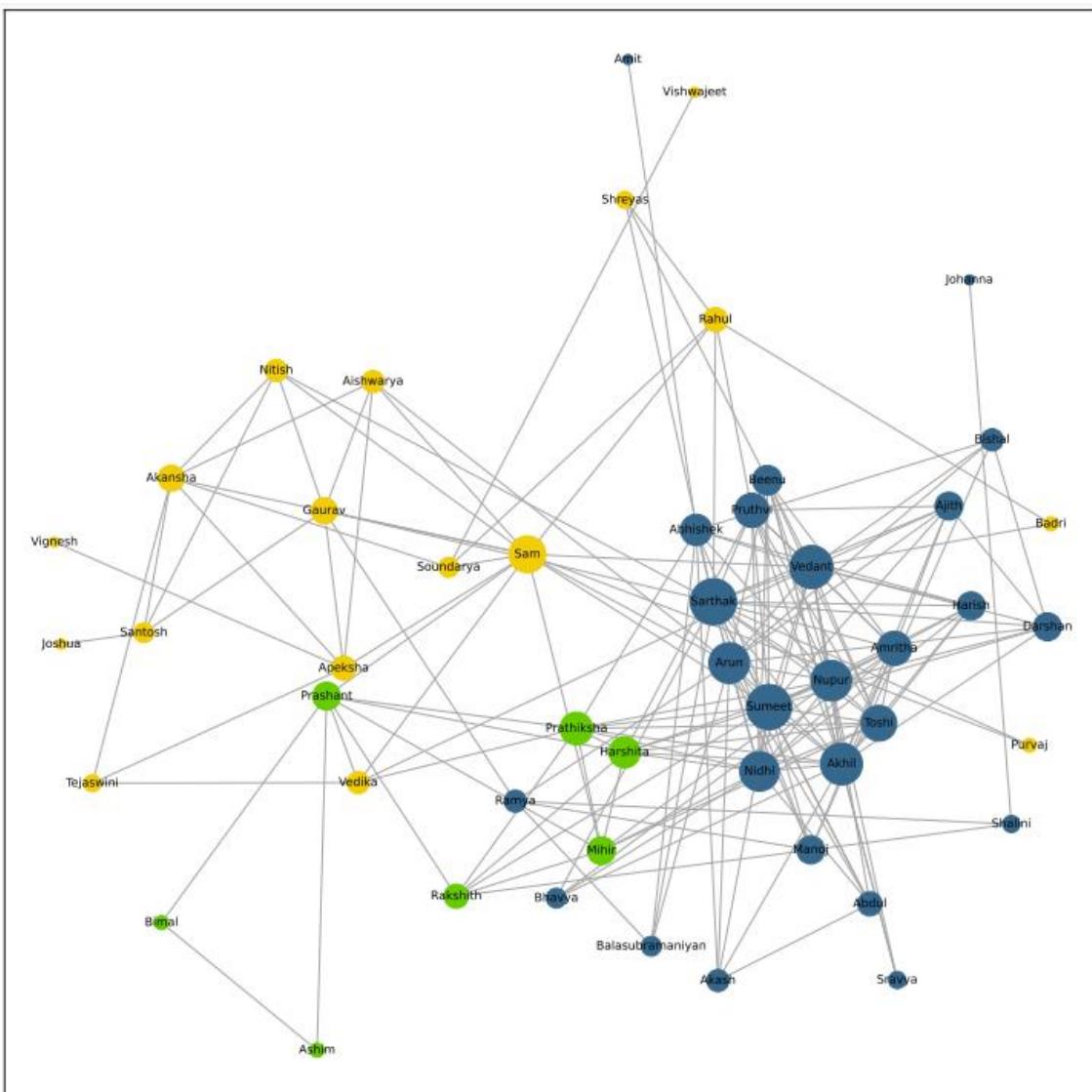
FACEBOOK NETWORK-

Number of nodes: 50

- A section – 24
- B section – 7
- C section – 18
- Atharv (most Popular)

Number of edges: 284

Average degree: 11.36



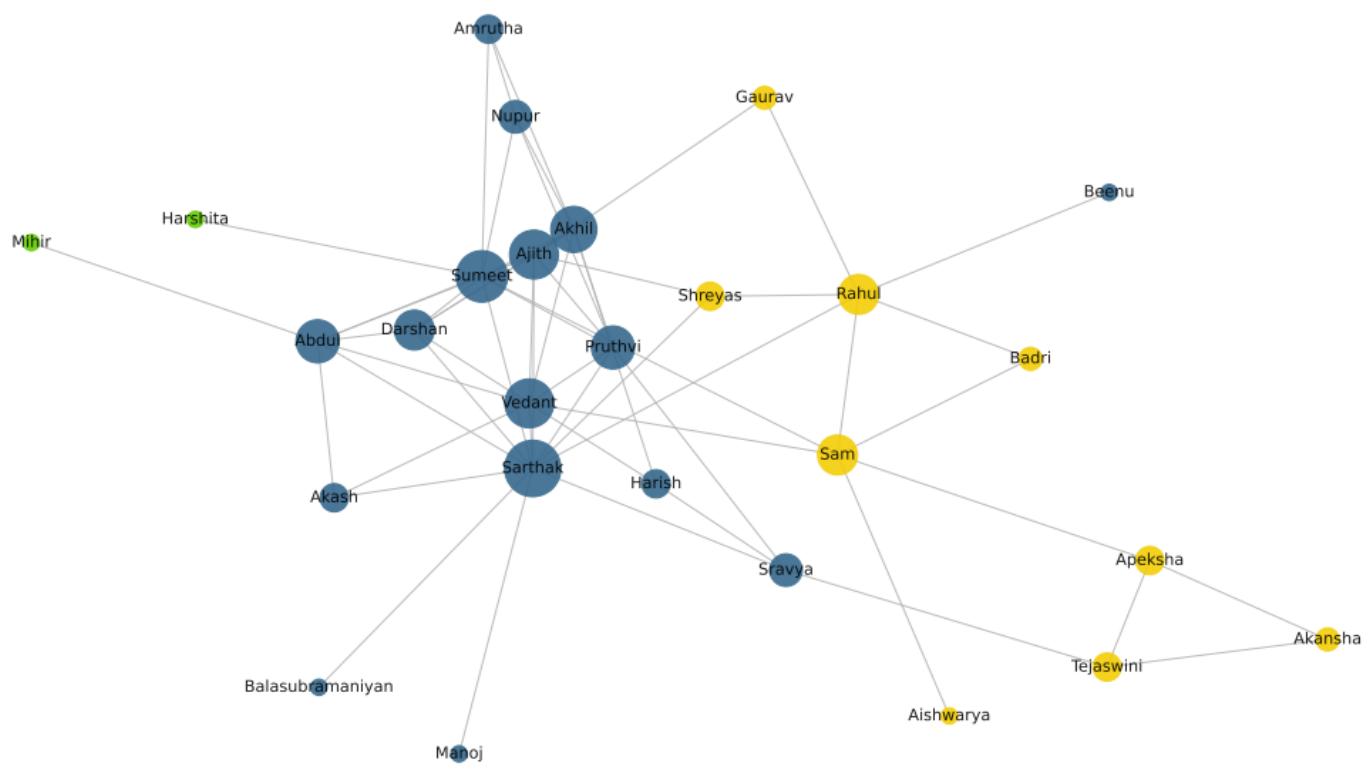
SNAPCHAT NETWORK-

Number of nodes: 27

- A section – 16
- B section – 2
- C section – 9

Number of edges: 59

Average degree: 4.37



ANALYSING THE NETWORKS

In Network Analysis, indicators of Centrality identify the most important vertices within a network. Its applications include identifying, for example,

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- key infrastructure nodes in urban networks,
- important pages on the web,
- nodes that spread information across the network,
- nodes that can cause/prevent epidemics,
- and nodes that are crucial to keep the network from breaking up.

DEGREE CENTRALITY-

Assigns an importance score based on the number of ties each actor in the network has.

“More no. of ties = More important”

ANSWERS THE IMMEDIATE QUESTION –

How many people in the network are you directly connected to?

CLOSENESS CENTRALITY-

Closeness Centrality is a measure of the degree to which an individual is near all other individuals (the number of hops) in a network.

It is used for finding the individuals who are best placed to influence the entire network most quickly –good ‘broadcasters’.

“Close to everyone in the network = More important”

ANSWERS THE QUESTION –

How close are you to every person in the network?

BETWEENNESS CENTRALITY-

Betweenness Centrality is the measure of how many times a particular node comes in between the shortest path between any other two nodes.

“People that act as bridges between other people = More important”

Removal of a node with a high betweenness centrality would result in the disruption of communication across the entire network.

ANSWERS THE QUESTION

Who is important for the flow of information in a network?

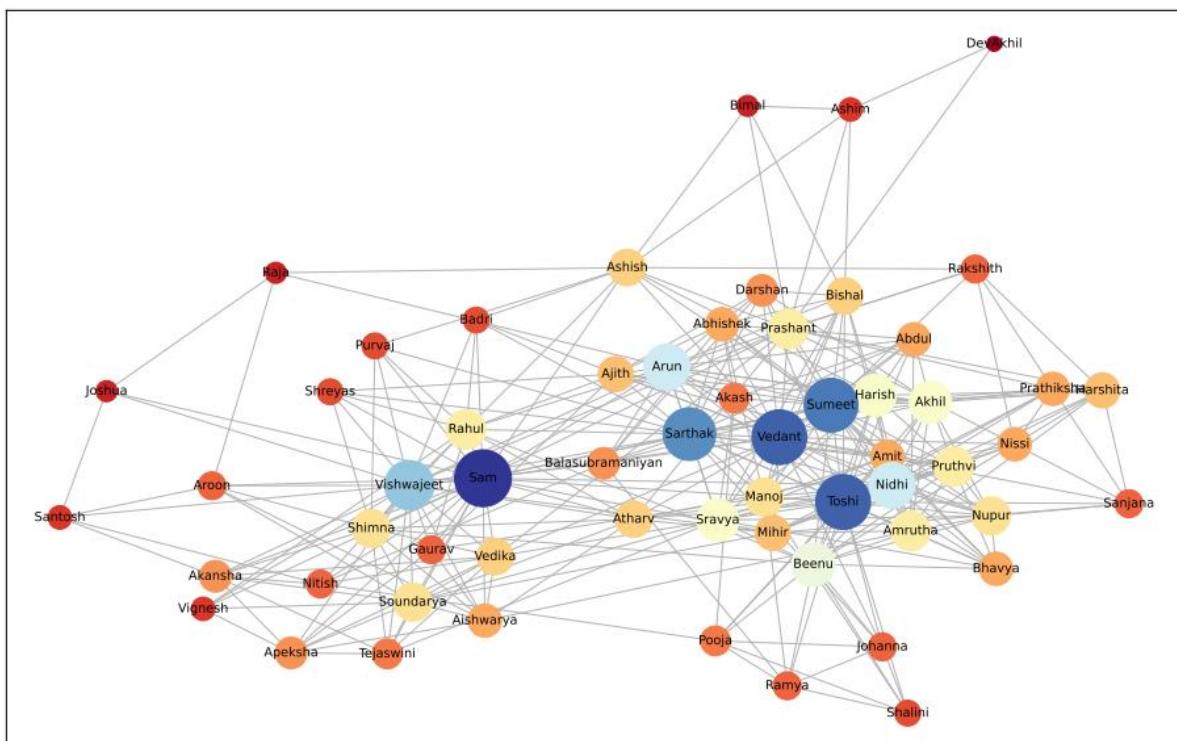
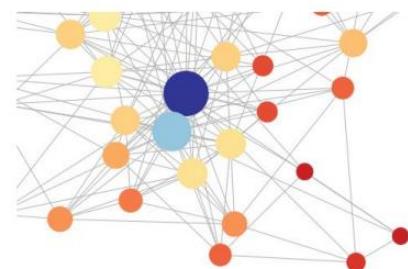
CENTRALITY MEASURES- WHATSAPP

DEGREE CENTRALITY – WHATSAPP

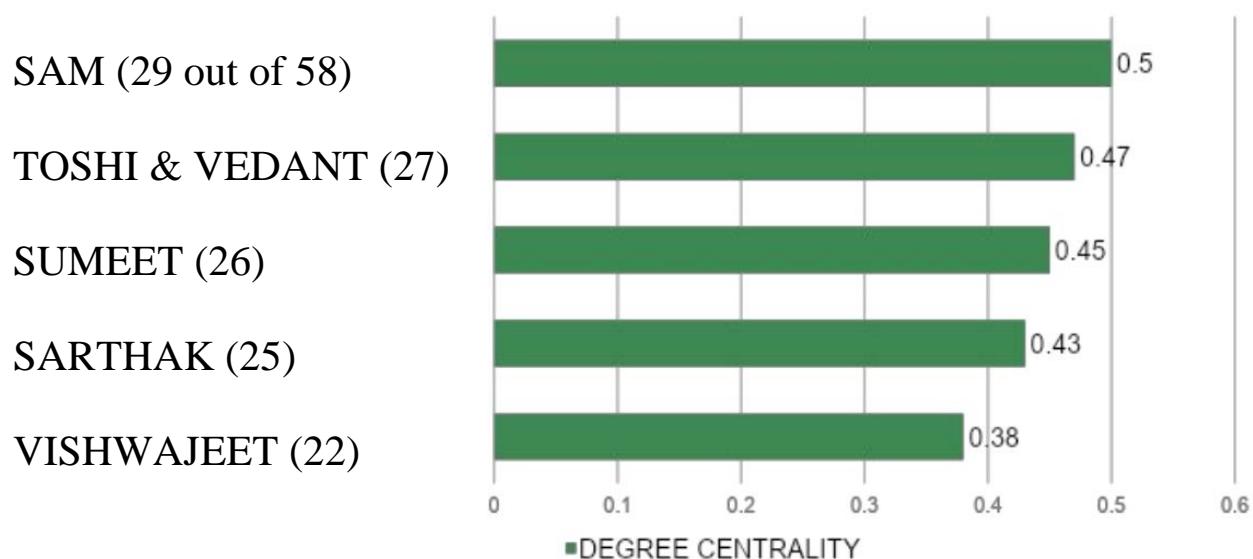
RED (low)



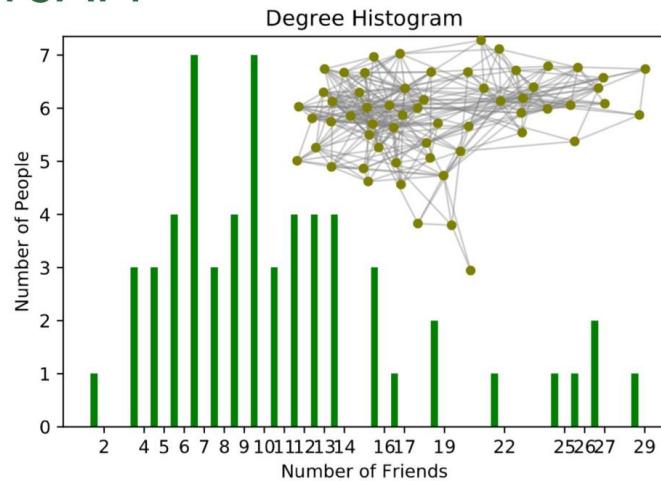
BLUE (high)



WHO HAS THE MOST NUMBER OF CONNECTIONS?



