

1 Question 1

1. the Erdos-Renyi model takes
 - (a) n , the number of nodes in the graph
 - (b) p , the probability that two nodes in the graph have an edge between them
2. the Watts and Strogatz model takes
 - (a) n , the number of nodes in the graph
 - (b) c , an even number. Each node is connected by edges to the c nodes nearest to it
 - (c) p , the probability that we remove an edge and replace it with one that joins two nodes chosen uniformly at random from the network
3. the configuration model takes
 - (a) k , the degree sequence such that for each node i , k_i is the degree of that node
4. the Barabasi-Albert preferential attachment model takes
 - (a) n , the number of nodes in the graph
 - (b) c , the number of connections made by each node added in each step

2 Question 2

1. the Erdos-Renyi model

(a) Karate Club Dataset

- $n = 34$
- $p = 0.14$

(b) Prison Dataset

- $n = 67$
- $p = 0.08$

(c) Dolphins Dataset

- $n = 62$
- $p = 0.08$

2. the Watts and Strogatz model

(a) Karate Club Dataset

- $n = 34$
- $c = 7$
- $p = 0.25$

(b) Prison Dataset

- $n = 67$
- $c = 20$
- $p = 0.25$

(c) Dolphins Dataset

- $n = 62$
- $c = 12$
- $p = 0.25$

3. the configuration model

(a) Karate Club Dataset

- $k = [17, 16, 12, 10, 9, 6, 6, 5, 5, 5, 4, 4, 4, 4, 4, 4, 3, 3, 3, 3, 3, 3, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 1]$

(b) Prison Dataset

- $k = [13, 12, 11, 11, 11, 10, 10, 9, 8, 8, 8, 8, 8, 8, 7, 7, 7, 7, 7, 7, 6, 6, 6, 6, 6, 6, 6, 5, 5, 5, 5, 5, 5, 5, 5, 5, 5, 5, 5, 4, 4, 4, 4, 4, 4, 4, 4, 4, 4, 3, 3, 3, 3, 3, 3, 3, 3, 3, 2, 2, 2, 2, 2, 2, 1, 1]$

(c) Dolphins Dataset

- $k = [12, 11, 11, 10, 10, 9, 9, 9, 9, 8, 8, 8, 8, 7, 7, 7, 7, 7, 7, 7, 6, 6, 6, 6, 6, 6, 6, 5, 5, 5, 5, 5, 5, 5, 5, 4, 4, 4, 4, 4, 3, 3, 3, 3, 3, 3, 2, 2, 2, 2, 2, 2, 1, 1, 1, 1, 1, 1, 1, 1, 1]$

4. the Barabasi-Albert preferential attachment model

(a) Karate Club Dataset

- $n = 34$
- $c = 3$

(b) Prison Dataset

- $n = 67$
- $c = 5$

(c) Dolphins Dataset

- $n = 62$
- $c = 4$

3 Question 3

See appendix.

4 Question 4

1. The configuration model works best for Karate Club dataset. It's because the karate club dataset is a small one with only 34 nodes, therefore, once we have the degree sequence the outcome tends to be similar to the real world dataset.
2. The arabasi-Albert preferential attachment model works best for prison dataset. It's because the new prisoner is often added to prison one by one. And this way of adding prisoner is like the way arabasi-Albert preferential attachment model uses to construct a graph.
3. The Watts–Strogatz model works best for dolphins dataset. It's because the dolphins dataset is a social network in which two dolphins that are communicated with a dolphin are more likely to communicate with each other. Such pattern is best described by the Watts–Strogatz small-world model.

