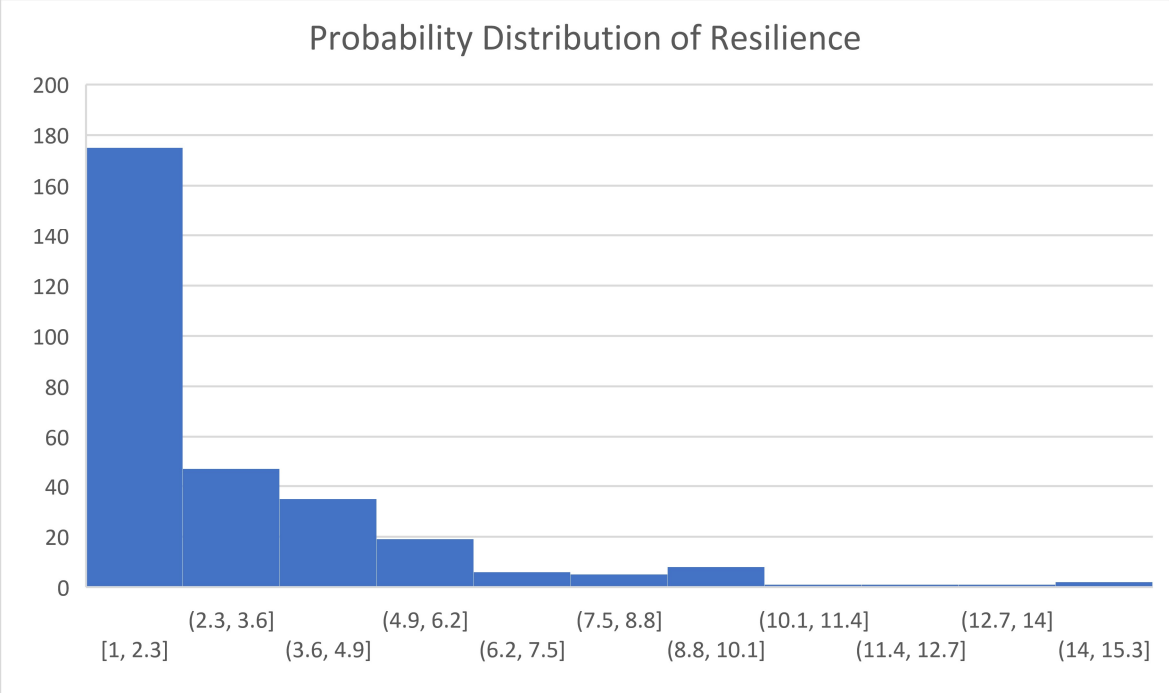
# Scale-Free Networks

- Scale-free networks are interesting in that they are graphs constructed with probability. These graphs closely resemble social networks (although social networks tend to have fewer leaves and more clusters).
- The results that I obtained seemed to show that most graphs could be cut with the random deletion of only a few vertices. At first, I thought there would be so many leaves, that the deletion of a random vertex would likely be a leaf and would not cut the graph. However, due to the preferential attachment rule forming many trees, many random nodes turned out to be cut-vertices. Below is my histogram where I used a graph with order 2500 and ran my algorithm on it 300 times:




- Here, we obtain an inverse-exponential graph. After doing some closer analyzing by using different ordered-graphs, I also realized that a larger scale-free network could have on average more nodes randomly deleted without breaking its integrity than smaller networks. This brings us to an application of scale-free networks to the real-world: social networks. For example, let us take a social media platform like Instagram, which is composed of followers. In this example, nodes represent individual users and an edge represents one user following another. It is worth mentioning that, in this case, this network is a directed graph, since a follower does not have to be followed back and vice versa. By finding the minimum vertex-cut of a graph (resilience), we can measure how connected or "tightly knit" different communities are with each other. It is also possible to observe all the groups that an individual is involved with based on how many clusters the user is connected to. In this case, a cluster is like a clique, where a subset of vertices is very interconnected. In conclusion, network graph analysis allows us to identify groups of friends, family, or colleagues in a user's life through an abstract model.

- Below are screenshots to prove that the code works. This is a sample execution run on a graph of Size 10, which required 3 vertex removals to disconnect: