CS/SE 2XB3 Lab 7 Report
Enrolled in CSL02

Wang, Mingzhe
400316660
wangm235@mcmaster.ca

Li, Xing
400292346
li64@mcmaster.ca

Moon, Hyosik
400295620
moonh8@mcmaster.ca

March 12, 2021

Contents

1 Basic Graph Algorithms

We implemented all relevant codes in `graphs.py` file.

2 Cycles and Connected Probability

2.1 Cycle test

To randomly construct graphs with k nodes and c edges, we treat each edge as the combination of two different nodes, then use `random.sample` function to choose c edges. The detail for this implementation can be found in `cons_random_graph` of `code.py`.

We designed the cycle test by increasing the number of edges from 1 to 400 for graphs with 100 nodes. For each number of edges c, we randomly generate 200 graphs, then calculated the portion of graphs which have a cycle vs c.

The observation is listed below:

- The test result (Figure 1) shows that the portion of graphs which have a cycle increases as the edge number c increases, and when the edge number c is around 80, the portion almost converges to 1.
- In addition, the average value of c which roughly half the graphs to contain a cycle is 55.0, with the accepted value for "half" is set as $(0.45, 0.55)$.

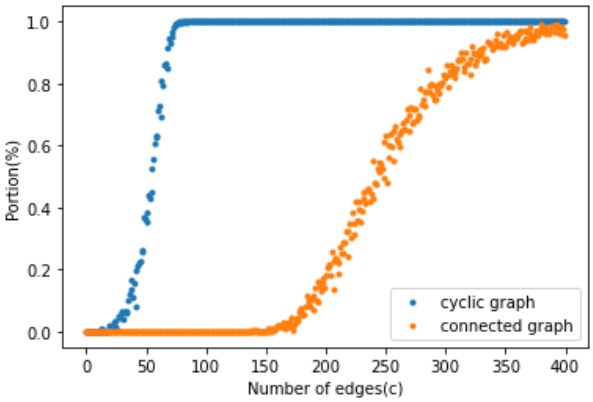

Figure 1: Cycles and Connected Probability test

2.2 Connection test

Following the same process, we also provide the connection test result in Figure 1.

The observation is listed below:

- The portion of graphs which are connected increases as the edge number c increases, and when the edge number c is around 400, the portion almost converges to 1, (around 0.96).
- In addition, the average value of c which roughly half the graphs to be connected is 242.75, with the accepted value for "half" is set as $(0.45, 0.55)$.

2.3 Why portion of connected graph is less than that of cyclic graph

The portion of connected graphs needs a higher number of edges to reach the same portion of cyclic graphs. Because in the case of cycle, it requires at least (k-1) edges for a graph with k nodes to be connected; while in the case of cycle, a graph with k nodes can easily be cyclic even with only 3 edges. (Assume $k \geq 3$.) That's the reason that the portion of cyclic graphs starts to rise at about 3 and the portion of connected graph rises only after 150.

References