Erdos-Renyi model

Metrics

1. Karate Club

Average Diameter is 4.6

Average Clustering coefficient is 0.12326500297088536

Average Number of connected components is 1.0

2. Prison

Average Diameter is 5.2

Average Clustering coefficient is 0.08715610260386378

Average Number of connected components is 1.0

3. Dolphin

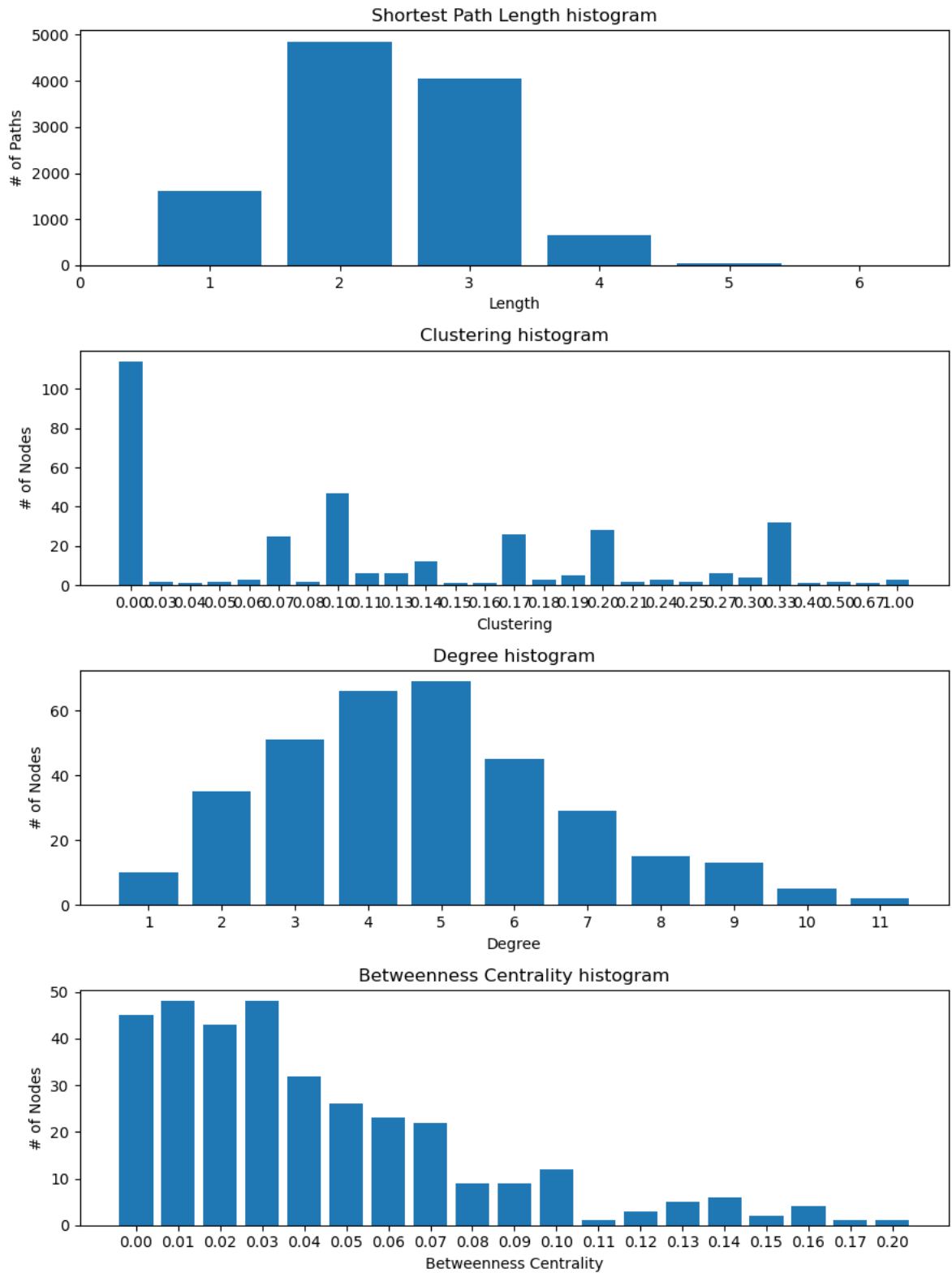
Average Diameter is 5.0

Average Clustering coefficient is 0.07748185479528763

