For the graph analysis program, it can use txt file as input file. For the first line of txt file, it’s the numbers of node. After that, its node pairs from node 1 to the last nodes. For each node, I use bread first search to get the other nearby nodes. At each iteration, I pop the first node in the queue and put its nearby nodes into a queue. And I also marked the search node in visited as 1 (meaning this node has been searched). In the last iteration, I store all the node in this iteration.

Literature review:

It is well known that random networks, such as Erdo˝s-Re´nyi networks [1] as well as partially random networks such as small-world networks [2], have a very small average distance (or diameter) between sites, which scales as d ~ lnN, where N is the number of sites. Since the diameter is small even for large N, it is common to refer to such networks as ‘‘small-world’’ networks. Many natural and manmade networks have been shown to possess a scale-free degree distribution, including the Internet, World Wide Web, metabolic and cellular networks, and trust cooperation networks.

We define the diameter of a graph as the largest distance between any two sites on the graph. In our result of diameter. For small size of input, the d almost equal to ln(N), when the size become larger, the diameter is larger than the ln(N). Thus we find out the ln(N) could be the lower bound of the diameter.

[1] P. Erdo˝s and A. Re´nyi, Publ. Math. Inst. Hung. Acad. Sci. 5, 17–61 (1960).

[2] D. J. Watts and S. H. Strogatz, Nature (London) 393, 440 (1998).