DEGREE DISTRIBUTION GRAPH - WHATSAPP

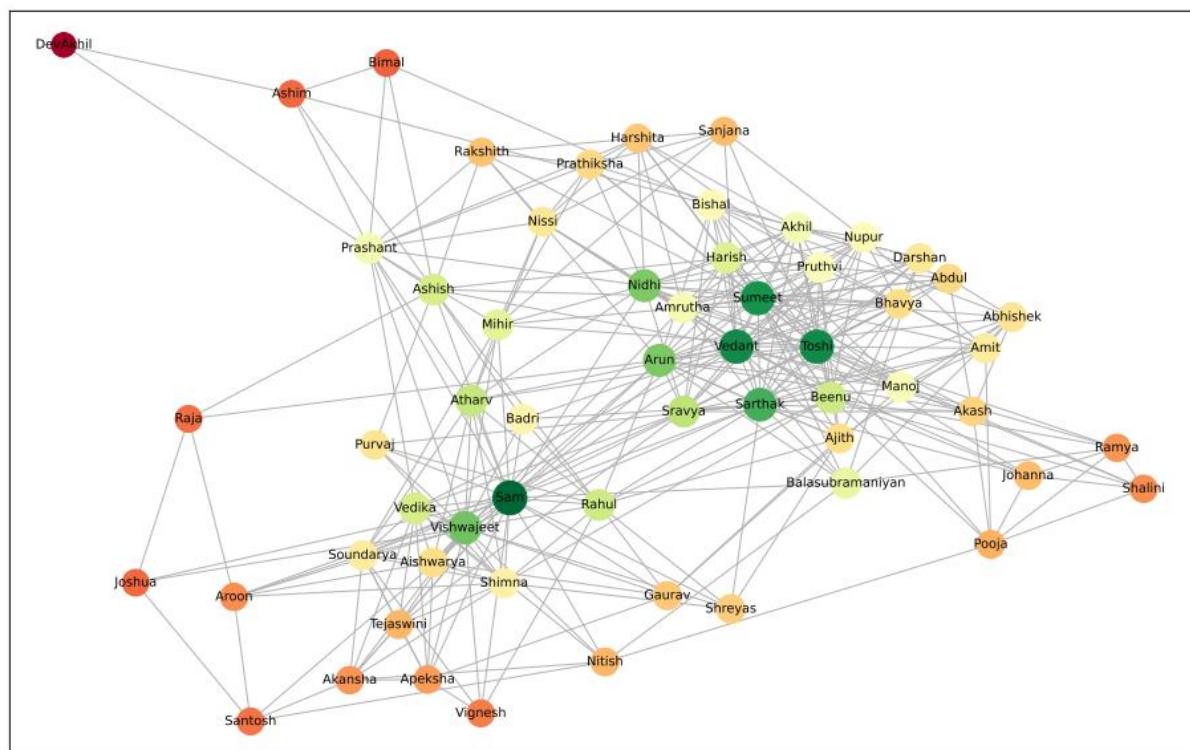
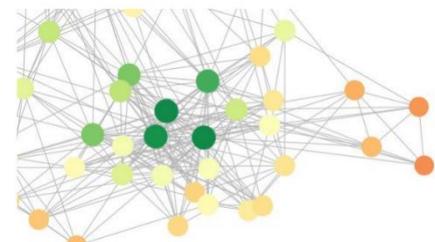


CLOSENESS CENTRALITY – WHATSAPP

RED (low)



GREEN (high)

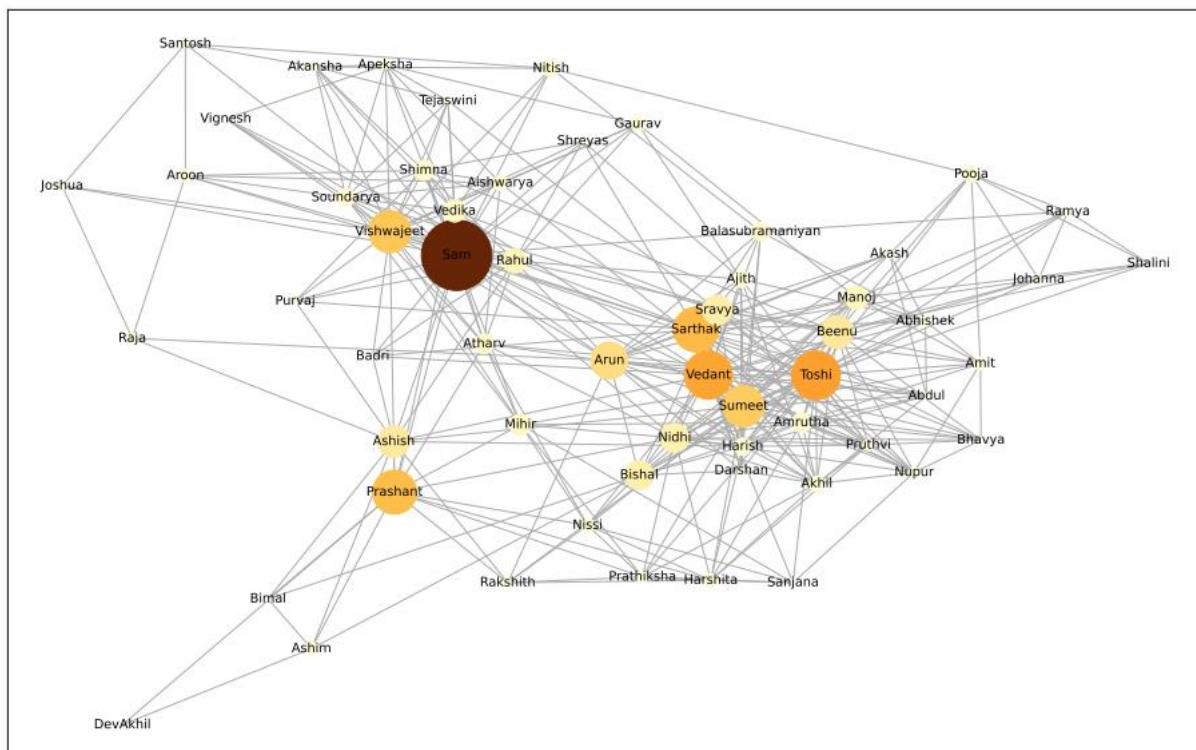
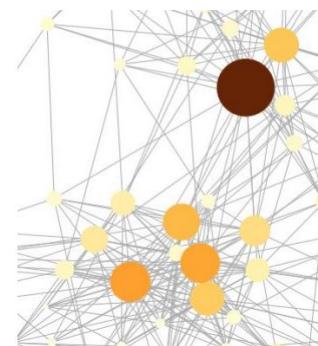


BETWEENNESS CENTRALITY – WHATSAPP

PALE ORANGE (low)



BROWN (high)



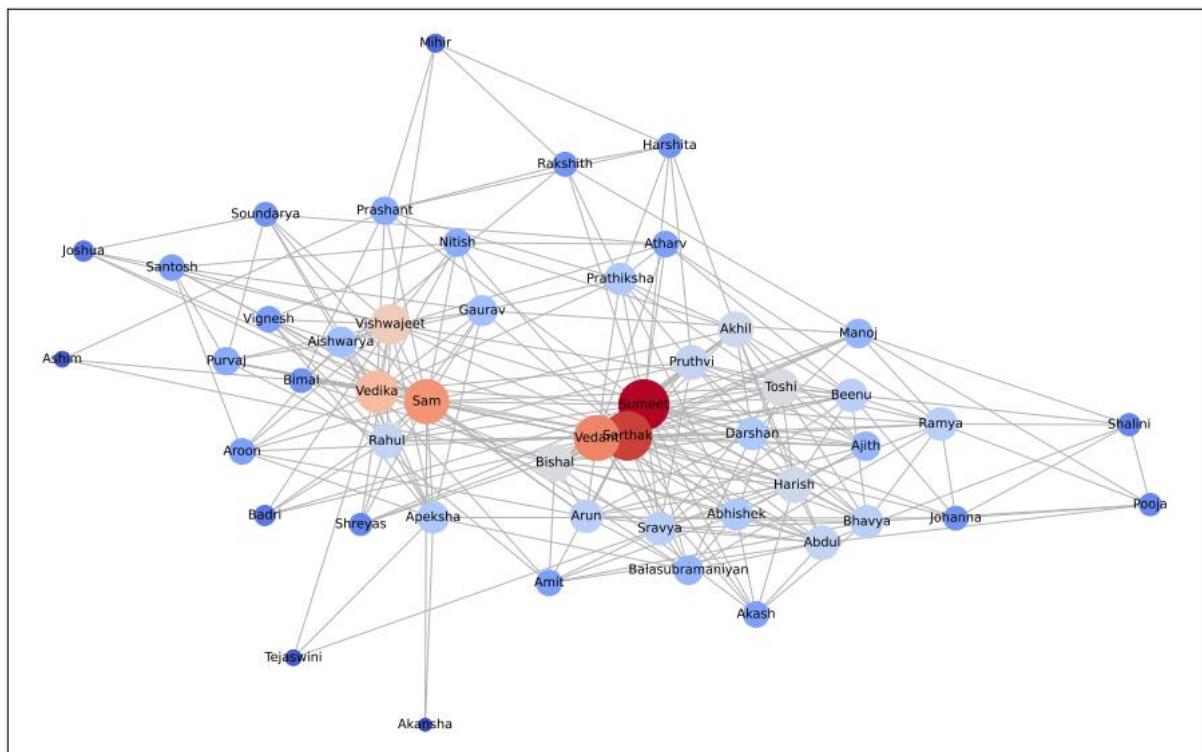
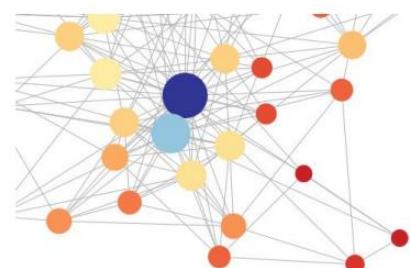
CENTRALITY MEASURES- FACEBOOK

DEGREE CENTRALITY – FACEBOOK

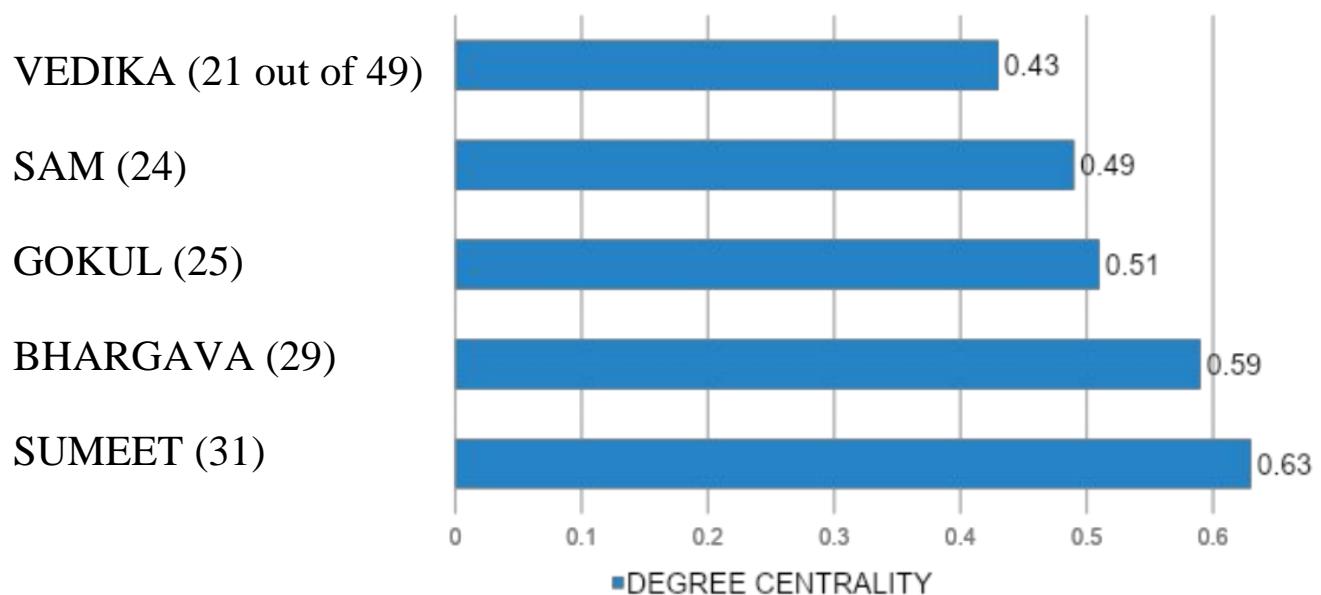
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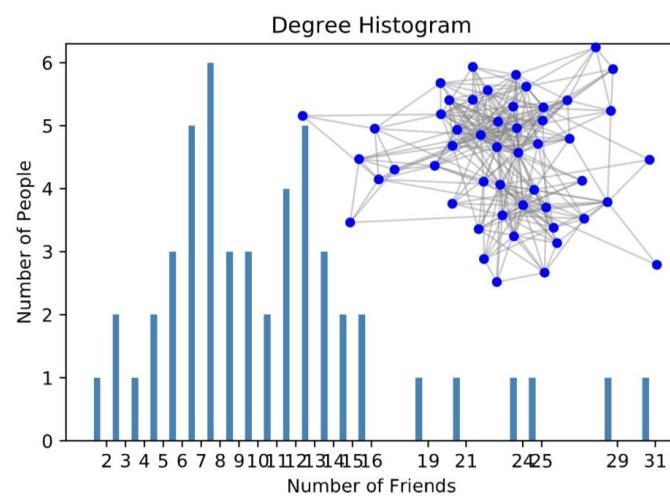
RED (high)



WHO HAS THE MOST NUMBER OF CONNECTIONS?