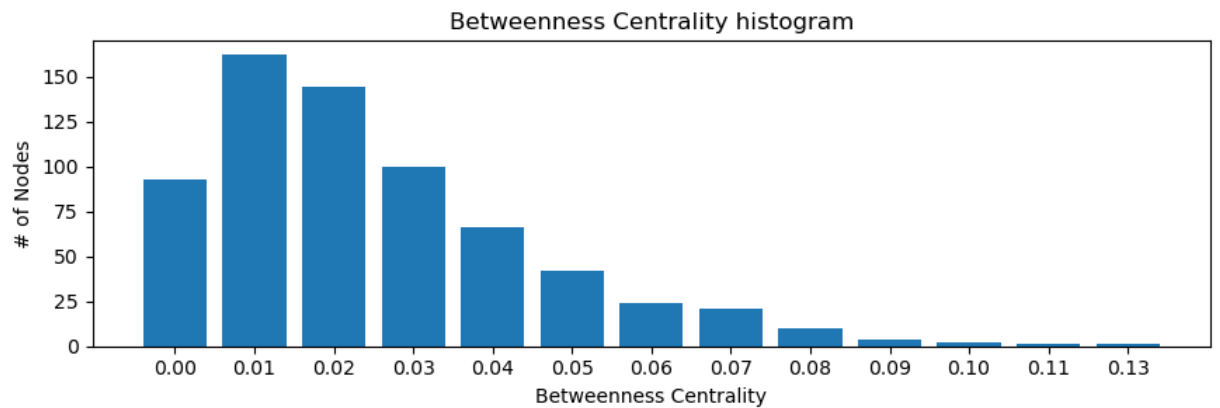
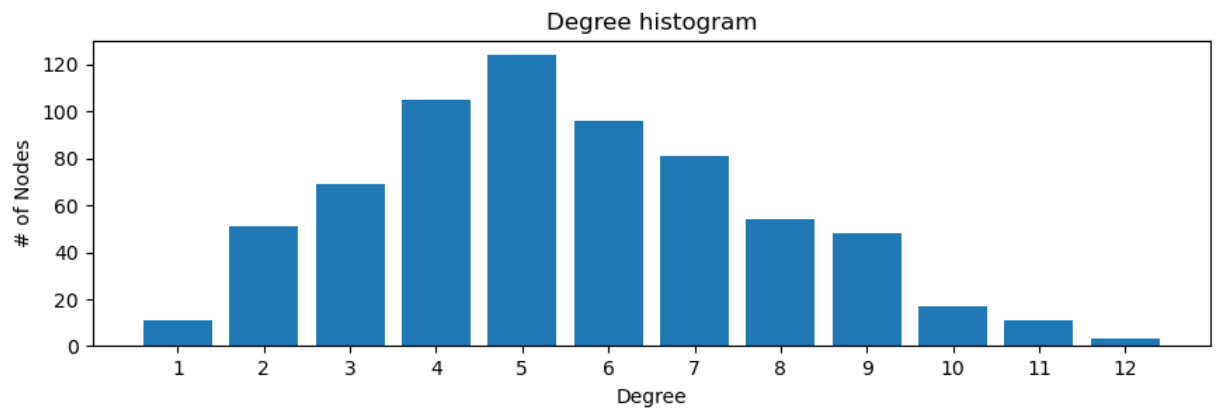
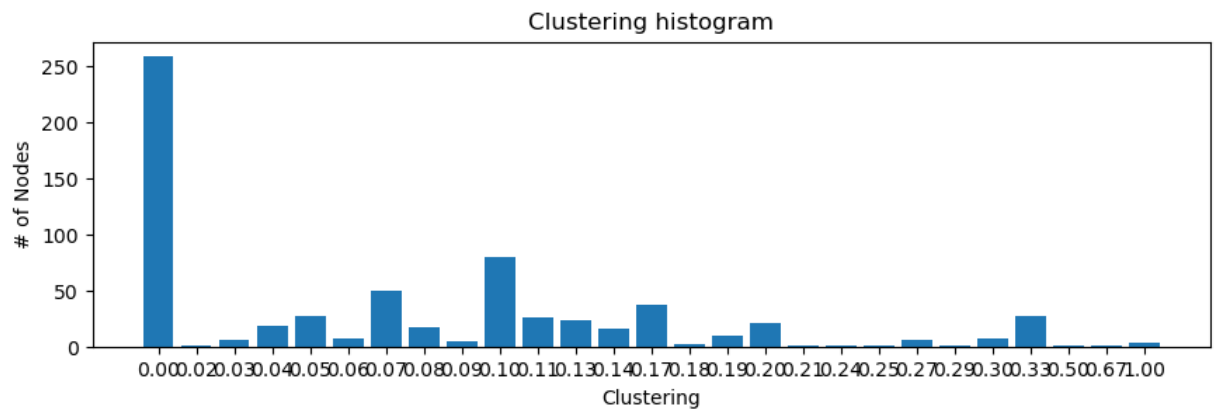
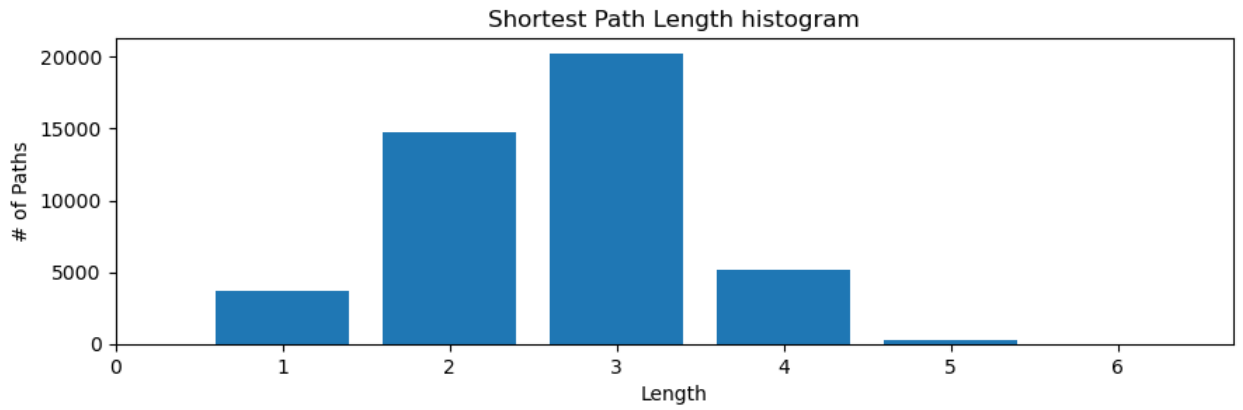
Average Number of connected components is 1.0

