



জাহ্নবলাল নেহরু মহাবিদ্যালয়
JAWAHARLAL NEHRU COLLEGE

A Project Report
On
The Study of Neighbourhood structure of Users
In Facebook Database

Master of Science
In Mathematics



Submitted By-

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Under the Guidance of

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Date: 26.02.23

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DECLARATION

I hereby declare that this project report has been prepared by me during the year 2023-24 under the guidance of Ripunjy Choudhury in the partial fulfillment of the syllabus for 3rd semester of M.Sc Degree.

I also declare that this project report represents largely my own understandings and words in this topic. This report has been prepared without resorting to plagiarism and adhered to all principles of academic honesty and integrity. No falsified or fabricated data or information has been presented.

Finally I declare that this project report is the outcome of my own efforts and that it has not been submitted elsewhere for the award of any degree.

Himashree Deka
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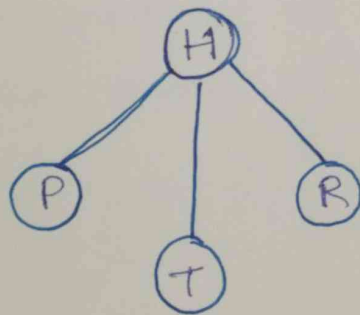
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Graph Generated by the Neighborhood structure:

At first we are showing some examples:

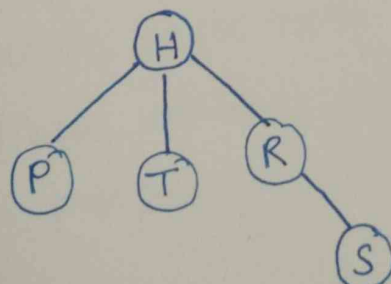
Example 1: If I search on Facebook some user ID's namely Pronali Borah, Tarali Borah, and Rejina Sultana. Then I found the results as. They are connected with the user (me) with the relation R .

Let's consider the users and the other searched ID's as nodes, and the edges represents the pre-defined relation R between the nodes. Then the graphical representation will be.



Example 2: I searched on Facebook the user ID* namely Shehnaas Ahmed. Then I found the result as the user ID ~~an~~ (searched) and the user (me). Shares a mutual friend namely Rejina Sultana.

Let's consider the user, searched name and the mutual friend as nodes. And the edges defines the above relation R between the nodes. we get



From the above examples we can now conclude that for Facebook search result the users are defined by the nodes and relation between the users are defined as the edges.. Let's consider users.

$$x, y, z, m, n, o, p, q \in V \subseteq B$$

such that

$$(x, y) \in E \Leftrightarrow \{xRy \mid x \text{ is friend of } y \text{ or } x \text{ and } y \text{ have mutual friends}\}$$

$$(y, z) \in E \Leftrightarrow \{yRz \mid y \text{ is friend of } z \text{ or } y \text{ and } z \text{ share a mutual friend}\}$$

In similar manner we can find all the connection between nodes.

The Graph representation for all the neighborhood structure is given below —

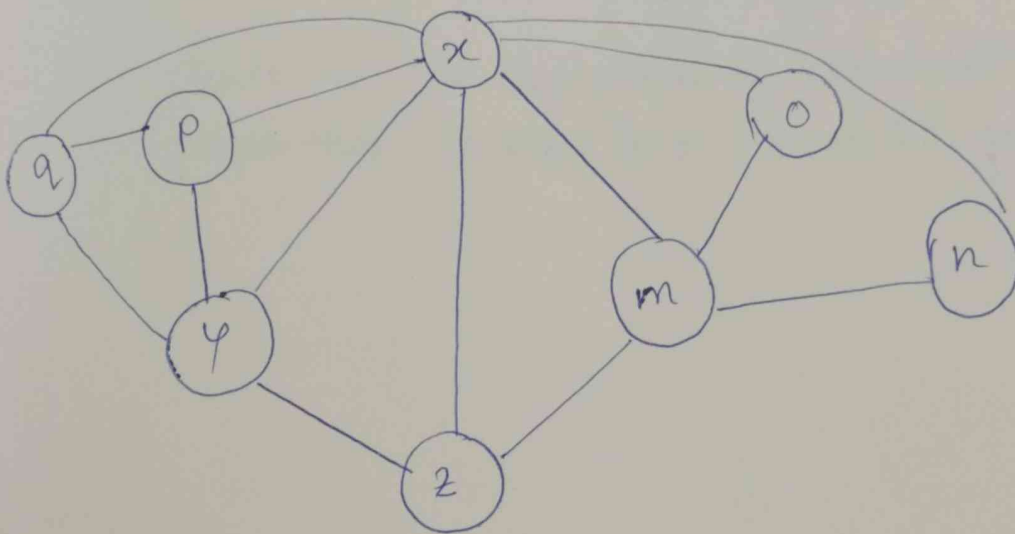


Fig: $V(K, E)$

Remark: In above graph, each node can have loop because the pre defined relation between the nodes satisfy the reflexive property. So, the graph is not a complete graph.

Theorem ③ : Let K be the set of nodes and also $K \subseteq B$ and E be the set of edges. where E defines the relation / connection between two nodes. Then the above graph $V(K, E)$ is a connected graph.

Proof : Let $x, y, z \in K \subseteq B$. i.e. K be the set of all nodes (users) and E be the edges between the nodes. which define the above relation R .

If x is friend of y then obviously $(x, y) \in E$ otherwise there exist a node z such that z is common friend of x and y . Then also $(x, y) \in E$

Then between any two nodes we can find path i.e. mathematically xRz and zRy

So xRy and hence $(x, y) \in E$.

Hence by the definition of connected graph it's prove that $V(K, E)$ is a connected graph.

CONCLUSION

In conclusion, this project successfully demonstrates the applicability of equivalence relations in the realm of social networks, particularly within the Facebook platform. By constructing a connected graph to visualize user connections, the study not only establishes the relation R as an equivalence relation but also provides a tangible representation of equivalence class. The project's intersecting of abstract mathematical concepts with real-life social scenarios underscores the versatility of graph theory. This innovative approach not only enhances our understanding of social network dynamics but also showcases the potential of mathematical principles in elucidating complex, interconnected systems in the digital age.