DEGREE DISTRIBUTION GRAPH - FACEBOOK

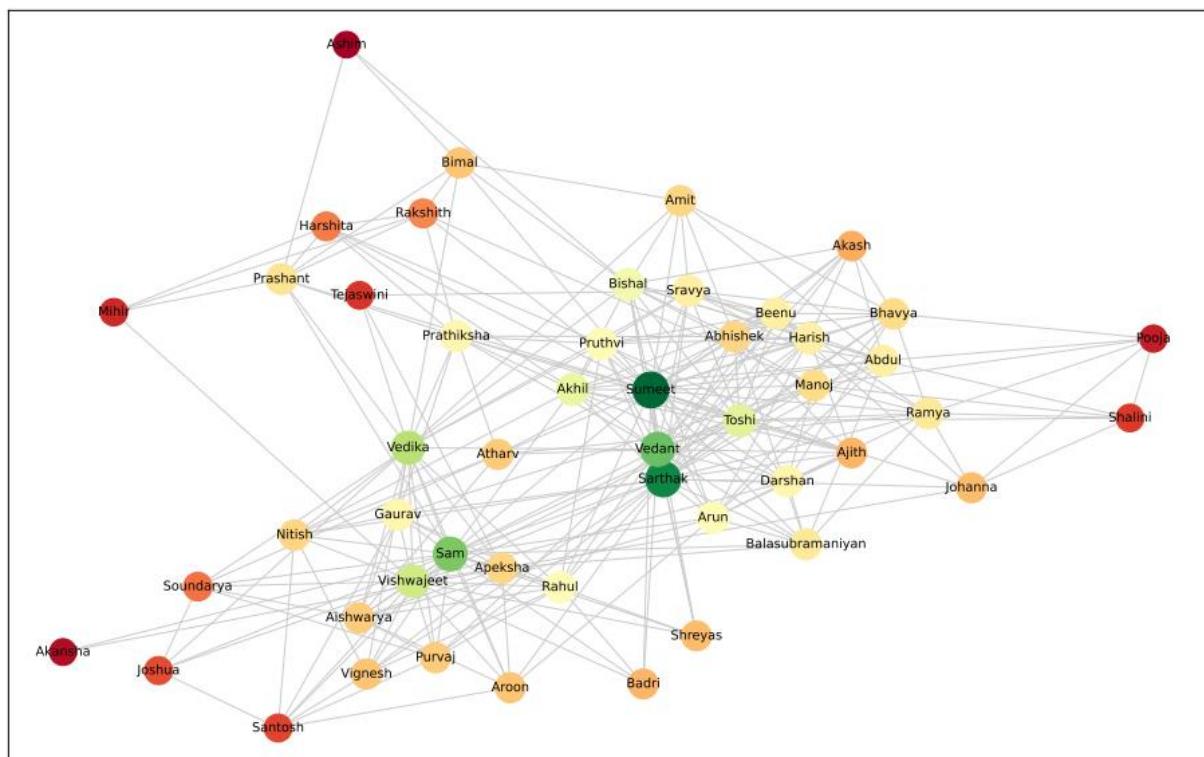
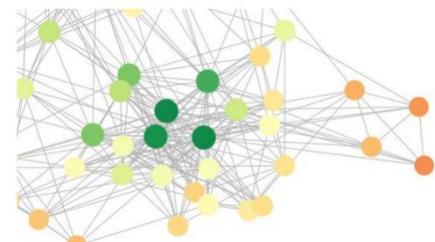


CLOSENESS CENTRALITY – FACEBOOK

RED (low)



GREEN (high)

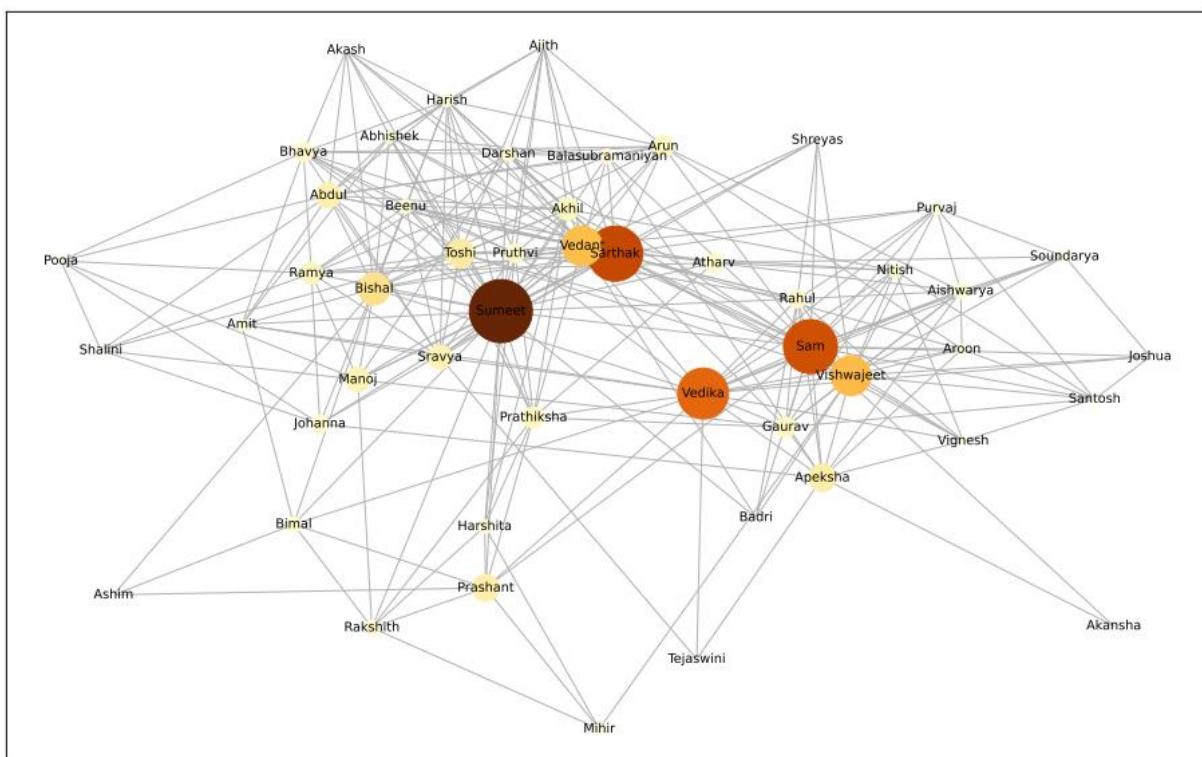
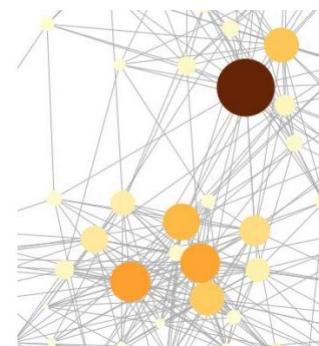


BETWEENNESS CENTRALITY – FACEBOOK

PALE ORANGE (low)



BROWN (high)



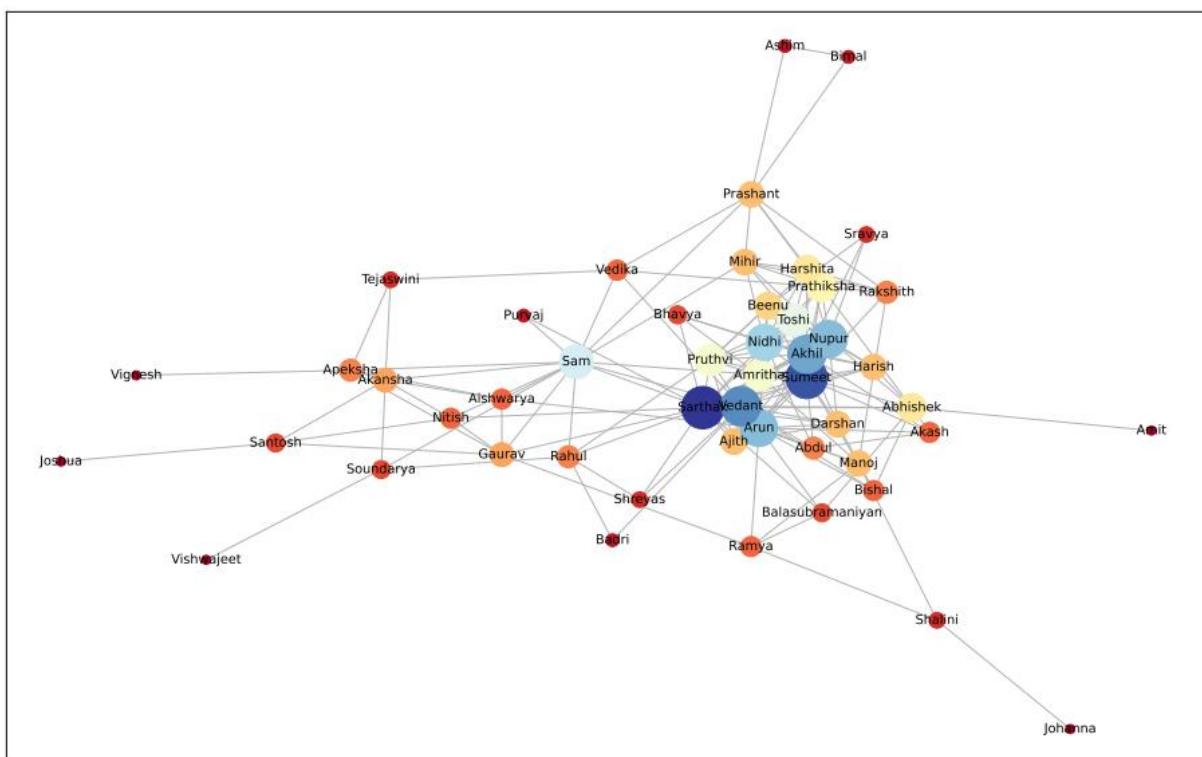
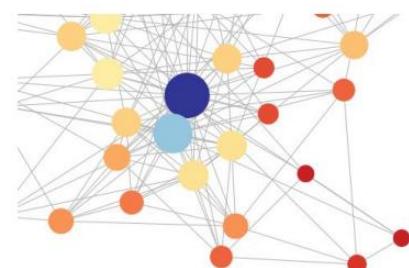
CENTRALITY MEASURES- INSTAGRAM

DEGREE CENTRALITY – INSTAGRAM

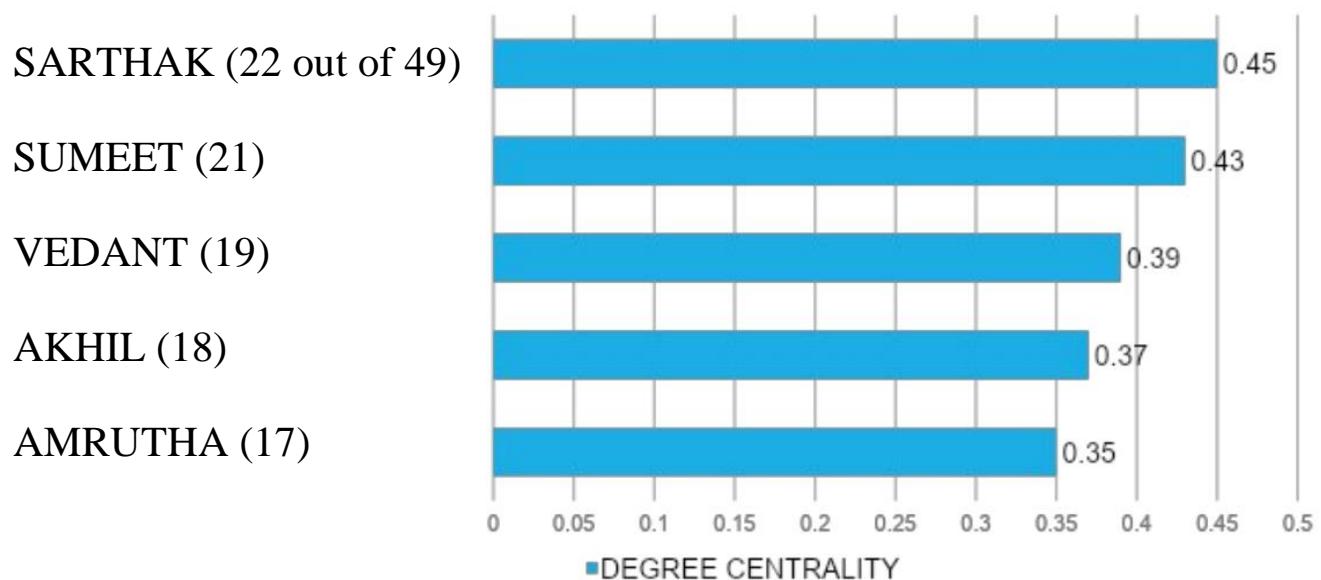
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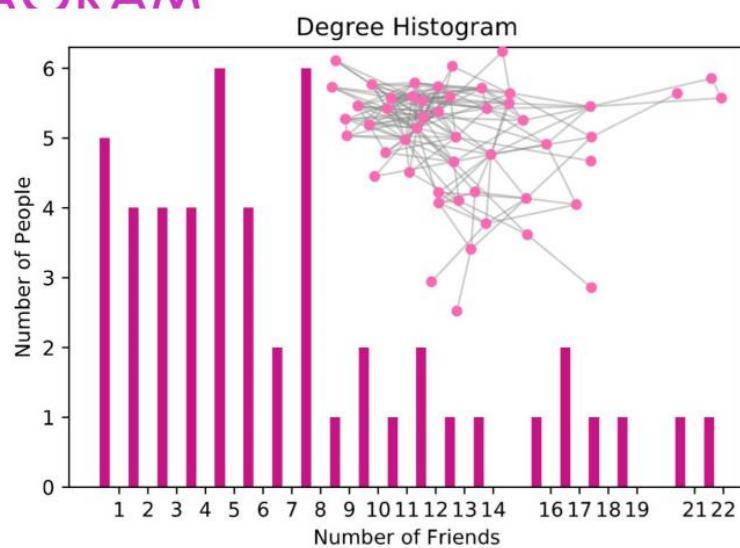
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WHO HAS THE MOST NUMBER OF CONNECTIONS?



DEGREE DISTRIBUTION GRAPH - INSTAGRAM

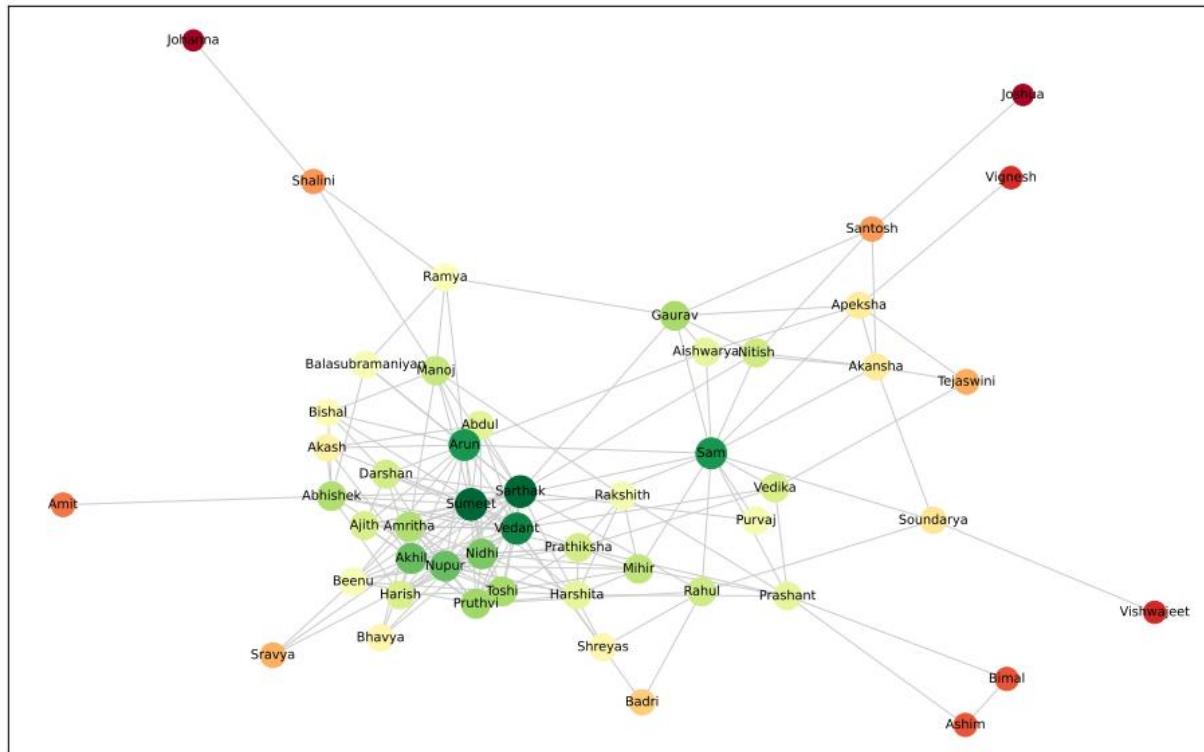
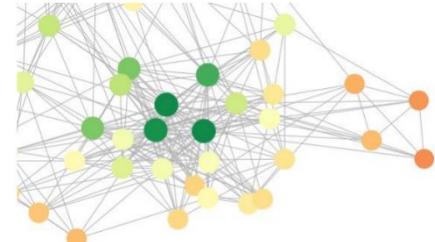


CLOSENESS CENTRALITY – FACEBOOK

RED (low)



GREEN (high)

