

# nada mohamed abdelatar

## 2205173

### 1. Introduction

This report analyzes two real Twitter interaction subgraphs extracted from the **WICO Graph Dataset**:

1. A **misinformation** community from the **5G\_Conspiracy\_Graphs** folder.
2. A normal, **non-misinformation** community from the **Non\_Conspiracy\_Graphs** folder.

The goal is to compare their structural properties using **Social Network Analysis (SNA)** in **Gephi**, and understand how misinformation networks differ from normal Twitter communities.

Both graphs were imported into Gephi (nodes + edges tables) and visualized using ForceAtlas2.

Network statistics were computed including:

- Node/edge counts
- Average degree
- Density
- Clustering coefficient
- Network diameter
- Modularity
- Betweenness & closeness centrality
- Connected components

## 2. Methodology

The analysis followed these steps for both graphs:

1. Import nodes.csv and edges.csv into Gephi.
2. Visualize the graph in **Overview**.
3. Apply **ForceAtlas2** layout (and Noverlap).
4. Run the following metrics in *Statistics*:
  - Average Degree
  - Graph Density
  - Average Clustering Coefficient
  - Network Diameter
  - Modularity
  - Betweenness Centrality
  - Closeness Centrality
5. Export screenshots for each metric and the modularity-colored graph.
6. Compare results between the two networks.

## 3. Results — 5G Conspiracy Subgraph

Basic Network Measures

### 1. **Non\_Conspiracy\_Graphs**

Nodes, Edges	<b>Nodes:</b> 4 <b>Edges:</b> 4		
Average Degree	Average Degree	1	Run <a href="#">?</a>
Graph Density	Graph Density	0.333	Run <a href="#">?</a>
Average Clustering Coefficient	Avg. Clustering Coefficient	0	Run <a href="#">?</a>
Modularity	<b>Results:</b>  Modularity: 0.500 Modularity with resolution: 0.500 Number of Communities: 2		
Betweenness & Closeness Centrality	<b>Results:</b>  Diameter: 1 Radius: 1 Average Path length: 1.0		
Connected Components	Number of Weakly Connected Components: 2 Number of Strongly Connected Components: 2		

# 5G\_Conspiracy\_Graphs

Nodes, Edges	<b>Nodes:</b> 91 <b>Edges:</b> 214		
Average Degree	Average Degree	2.352	Run ⓘ
Graph Density	Graph Density	0.026	Run ⓘ
Average Clustering Coefficient	Avg. Clustering Coefficient	0.156	Run ⓘ
Modularity	<b>Results:</b> Modularity: 0.390 Modularity with resolution: 0.390 Number of Communities: 7		
Betweenness & Closeness Centrality	Diameter: 7 Radius: 0 Average Path length: 2.9000984251968505		
Connected Components	Number of Weakly Connected Components: 1 Number of Strongly Connected Components: 52		



# Comparative Analysis



## 1. Network Size and Structure

The non-conspiracy graph is extremely small (4 nodes), resulting in two disconnected components.

This fragmentation reflects the limited scope of normal interactions in this sample.

The 5G conspiracy graph is much larger (91 nodes) and forms one connected component.

This unified structure is typical of misinformation networks, which often attract larger numbers of users engaging in the same narrative.

→ **Difference partly due to content (misinformation attracts more users), and partly due to graph size.**

## 2. Density and Degree

The non-conspiracy graph has a high density (0.333), but this is mainly an effect of its very small size—any connection strongly increases density.

The conspiracy graph has lower density (0.026), which is normal for larger networks, but it shows a **higher average degree (2.352)**.

This indicates stronger engagement and more user-to-user interactions, which aligns with the behavior of coordinated or viral misinformation clusters.

→ **Density difference is due to size, but the higher average degree reflects stronger activity in the conspiracy community.**

## 3. Clustering

The non-conspiracy graph has **zero clustering**, meaning no small groups or local interaction patterns appear—again because the network is tiny.

The conspiracy graph shows a **positive clustering coefficient (0.156)**.

This highlights the presence of tightly connected groups, often described as *echo chambers*, where misinformation is reinforced and circulated.

→ **Clustering difference reflects the typical behavior of misinformation networks forming cohesive subgroups.**

## 4. Modularity

The non-conspiracy graph has higher modularity (0.50) because it is split into two isolated components.

The conspiracy graph has lower modularity (0.39), indicating several communities exist, but they are still connected within one large discussion.

→ **Higher modularity in the non-conspiracy graph is mostly due to size; lower modularity in the conspiracy graph reflects one unified misinformation community.**

## 5. Information Flow

The non-conspiracy graph has a diameter of **1**, representing very shallow structure and minimal reach—this is a direct consequence of its tiny size.

The conspiracy graph has a diameter of **7**, showing deeper paths and more complex information flow. This is expected in large misinformation networks where content spreads through many layers of users.

→ **Diameter difference mainly comes from size, but the complex flow aligns with how misinformation spreads.**