Histogram

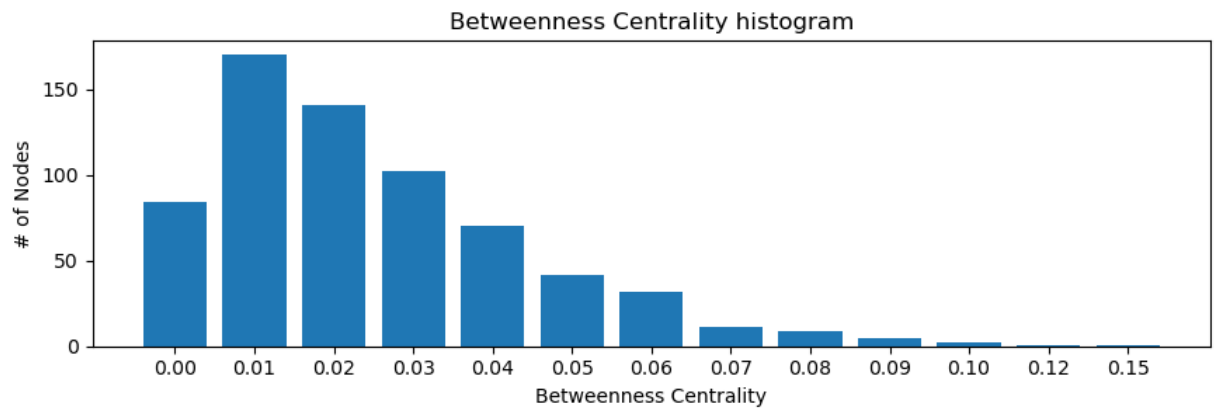
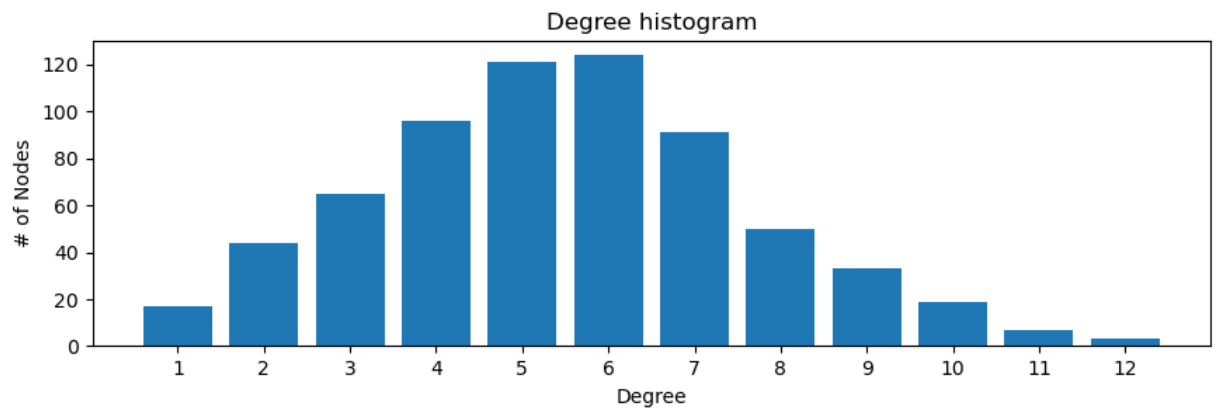
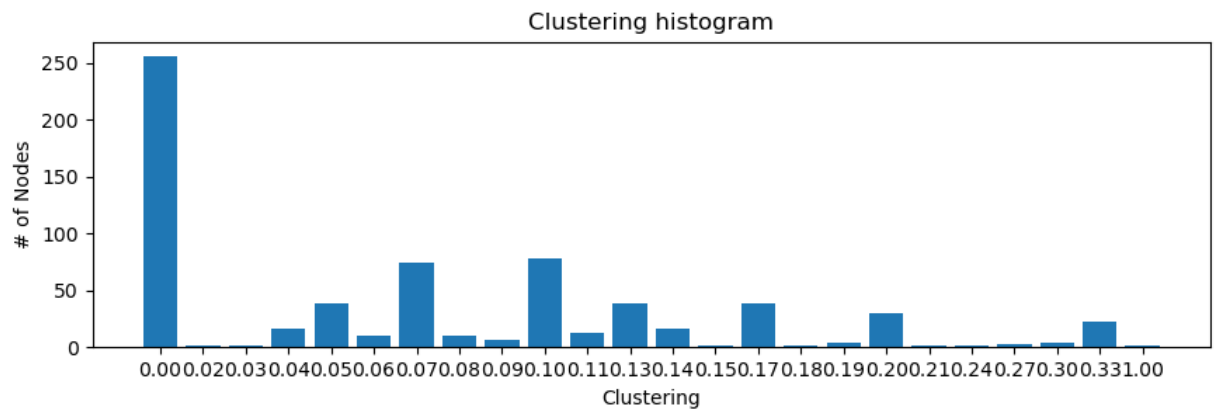
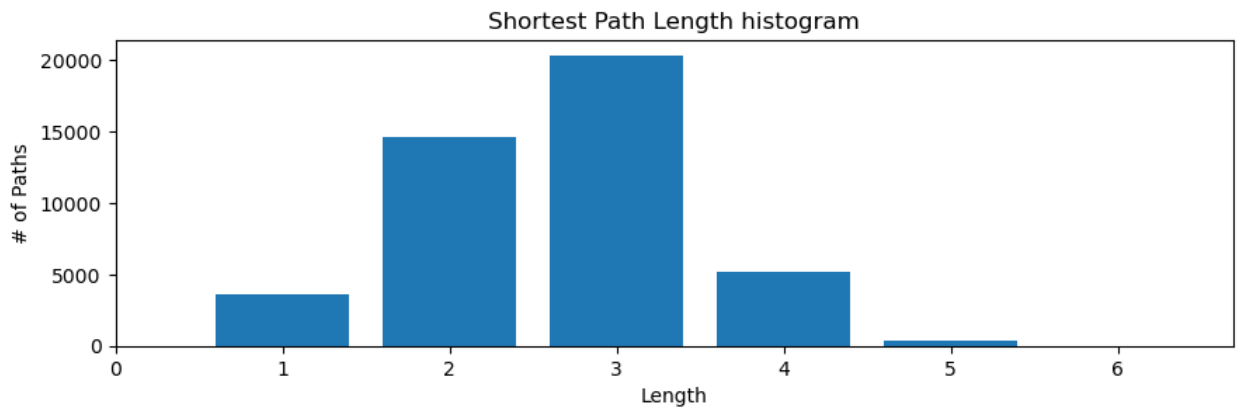
1. Karate Club



