Report

In this project, I am exploring the structure of random graphs defined over the natural numbers. For generating the graph on the naturals, I am using the Erdos-Renyi graph formation rule where in the user can specify the probability with which an edge between any two nodes in the graph is formed. This kind of graph generation can be parallelized using parMapM when applying edge formation for a set of vertices. These independent edge selection formation processes allow for seamless parallelization.

For each generated graph, I am checking the behavior of different metric functions. The first metric is degree distribution. One common fact about the structure of social networks is the fat tails nature of the degree distribution in this graph - there are more people in the outliers of the degree distribution than would be in a normal distribution i.e. there are many people with high degree and low degree connections. What we observe from the random graph generation here is that kurtosis is negative and marginally goes over 0 as we scale orders of magnitude. Low kurtosis means that the distribution processes fewer and less extreme outliers than the normal. For social networks, we find high kurtosis as mentioned above.

Graph analysis
Erdos Renyi Graph with 10 nodes and 13 edges
Mean degree is 2.6 and the distribution has kurtosis -0.8979591836734695

Graph analysis
Erdos Renyi Graph with 100 nodes and 985 edges
Mean degree is 19.7 and the distribution has kurtosis -0.17087655883231756

Graph analysis
Erdos Renyi Graph with 1000 nodes and 99871 edges
Mean degree is 199.742 and the distribution has kurtosis 3.170740235462377e-2

Graph analysis
Erdos Renyi Graph with 10000 nodes and 9998732 edges
Mean degree is 1999.7464 and the distribution has kurtosis 9.25023975480701e-2