Assignment 1

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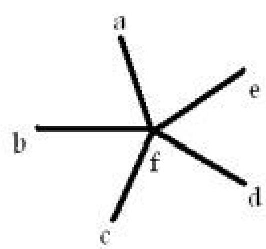
Q2. You are given a sexual network from which you need to infer whether a person is prone to STD by inspecting a metric of the network. Would it be reasonable to check the degree centrality of the network? Justify you answer with a suitable example.

Ans2. It would not be reasonable to check the degree centrality of the network. The chance of getting infected does not depend upon how many people one is connected to but to whom he/she is connected. Yet the degree centrality will give a rough estimate but eigenvector centrality will give more appropriate estimate in this case, which is the measure of importance of a node in a network.



For example in the figure above the degree centrality of node f is more than any of the other nodes but the chance of f getting infected does not depend on how many people he/she is connected to. It depends on whether or not f is connected to people who already have STD. Eigenvector centrality measures the importance of node in this context so is a good measure.

Q3. For a Zipf's distribution, the rank (r) of the income of a person is related to the amount of the income (n) as n $\sim$ r$^{-\alpha}$ where α is a positive constant. However, Pareto was interested in the distribution of income. Instead of asking what the rth largest income is, he asked how many people have an income greater than n. He found that this number P_n is related to n as $P_n \sim n^{-\beta}$ where β is a positive constant. Show that the Pareto distribution can be derived given the Zif's distribution.

Ans3. According to Pareto distribution number of people having income greater than n is given by $P_n \sim n^{-\beta}$, where β is a positive constant. So P_n basically denotes the rank of person whose income is equal to n. So, for Zipf's law $n = k\, r^{-\alpha}$, k and α being constants.

Let X= Income. Then according to Pareto

$P(X \geq n) \sim n^{-\beta}$

And Zipf's law :

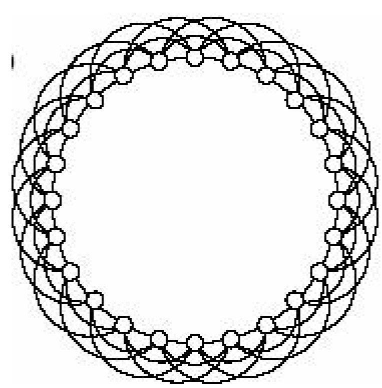
$n^{\frac{1}{\alpha}} = \frac{k}{r}$

therefore, $r = kn^{-\frac{1}{\alpha}}$

$P(X \geq n) = kn^{-\frac{1}{\alpha}}$

therefore, $\beta = \frac{1}{\alpha}$

Q4. The figure given below shows a 3-regular lattice. Find the clustering coefficient of the lattice.



Ans4. Clustering Coefficient of any node = no. of triangles/no. of triplets.

As all the nodes are symmetric the clustering coefficient of a node will be the clustering coefficient of the whole network. Each node is connected to six other nodes, three on each side. So the clustering coefficient can be calculated as :

$P = \frac{9}{{}^{6}C_2} = \frac{3}{5}$