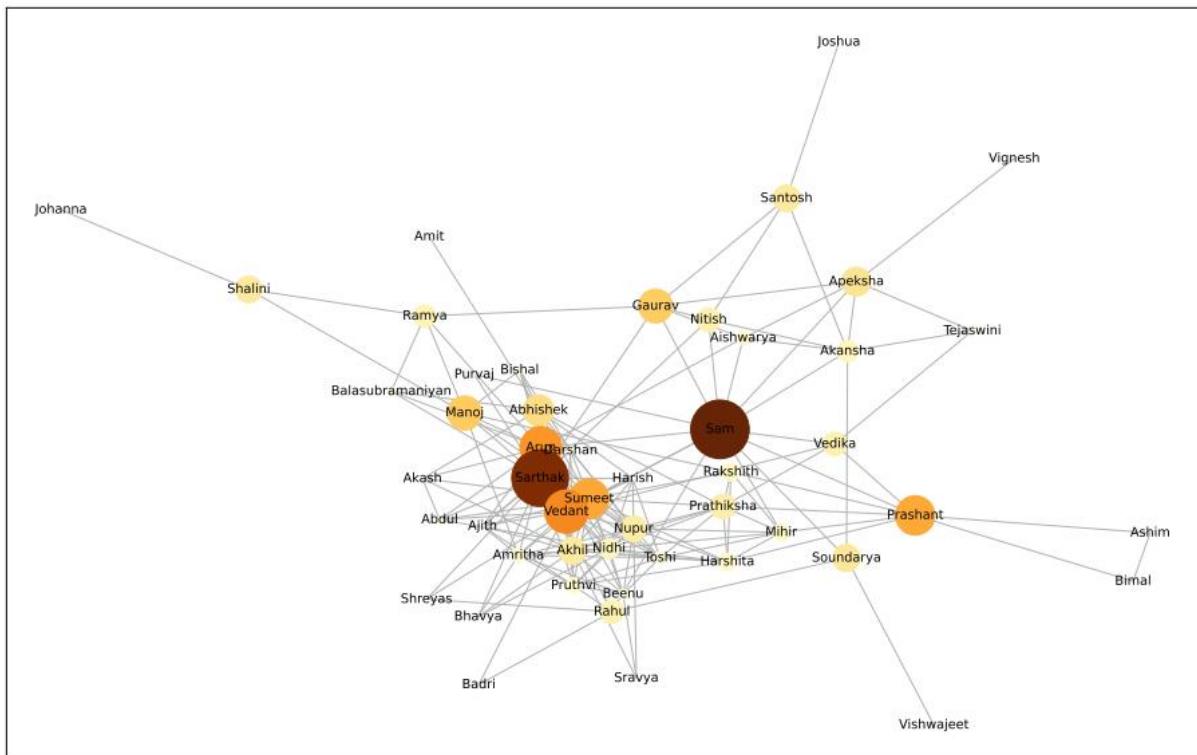
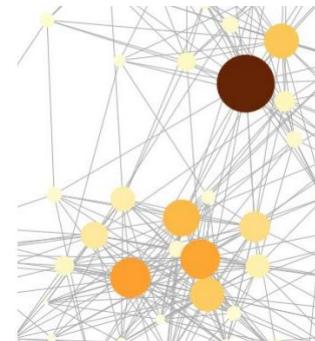


BETWEENNESS CENTRALITY – FACEBOOK

PALE ORANGE (low)



BROWN (high)



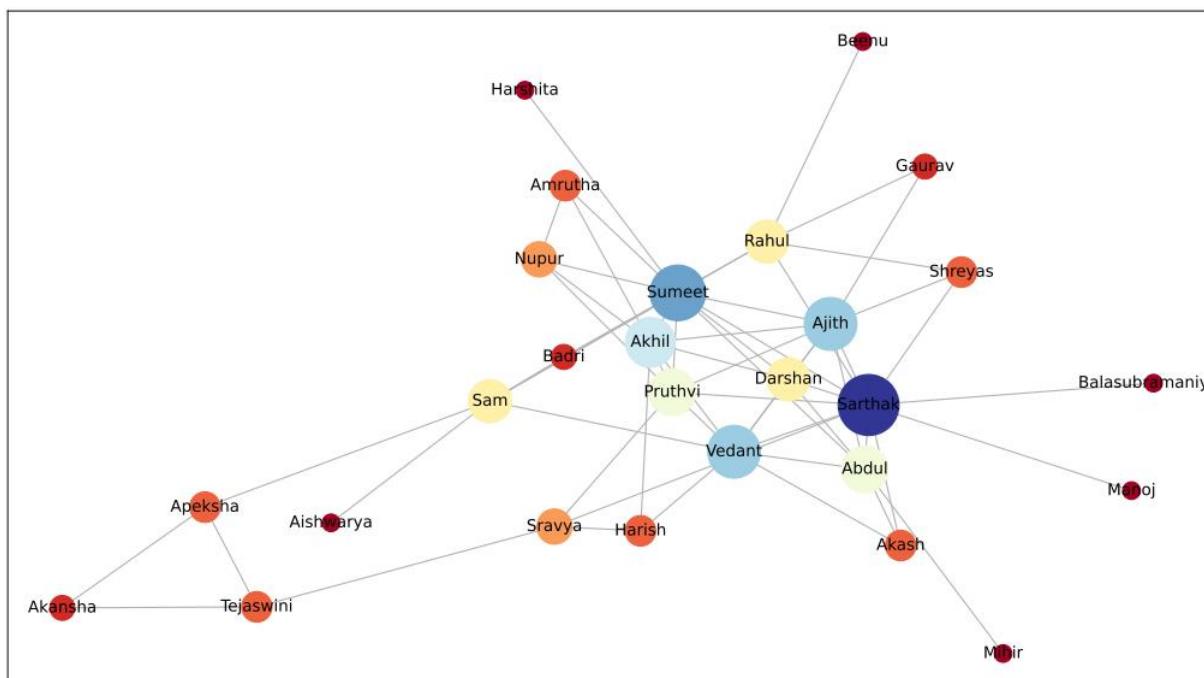
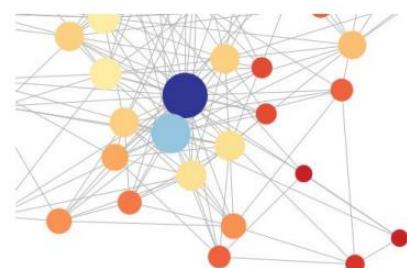
CENTRALITY MEASURES- SNAPCHAT

DEGREE CENTRALITY – SNAPCHAT

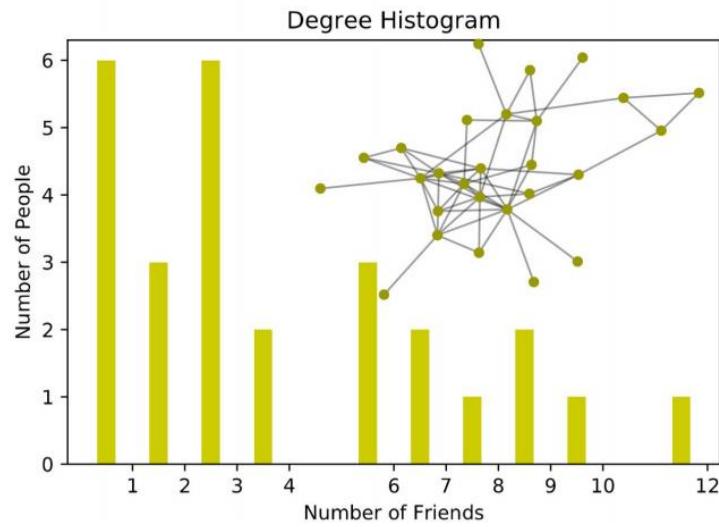
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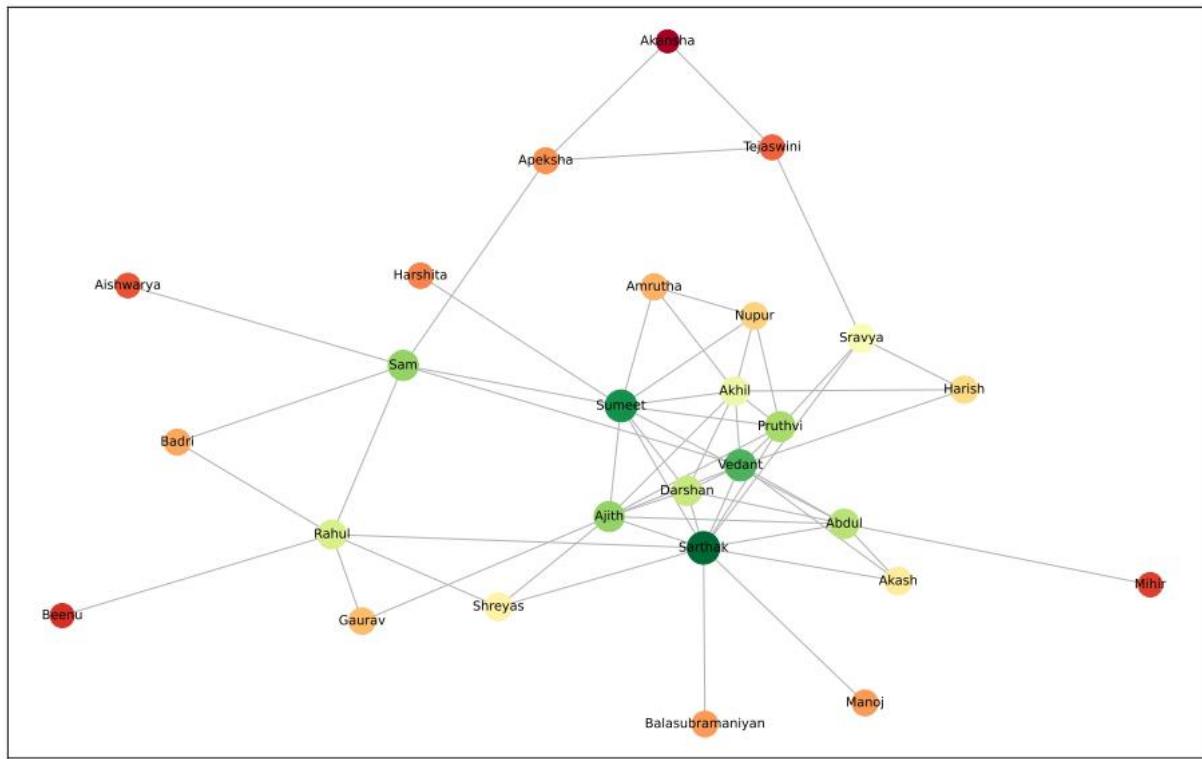


DEGREE DISTRIBUTION GRAPH - SNAPCHAT



CLOSENESS CENTRALITY – SNAPCHAT



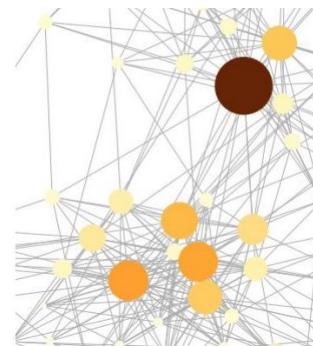


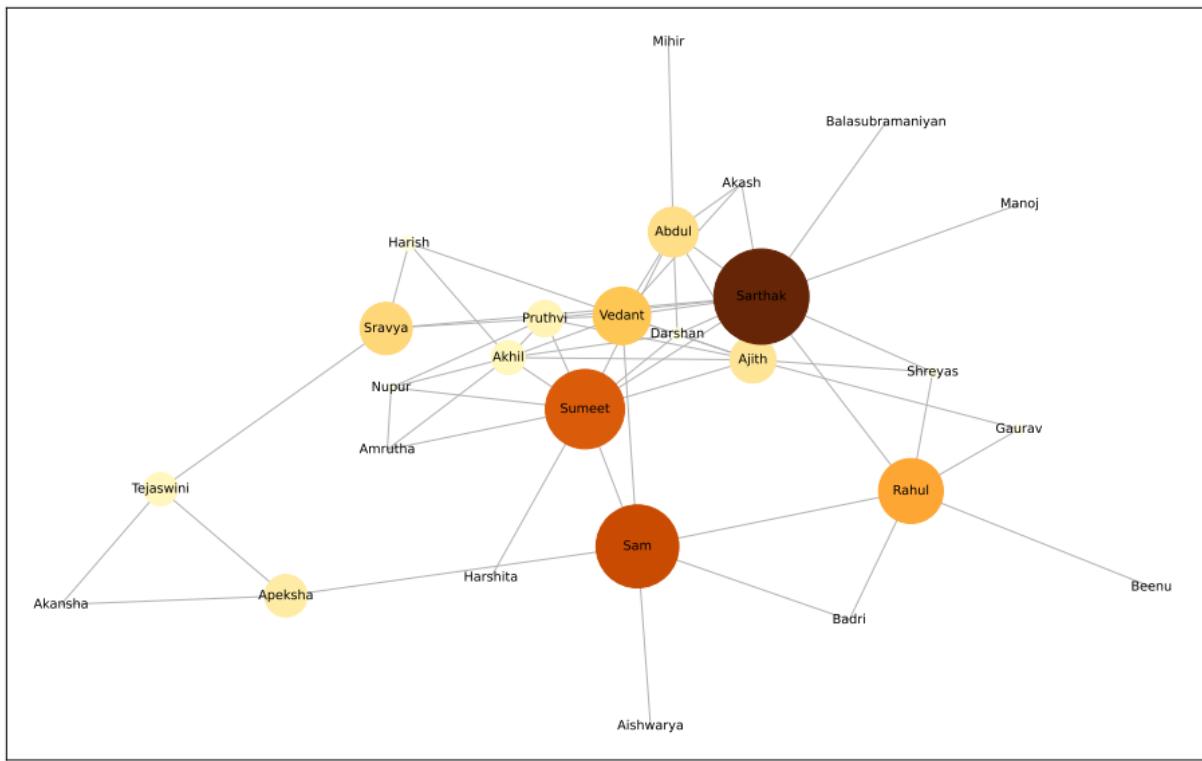
BETWEENNESS CENTRALITY – FACEBOOK

PALE ORANGE (low)



BROWN (high)





VARYING CENTRALITIES

DEGREE AND CLOSENESS

CENTRALITY - WHATSAPP

RED – HIGHER CLOSENESS CENTRALITY

BLUE – LOWER CLOSENESS CENTRALITY

BIGGER SIZE – HIGHER DEGREE

SMALLER SIZE – LOWER DEGREE

WHAT HAPPENS WHEN AN ACTOR HAS HIGH CLOSENESS AND LOW DEGREE CENTRALITY?

Prashant is connected to more people in the network, whereas Atharv is connected to key players in the network – such as Toshi, Sam, Vedant & Viswhajeet.

Through them, Atharv can cover the entire network faster than Prashant, even though Prashant has more number of connections.

CLUSTERING

- Harshita and Mihir have the same degree – 11.
- Harshita has a lower closeness centrality than me but we both have the same degree centrality. This means that she is a part of a cluster.
- In this case, she is connected to only A and B sections.

HIGH BETWEENNESS CENTRALITY

PERSON	BETWEENNESS CENTRALITY	DEGREE
PRASHANT	0.067	14
SARTHAK	0.069	25

Sarthak has almost double the connections Prashant has. However, Prashant and Sarthak have similar Betweenness Centrality.

What makes Prashant have a betweenness centrality as good as Sarthak's?

HIGH BETWEENNESS CENTRALITY

It turns out that Prashant has the highest degree in B section and this helps him act as the shortest path between some B section to C section.

