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# Final Project Report

**1. Average Distance Between the Nodes:**

Tthe average distance between the nodes of the network is found to be around 3.6925068496963913 using the following formula,

$$l_G = \frac{1}{n \cdot (n-1)} \cdot \sum_{i \neq j} d(v_i, v_j),$$

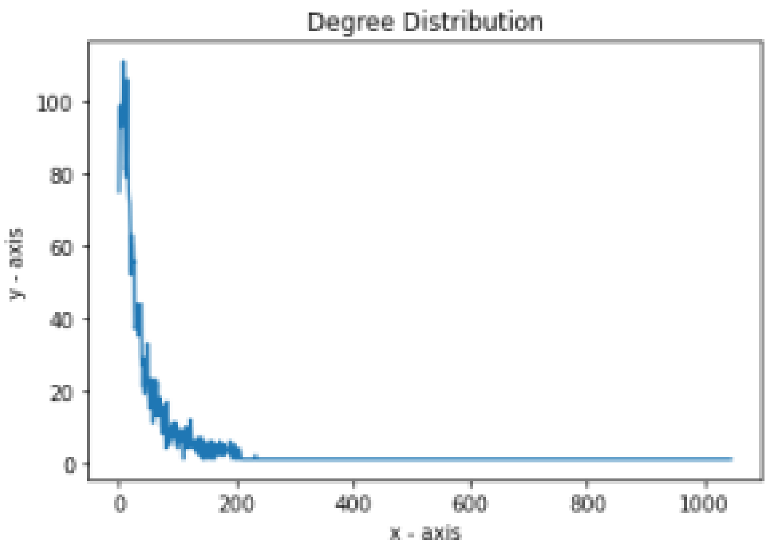
where $n$ is the number of vertices in $G$.

**2. Is the Network Connected?**

After calculating the number of connected components in the network it was found out that there exists only one component. That means, the whole network is connected and all the nodes/vertices are members of the same giant component.

**3. Degree Distribution**

The frequency of each degree of the network has been calculated and plotted. The degree distribution is plotted in Python. It looks like this:




From the distribution, we can see that, there are huge number of vertices with small degrees but very few nodes have large degrees. For example, the degree of node ‘0’ is 347 i.e. vertex ‘0’ is connected to 347 other vertices. But such hubs are very rare which is evident from the distribution plot. So we can say that, the distribution is not normal. In fact, it follows the power law distribution that means the network is scale-free. **4. Eccentricity of the Network**

Average eccentricity of a network ***G*** is defined as:

$$\bar{\varepsilon}(G) = \frac{1}{n} \sum_{v \in V} \varepsilon(v)$$

The average eccentricity of the network is found to be approximately 0.15880020985864057.

**5. Closeness of the Network**

The closeness $\mathrm{close}(v)$ of a node $v$ is defined as:

$$close(v) = 1/dist_{sum}(v)$$

Then after calculating the average of closeness of all the nodes, the average closeness of the network is found to be 0.000068392214850628.