

MP6 Dijkstra's Algorithm Performance Evaluation  
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ECE 2230, Fall 2020

[1] Computational Complexity Verification for Dijkstra's Algorithm

> Strongly connected graph, Operation 1

./lab6 -g 3 -h 1 -n 11000 -s 0 -d 10999      Time to run: 1018.05ms

./lab6 -g 3 -h 1 -n 5500 -s 0 -d 5499      Time to run: 254.606ms

For a graph with  $N = 11000$  vertices, the program ran in about 1 second. For a graph with  $N/2$  vertices (5500) it ran in about  $\frac{1}{4}$  of the time.  $\frac{1018}{254} \cong 4$ ,  $2^2 = 4$ , therefore this function performs at  $O(n^2)$ .

> Randomly connected graph, Operation 2

./lab6 -g 4 -a 20 -h 1 -n 9700 -s 0 -d 9699      Time to run: 1005.71ms

./lab6 -g 4 -a 20 -h 1 -n 4850 -s 0 -d 4849      Time to run: 249.448ms

For a randomly built graph with  $N = 9700$  vertices, the program ran in about 1 second, however, for  $N/2$  vertices (4850) it ran in about  $\frac{1}{4}$  of the time.  $\frac{1005}{249} \cong 4$ ,  $2^2 = 4$ , therefore this function performs at  $O(n^2)$  for a randomly built graph.

[2] Computational Complexity Verification for Network Diameter

./lab6 -g 4 -a 20 -h 2 -n 470 -s 0 -d 469      Time to run: 994.858ms

./lab6 -g 4 -a 20 -h 2 -n 235 -s 0 -d 234      Time to run: 127.875ms

For a randomly built graph with  $N = 470$  vertices, it took about 1 sec to find the network diameter.  $\frac{995}{128} \cong 8$ ,  $2^3 = 8$ , therefore this function performs at  $O(n^3)$  for a randomly built graph.

[3] Node Density for Random Graphs

Running the network diameter operation on a random graph with an average adjacency of 7 yielded a disconnected graph for 6 of the 10 different seeds. Running the same test with an adjacency of 20 yielded no disconnected graphs.

[4] Multiple Link-disjoint paths

This test was ran on two different graph types. For graph type 3 (strongly connected) the number of paths found was always 1 less than the number of vertices. For the Random graph, it produced a number of paths roughly half than the number of vertices, however it changed slightly with a new seed.

Seed 1:

R = 10, Paths = 7

R = 20, Paths = 9

R = 50, Paths = 21

R = 100, Paths = 49

Seed 2:

R = 10, Paths = 4

R = 20, Paths = 9

R = 50, Paths = 23  
R = 100, Paths = 54