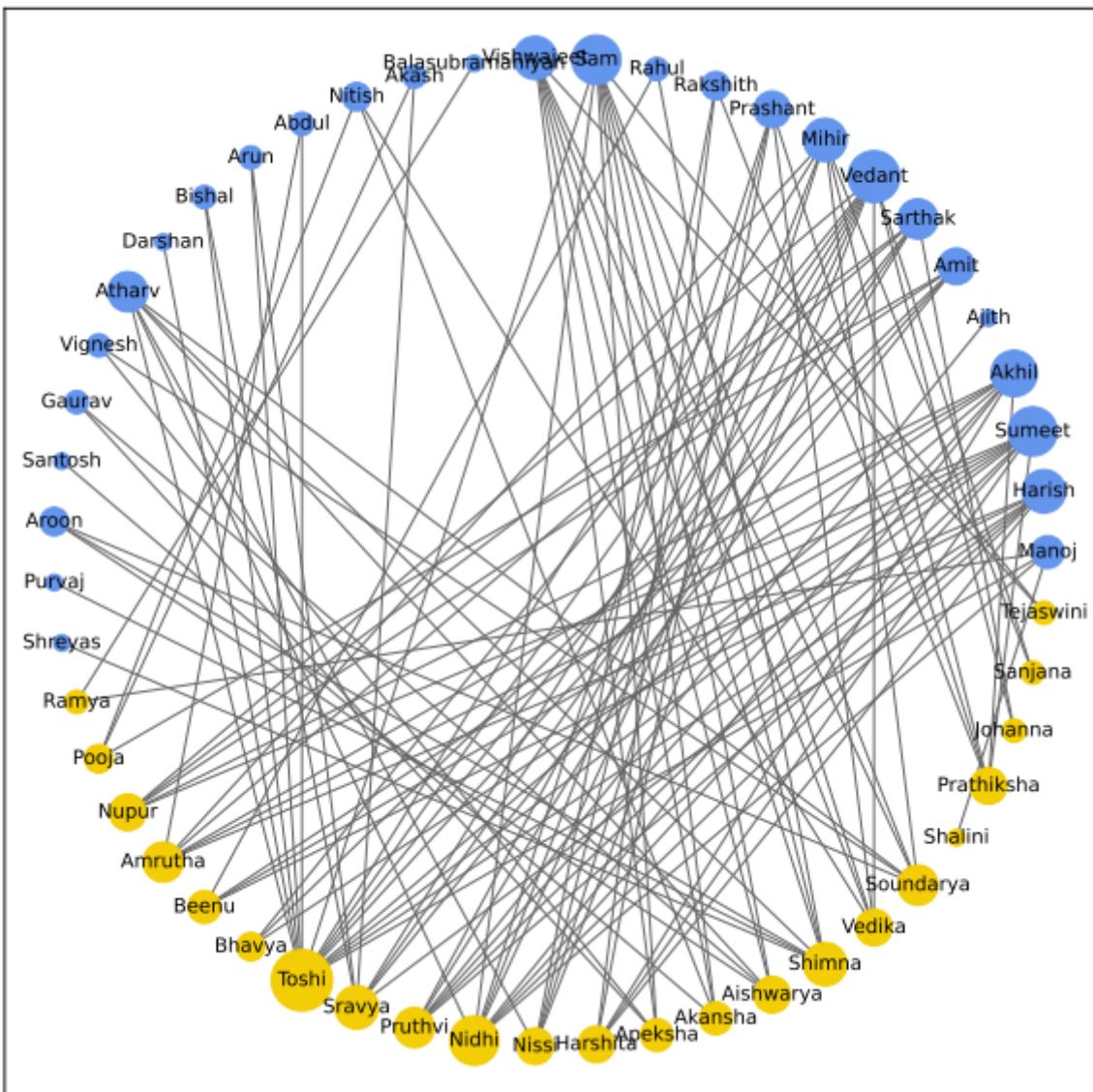
FRIENDSHIPS BASED ON GENDER

MALE-FEMALE FRIENDSHIPS

The next set of networks depict male-female friendships in our network. There exists an edge between two actors- male and female, if they are connected. There does not exist an edge between two males or two females. **Let us look at what we can analyse from this data...**

MALE-FEMALE FRIENDSHIPS

WHATSAPP



Out of 340 edges in the WhatsApp Network, only **112 edges** constitute the male-female friendship network. Out of 59 nodes, **51 nodes** constitute the male-female friendship network.

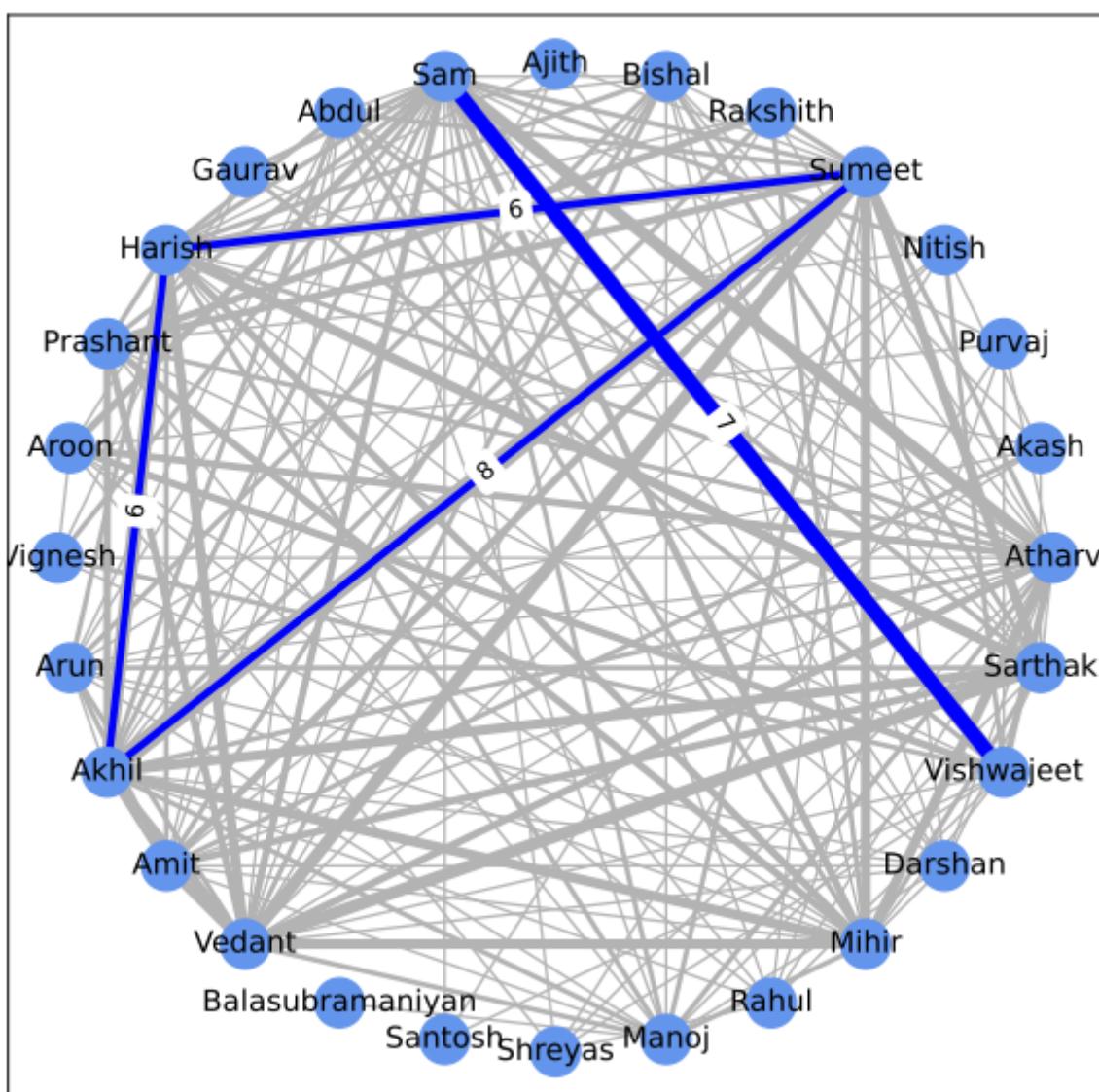
This means that only **33%** of friendships are male-female. The rest, **67%** of friendships are either male-male or female-female.

Vedant, Sumeet and Sam are among those with highest no. of female friends. Toshi, Nidhi, Sravya among those with highest no. of male friends.

COMMON FEMALE FRIENDS-

A blue edge between two boys denotes that they have one or more female friends in common.

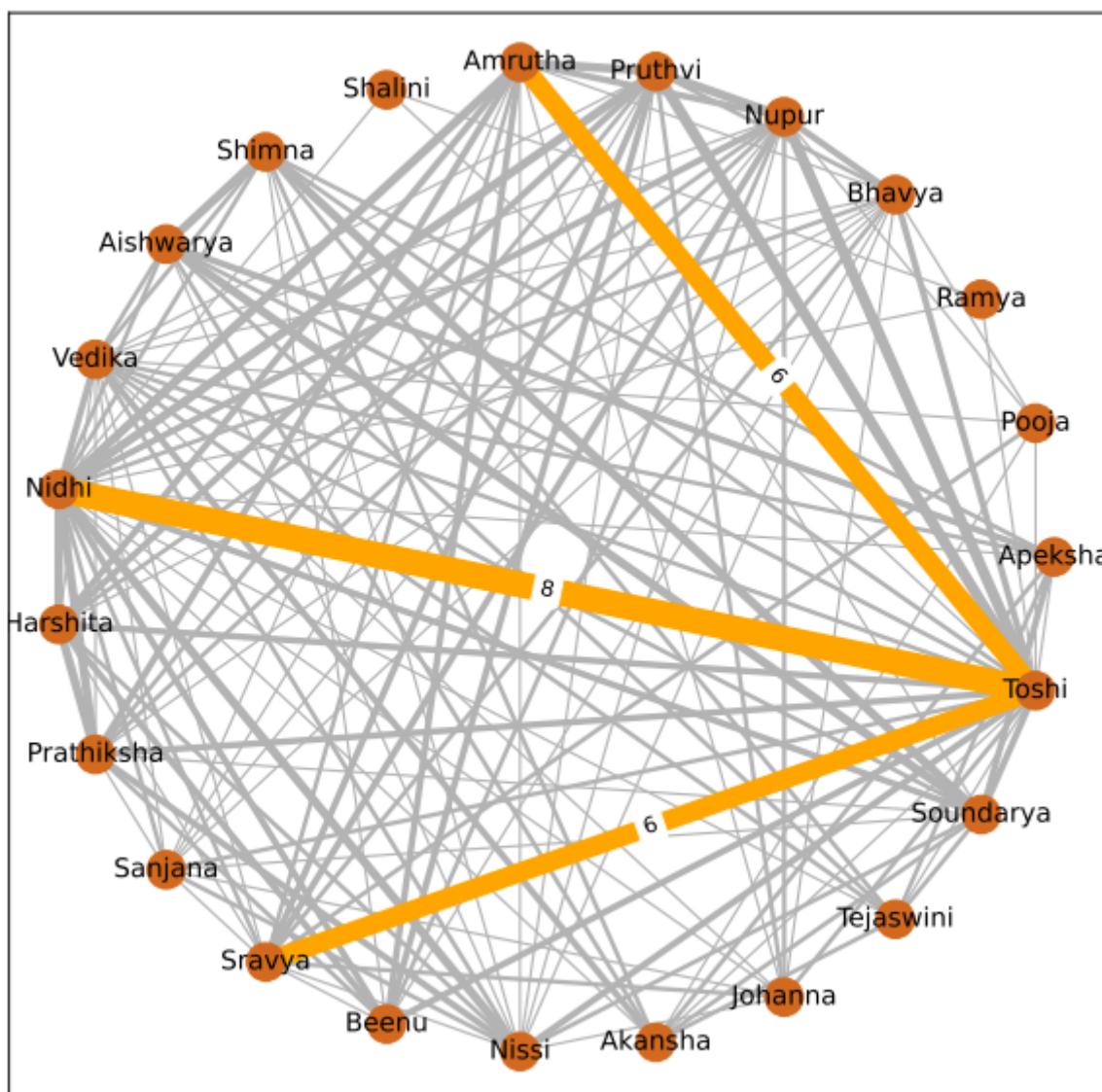
The graph-



COMMON MALE FRIENDS-

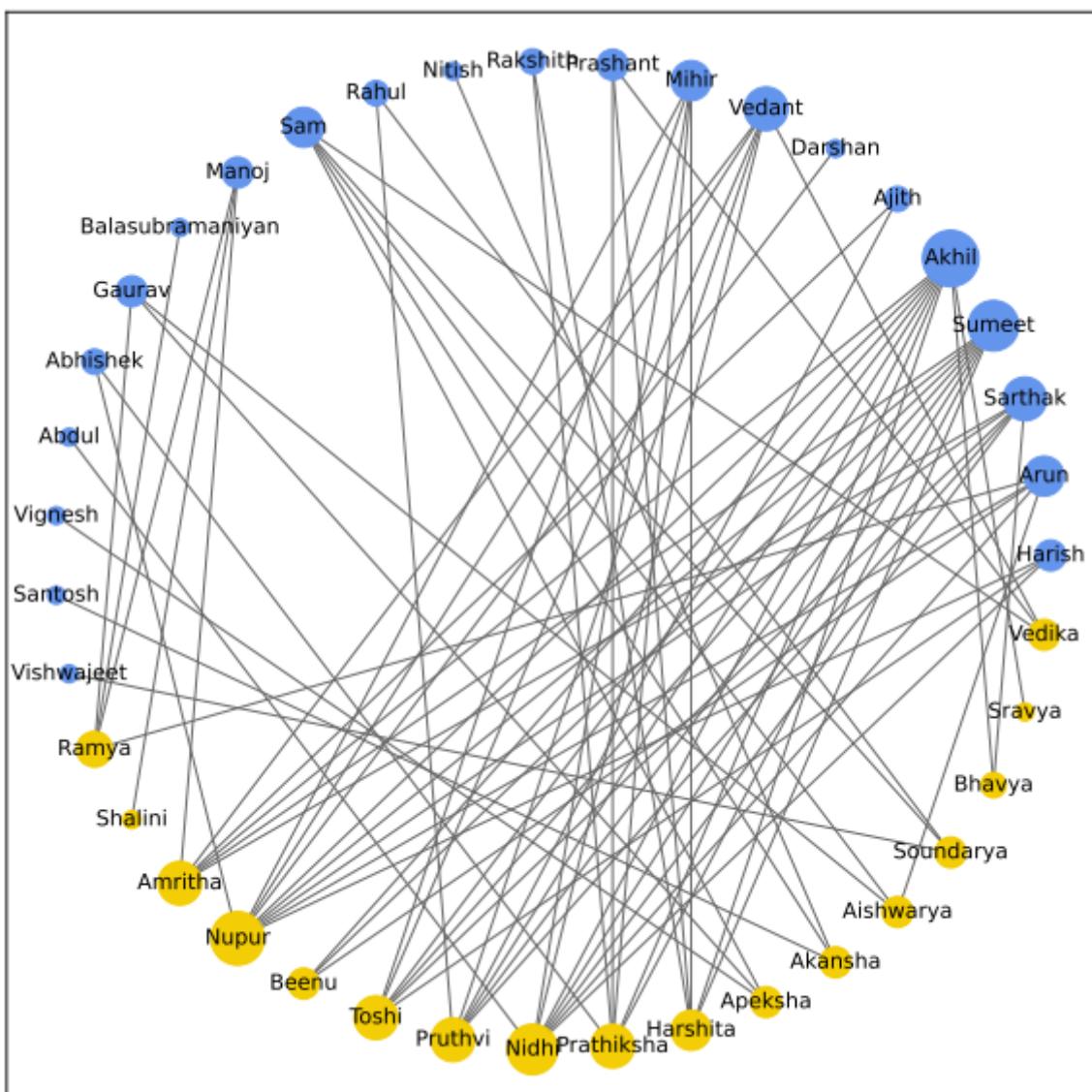
A yellow edge between two girls denotes that they have one or more male friends in common.

