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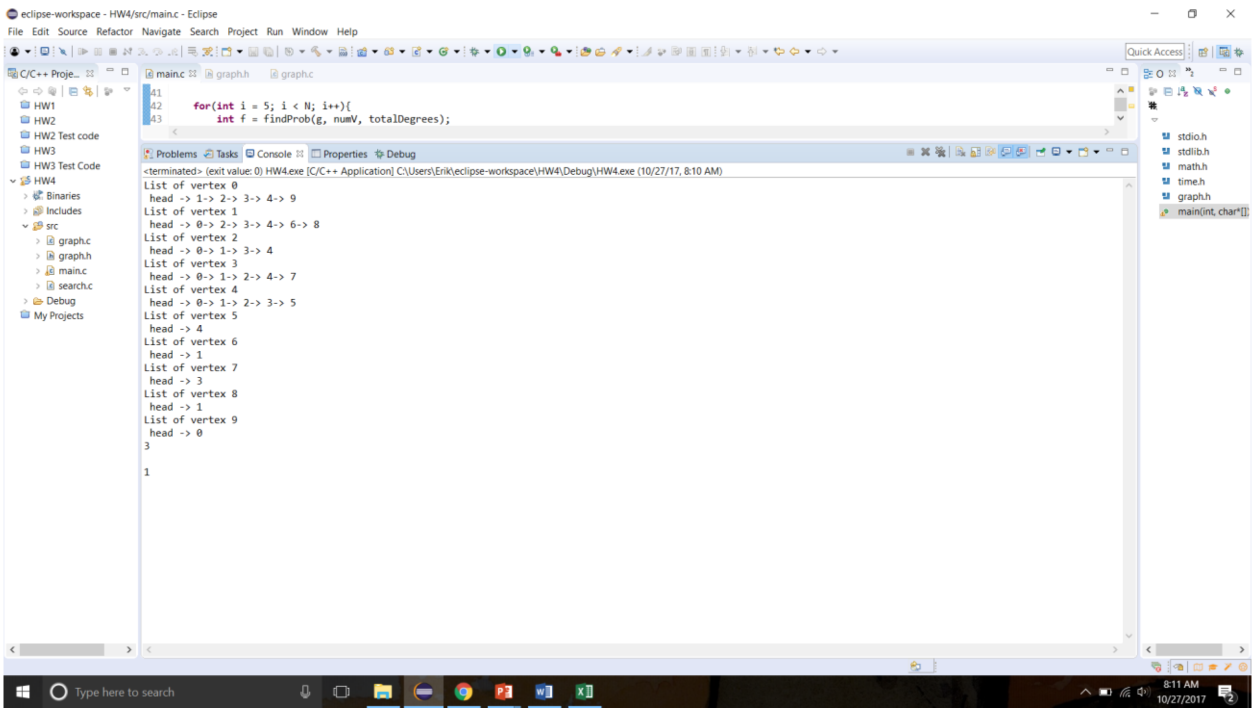
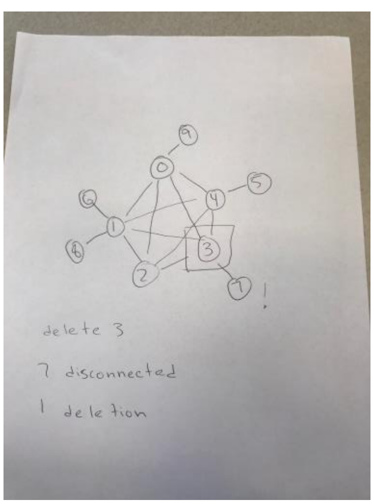
Homework 4

Scale Free Network Report

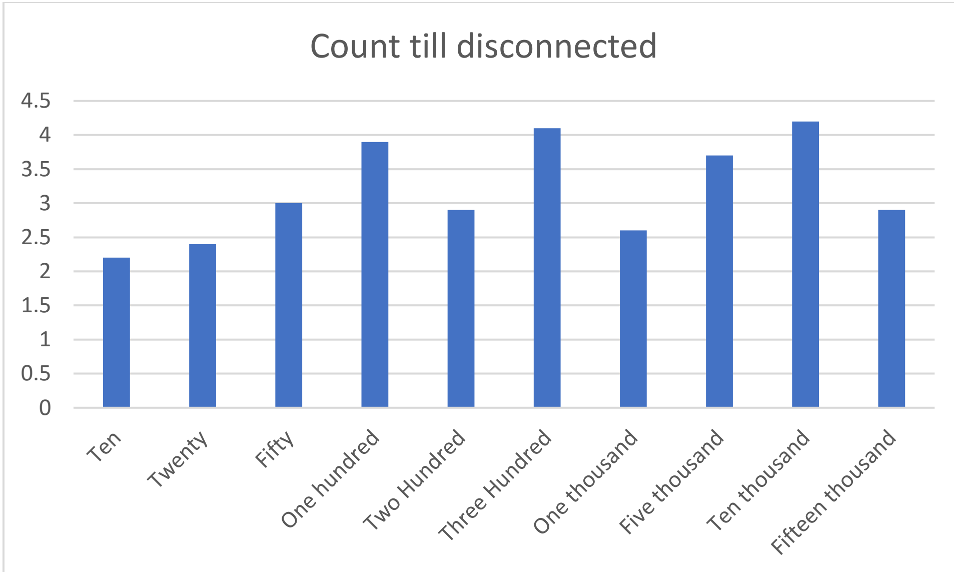
I believe my code is functioning correctly. I receive almost uniformly distributed numbers for the resilience of the graph to becoming disconnected even as the number of nodes increases. When I check the graph and the nodes that are deleted to see if the graph becomes disconnected myself at smaller numbers, the answer is correct. My remove node function and bfs function work correctly. I have tested them extensively.

Here is an example to prove the code works correctly. This can be replicated and checked. It prints the graph structure, node deleted and how many deletions till it is disconnected.





To create this histogram, I ran my code 10 times for each number of nodes and took the average number of deletions till it was disconnected in Excel. Here are the results. The results indicate the resiliency of the network is uniformly distributed around 2.5 node deletions.



A real-world example of a scale free network is the modern-day airport system. Nodes are represented by airports and edges between nodes are the flights. In this graph, there are hub nodes like the Atlanta airport with connections to hundreds of other airports, and there are smaller local airport nodes which can only fly to maybe one or two larger airport nodes. It the network is resilient to become disconnected by the deletion of random nodes. However, there are instances where a disconnected network could occur from airport node deletion. For example, to get deep into the amazon jungle often times you'd have to fly on multiple planes that only makes one trip to one destination further in the jungle. If one of the airport nodes was deleted on the journey to destination airport node, the network would become disconnected. An analysis of the graph would reveal which locations someone is able to reach by flying.