The graph-



MALE-FEMALE FRIENDSHIPS-

INSTAGRAM



Out of 189 edges in the Instagram Network, only **72 edges** constitute the male-female friendship network. Out of 50 nodes, **39 nodes** constitute the male-female friendship network.

38% of friendships are male-female. **62%** of friendships are either male-male or female-female.

22% of the people are not connected to the opposite gender.

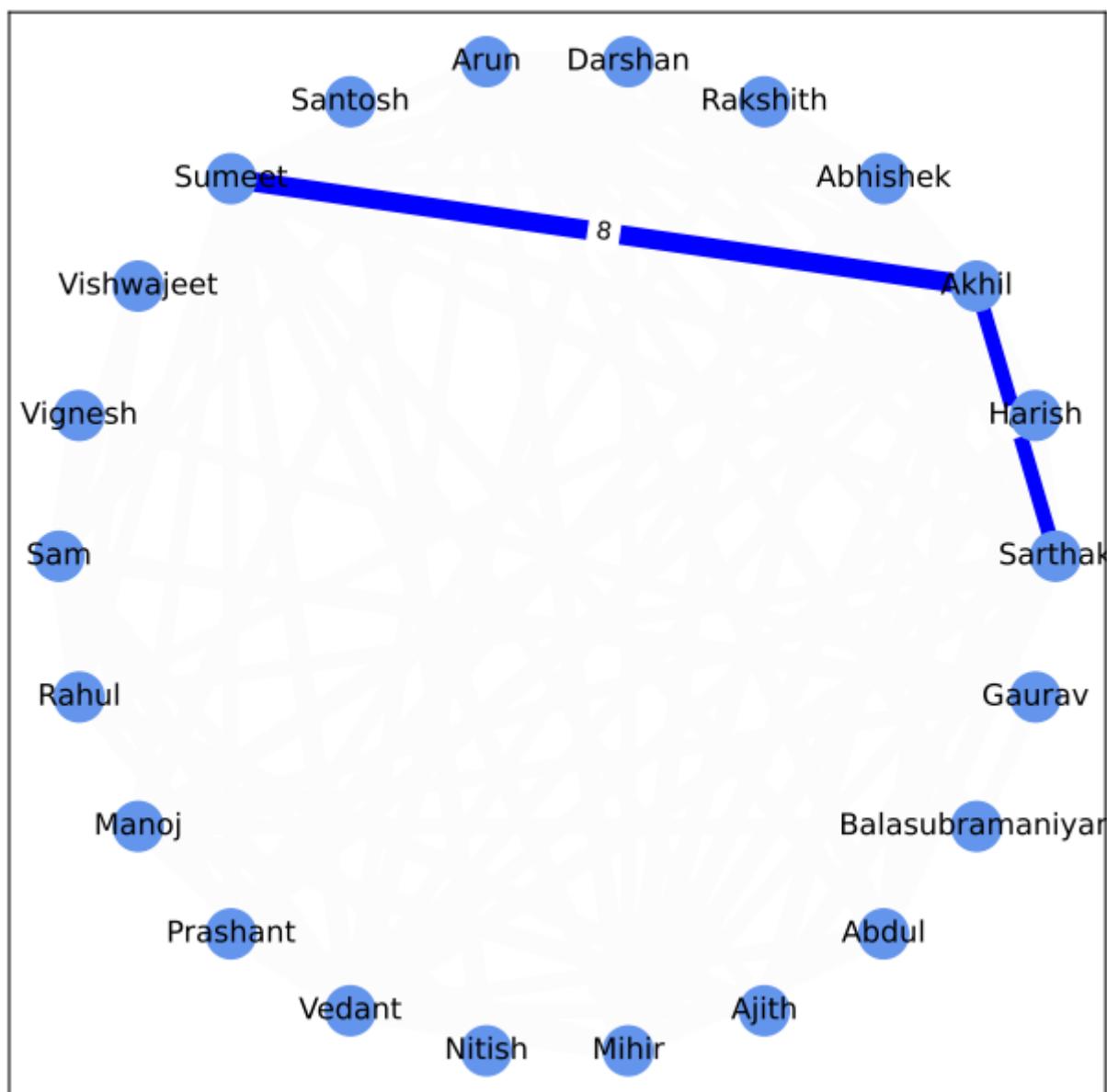
Akhil – highest no. of female friends. (10)

Nupur – highest no. of male friends. (9)

COMMON FEMALE FRIENDS-

A blue edge between two boys denotes that they have one or more female friends in common.

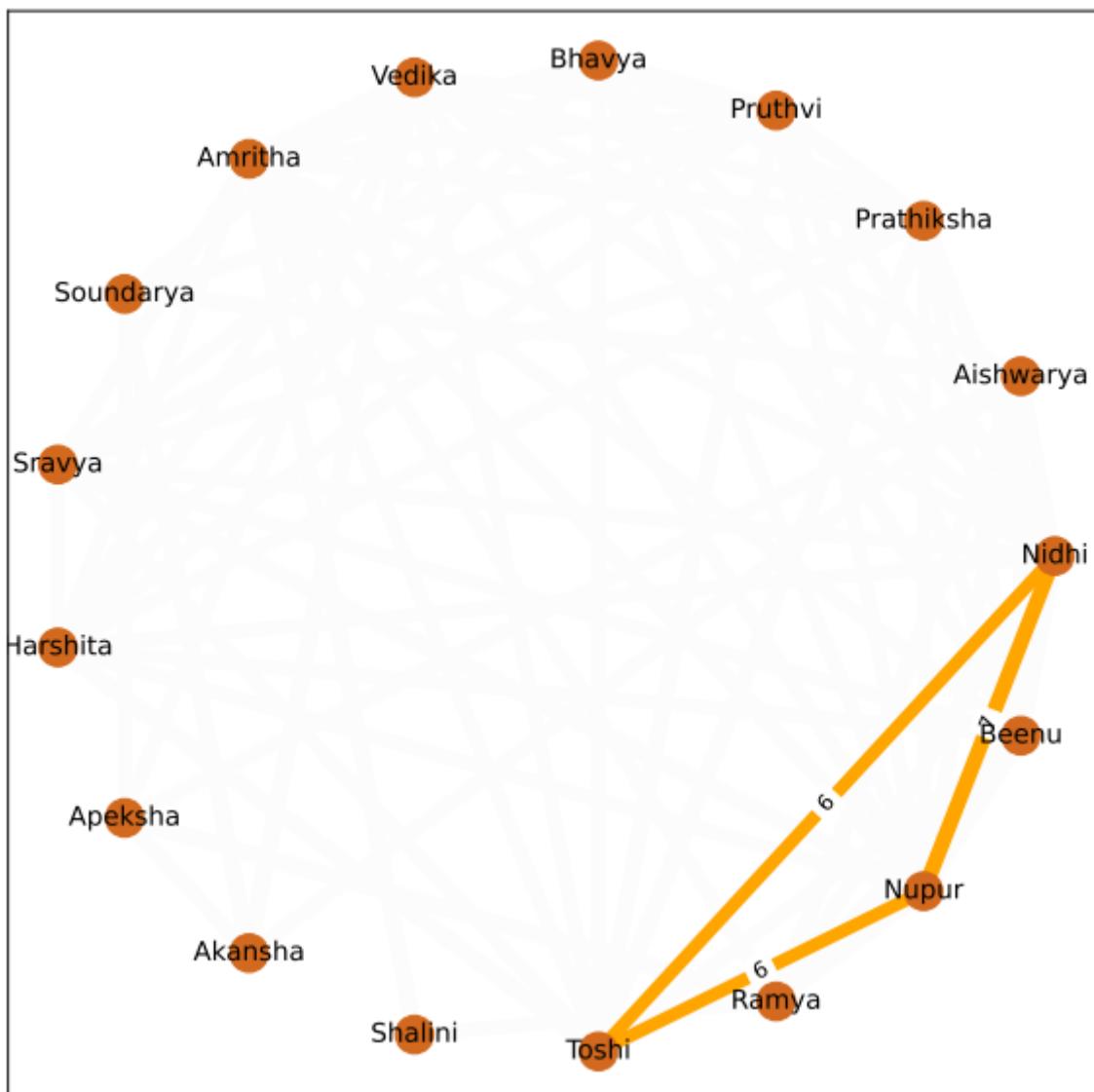
The graph-



COMMON MALE FRIENDS-

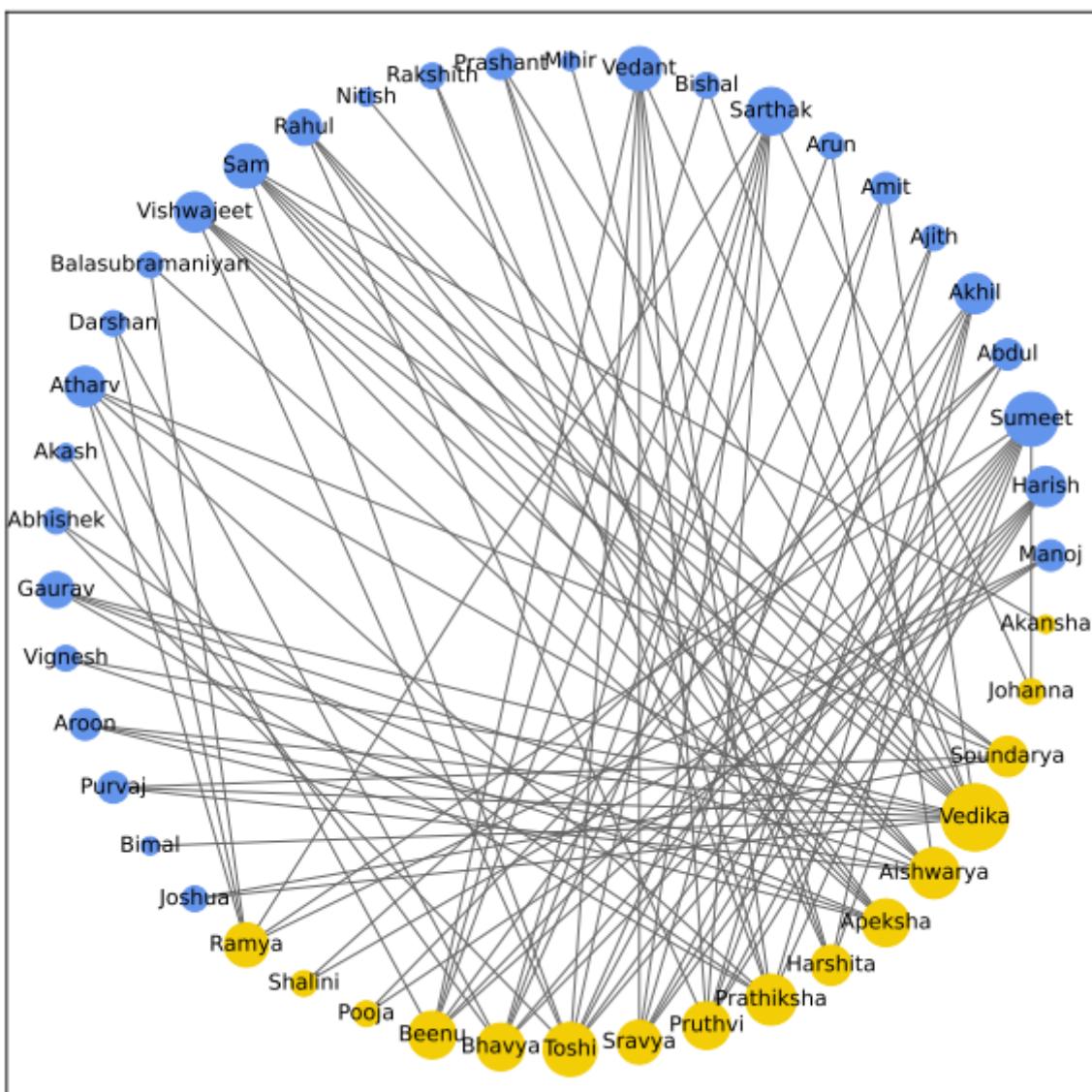
A yellow between two girls denotes that they have one or more male friends in common.

The graph-



MALE-FEMALE FRIENDSHIPS

FACEBOOK



Out of 284 edges in the Facebook Network, only **96 edges** constitute the male-female friendship network. Out of 50 nodes, **45 nodes** constitute the male-female friendship network.

34% of friendships are male-female. **66%** of friendships are either male-male or female-female.

10% of the people are not connected to the opposite gender.

Sumeet – highest no. of female friends. (10)

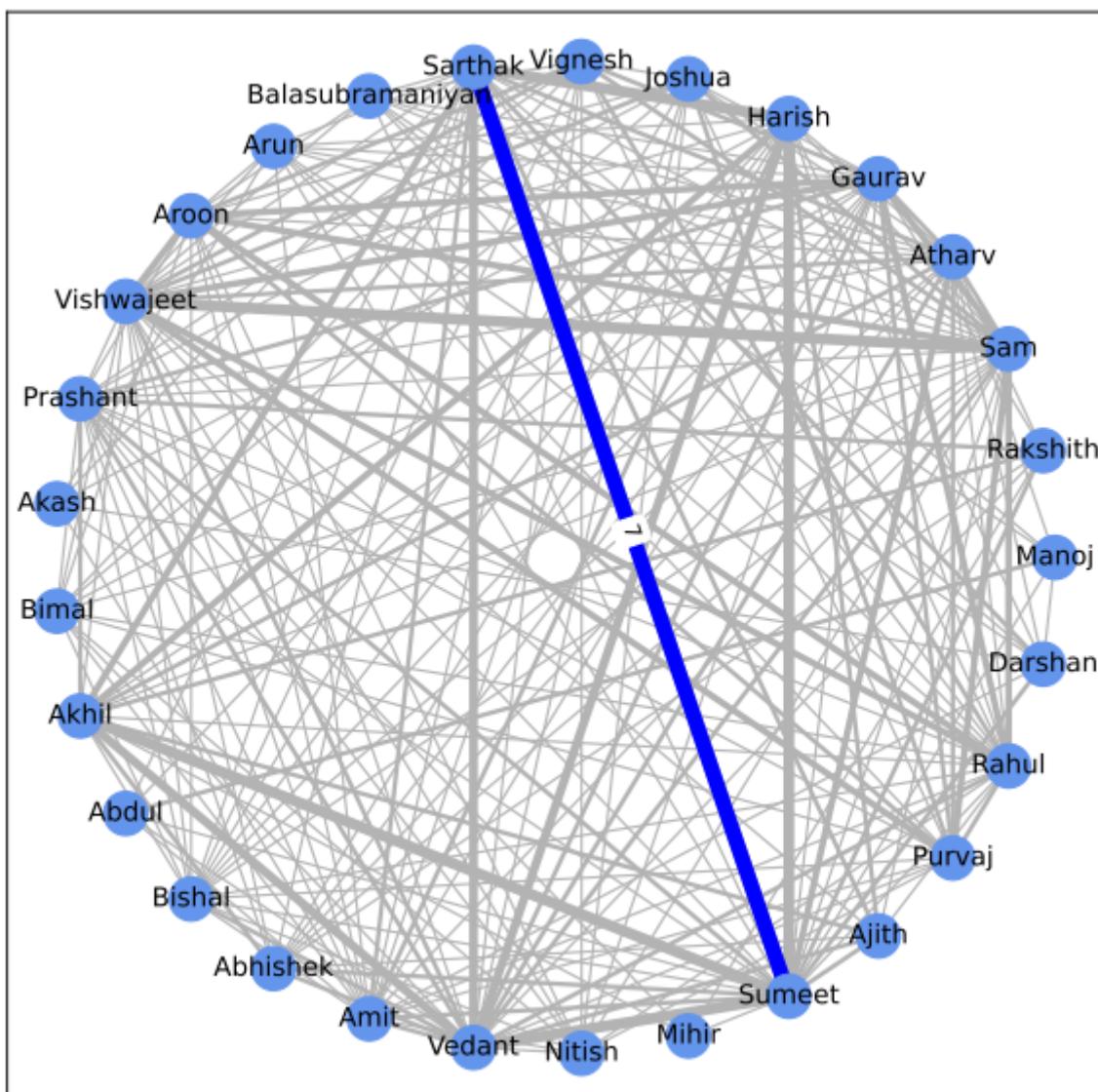
Vedika – highest no. of male friends.(9)

COMMON FEMALE FRIENDS-

A blue edge between two boys denotes that they have one or more female friends in common.

The graph-

Sumeet and Sarthak have 7 common female friends.

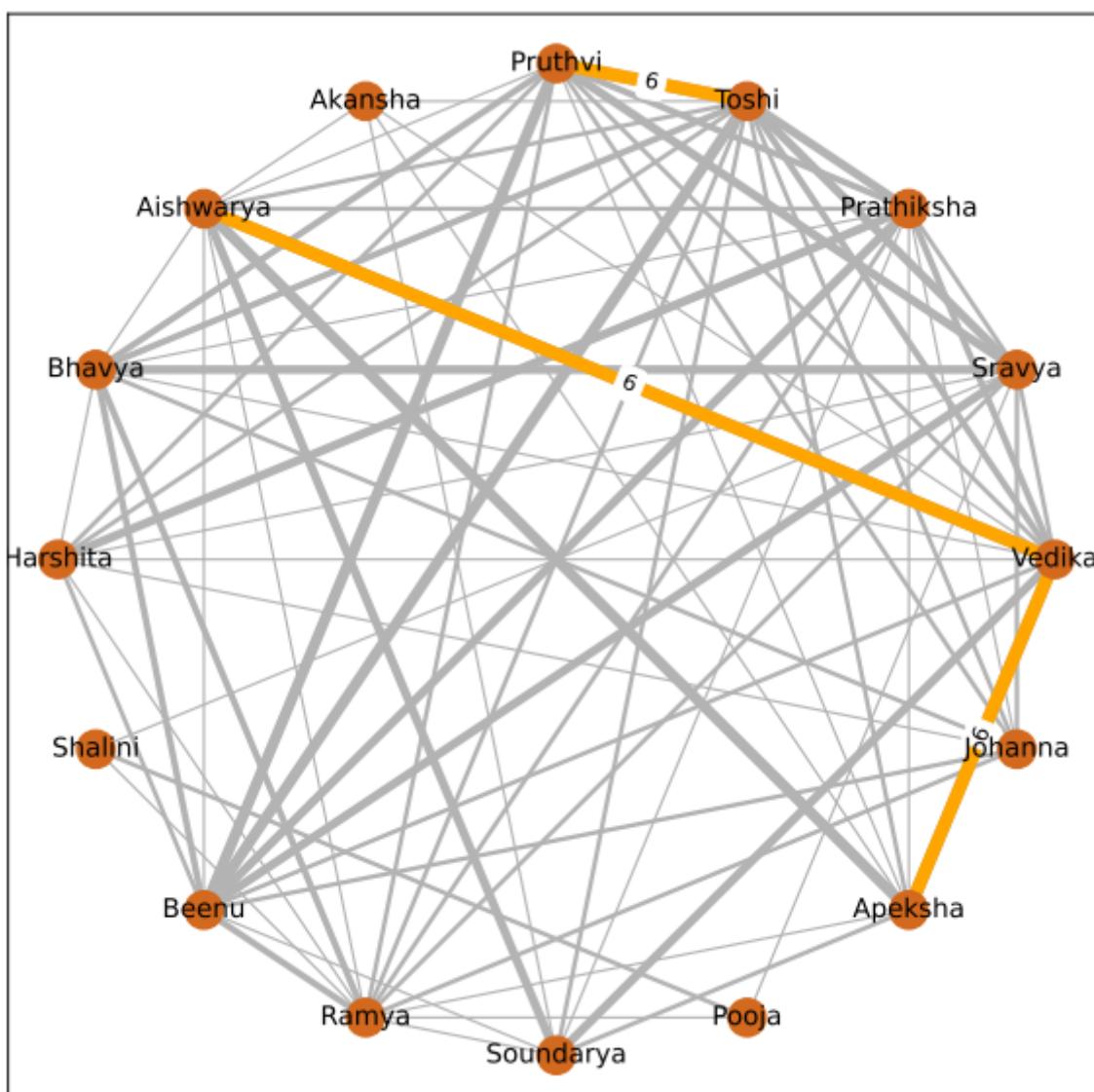


COMMON MALE FRIENDS-

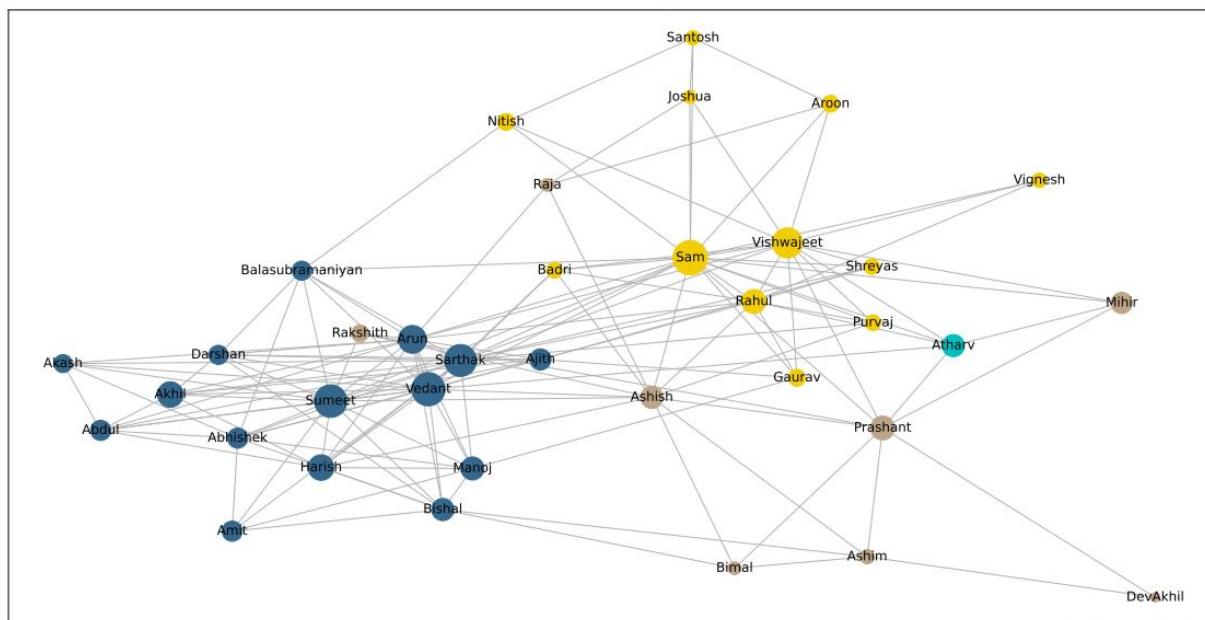
A yellow edge between two girls denotes that they have one or more male friends in common.

The graph-

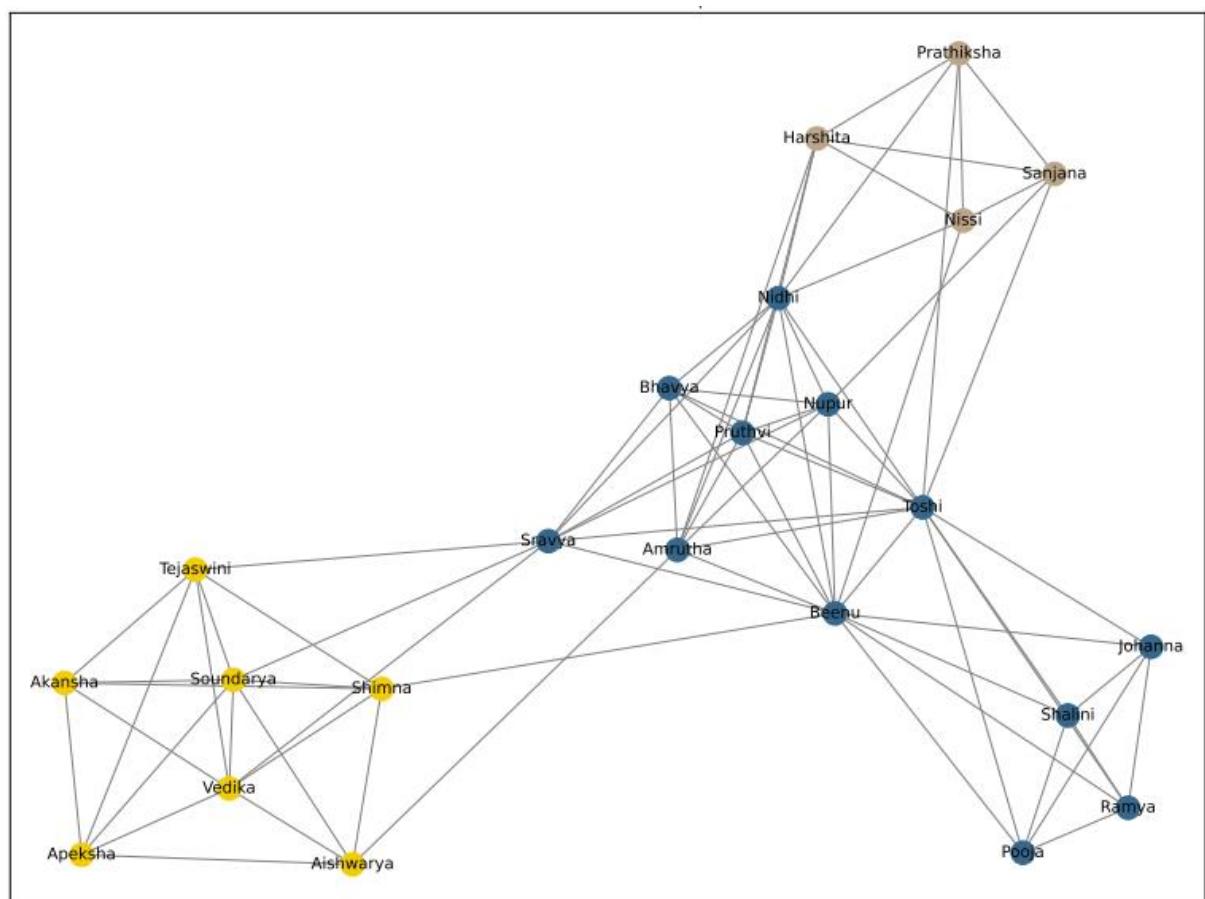
Apeksha and Vedika, Toshi and Pruthvi, Vedika and Aishwarya have 6 male friends in common.



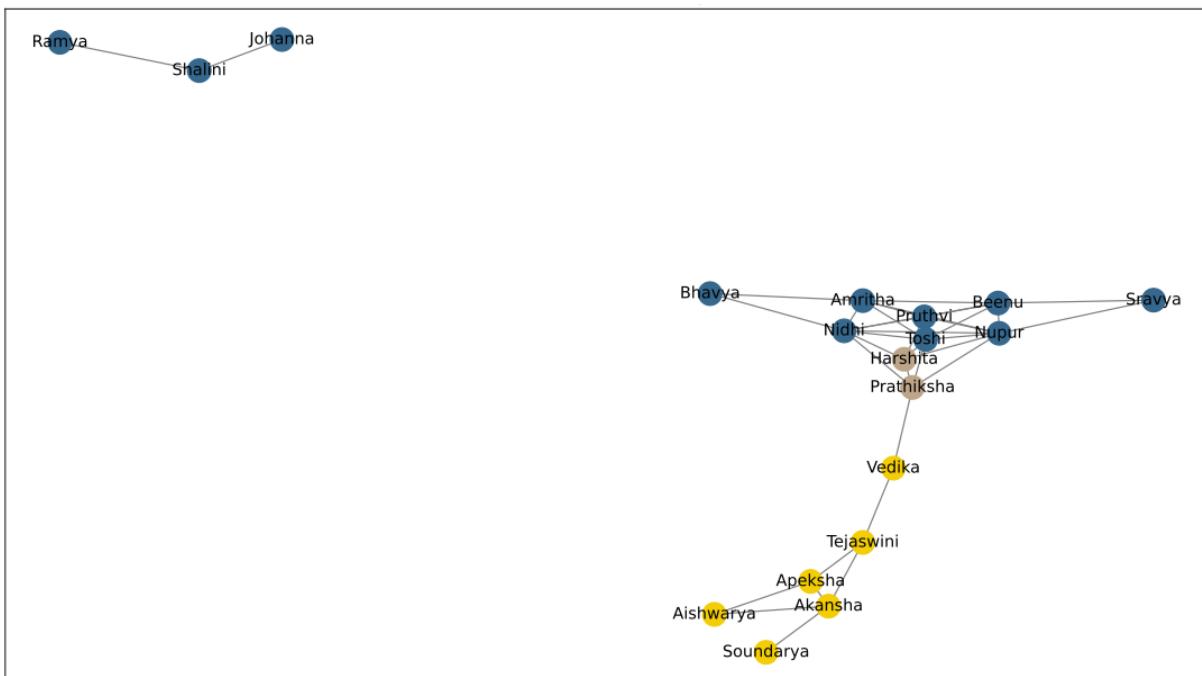
MALE FRIENDSHIPS-WHATSAPP



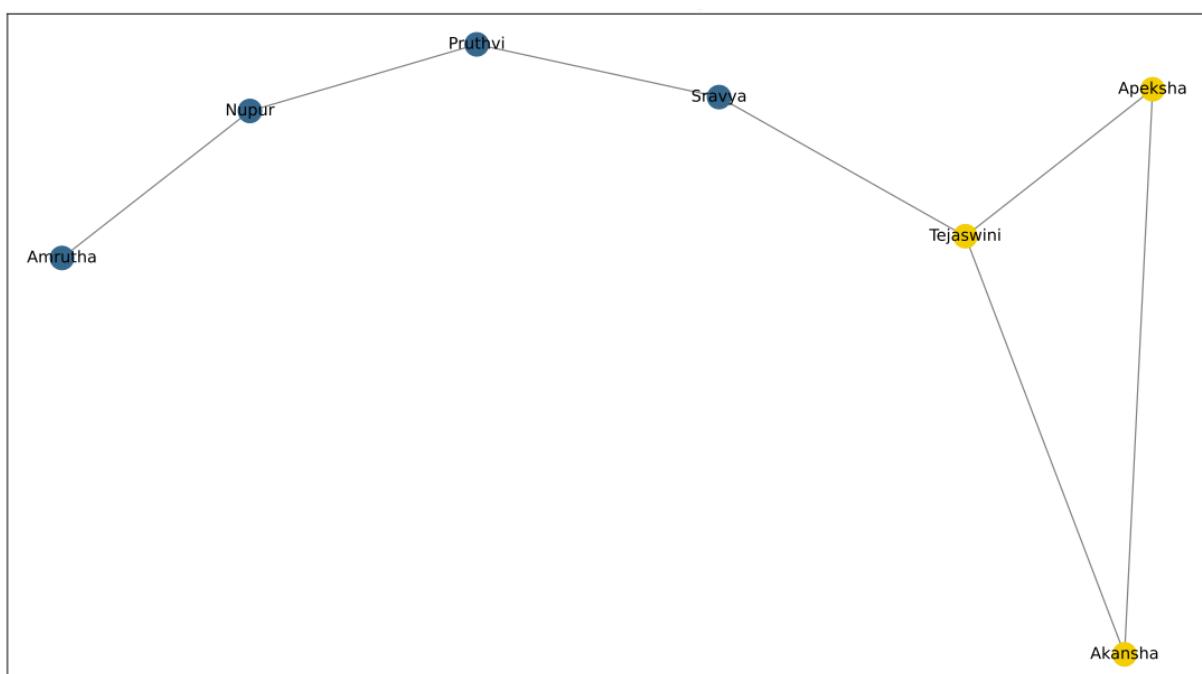
FEMALE FRIENDSHIPS-WHATSAPP



FEMALE FRIENDSHIPS-INSTAGRAM



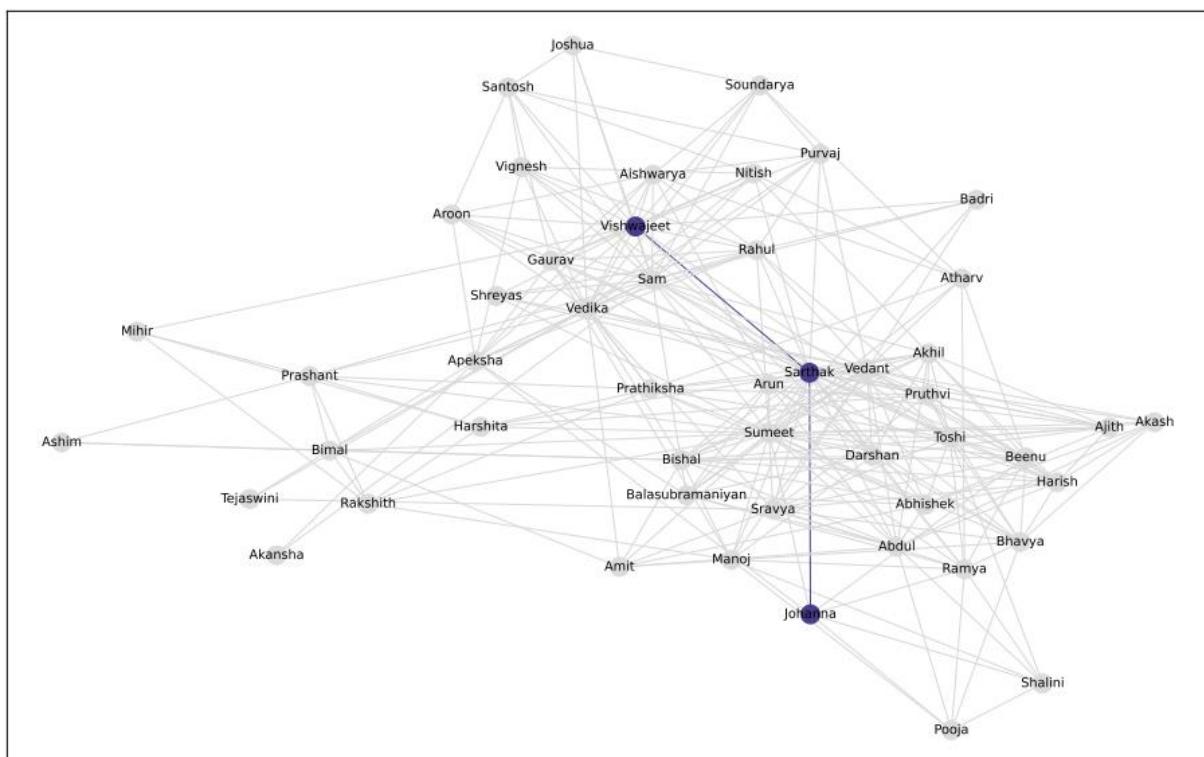
FEMALE FRIENDSHIPS-SNAPCHAT



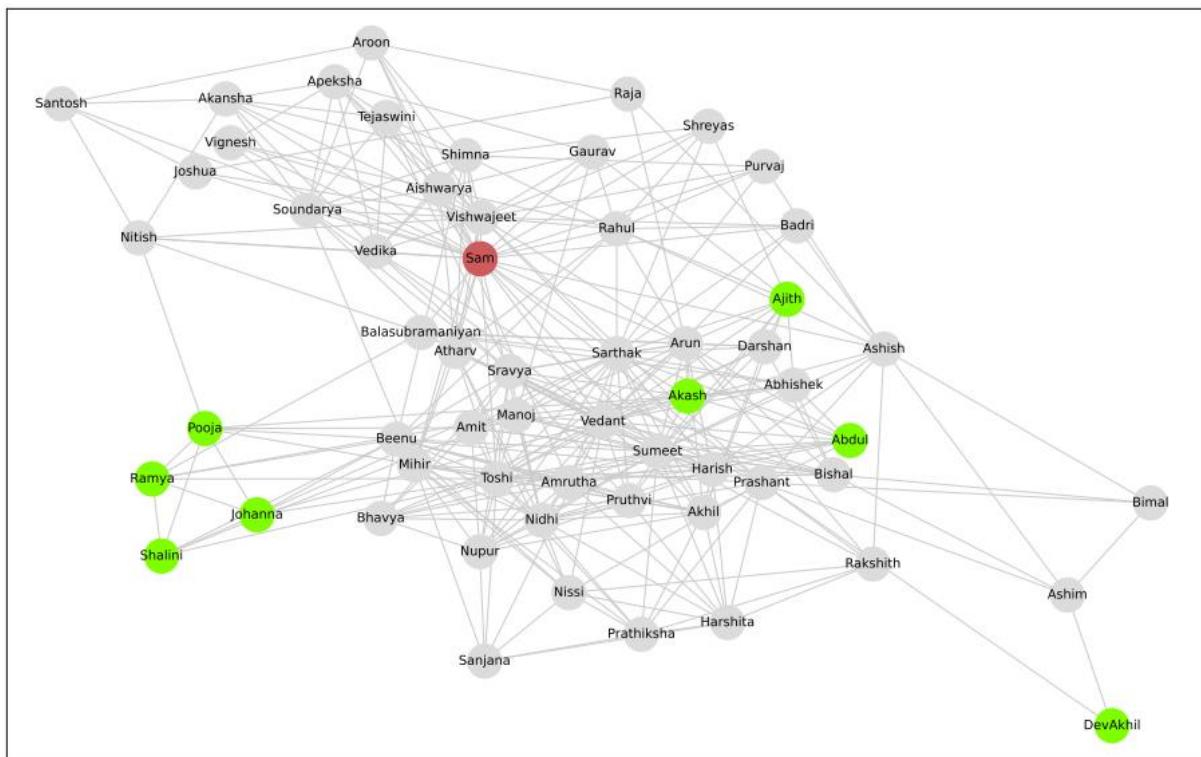
SHORTEST PATHS-

- The shortest path between two nodes is the minimum number of hops required to go from the source node to the destination node.
- The biggest shortest path in the entire network is known as the diameter of the network. This tells us which two nodes are the farthest in the network.
- Taking the Instagram network as an example, we'll see that the diameter of the network is 6.
- We'll also see the central and peripheral nodes in the WhatsApp network.
- Central nodes are the ones with minimum eccentricity, while peripheral nodes are the ones with maximum eccentricity.

SHORTEST PATHS-FACEBOOK



PERIPHERAL AND CENTRAL NODES- WHATSAPP

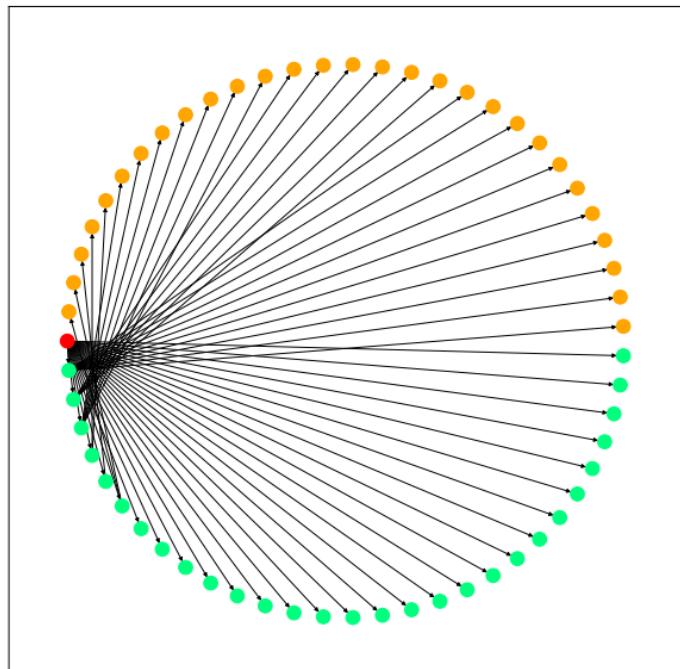


SHORTEST PATHS FOR A CENTRAL ACTOR – WHATSAPP

Half of the class is 1 hop away. The other half of the class is just 2 hops away.

Maximum number of hops to cover the entire network

- 2



CLIQUEs-

- A clique, in the social sciences, is a group of individuals who interact with one another and share similar interests.
- Similarly, a clique in social networks is a group of actors in a network where every actor in the group is directly connected to another actor in the group.
- Thus, a clique is a subgraph of the network, and it forms a complete graph.
- In a given network, the clique formed with the largest number of individuals is known as the maximum clique.

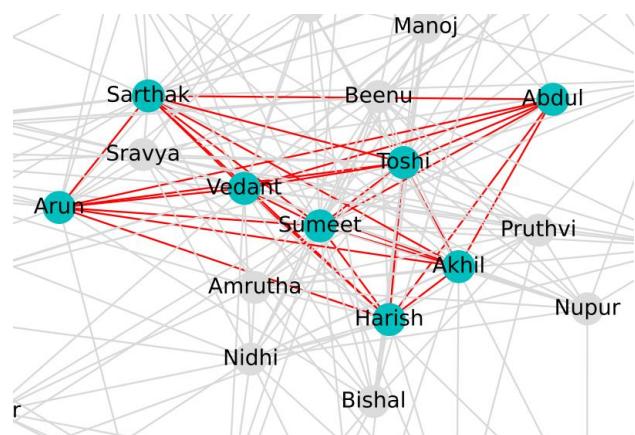
Let us look at all groups of people in our networks who are completely connected and form cliques...

CLIQUEs - WHATSAPP

There are 4 maximum cliques in the network.

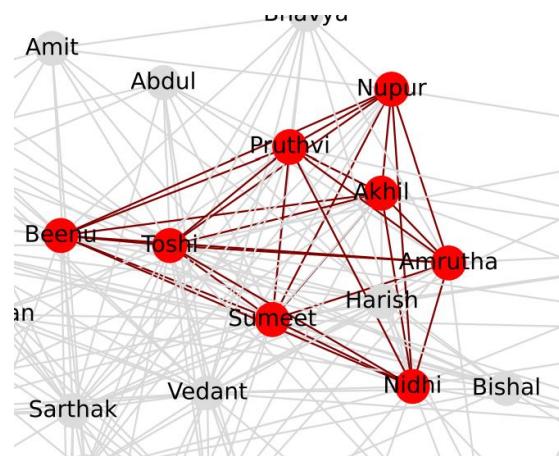
That is, there exist 4 cliques which consist of 8 people in it.

One such clique is shown here.



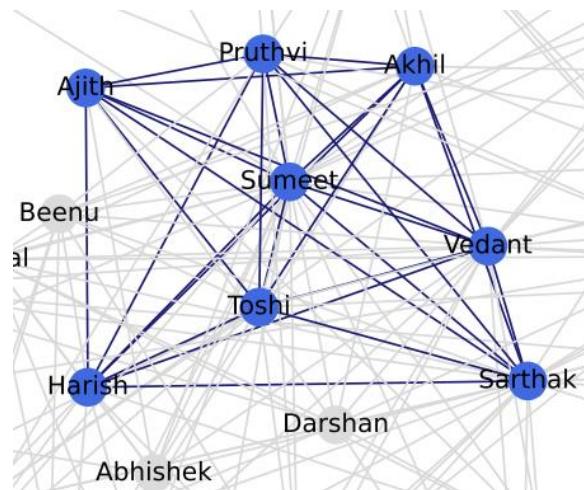
CLIQUE - WHATSAPP

Another such clique which consists of 8 actors.

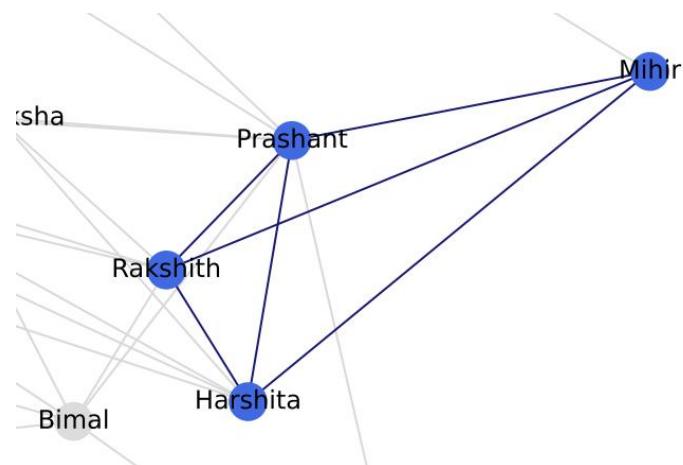


CLIQUE - FACEBOOK

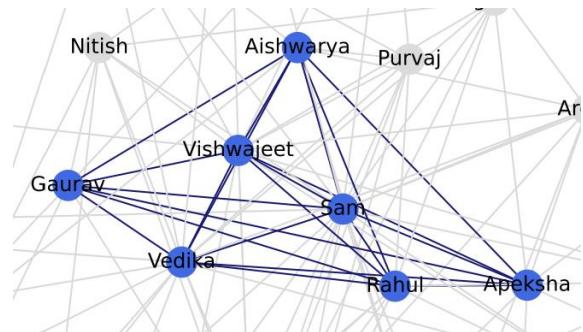
In Facebook, there are 8 people from section A who form a clique



From section B, 4 people form the maximum clique.



Clique which consists of 7 actors.



NETWORK ROBUSTNESS

How robust are we as a network?

A network is robust if a large number of nodes should be removed from the network in order for it to become disconnected.

WHATSAPP NETWORK – 2 nodes [Ashim, Prashant]

FACEBOOK NETWORK – 2 nodes [Apeksha, Sam]

INSTAGRAM NETWORK – 1 node [Shalini]

SNAPCHAT NETWORK – 1 node [Sarthak]

FINALLY,

Are there people who are connected on all 4 social media?

YES, there exists 38 pairs of friends who are connected to each other on all 4 social media.

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- [8] Social Network Analysis Methods and Examples- Song Yang, Franziska B. Keller, Lu Zheng

Dataset link

<https://drive.google.com/drive/folders/1vUmYrtPylv4H6JDzvFfBAsBHmeniyirf?usp=sharing>