2. Prison



3. Dolphin



Watts and Strogatz model model

Metrics

- **Karate Club**

Average Diameter is 4.8

Average Clustering coefficient is 0.13153361344537814

Average Number of connected components is 1.0

- **Prison**

Average Diameter is 5.8

Average Clustering coefficient is 0.06834399431414358

Average Number of connected components is 1.0

- **Dolphin**

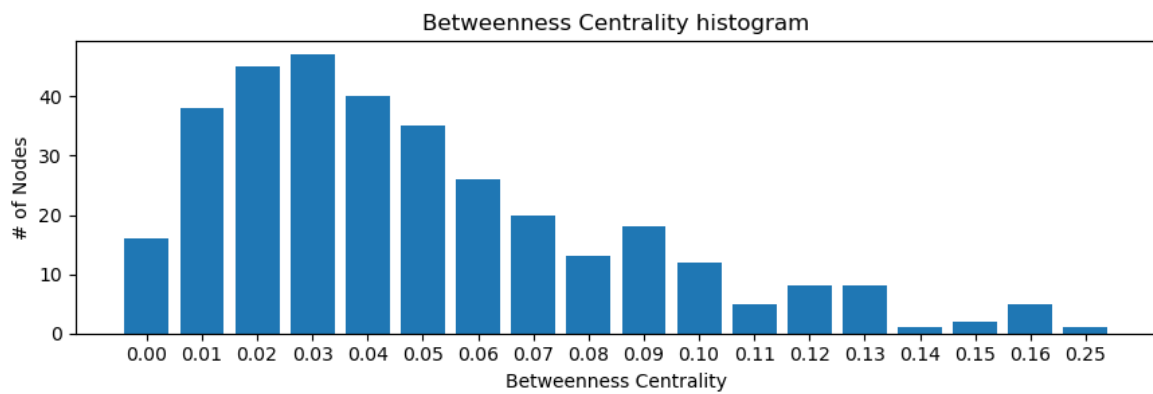
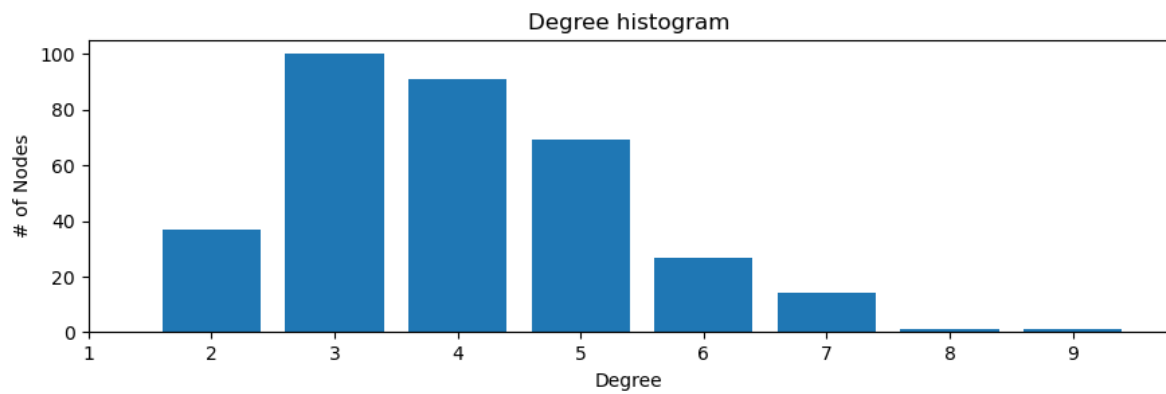
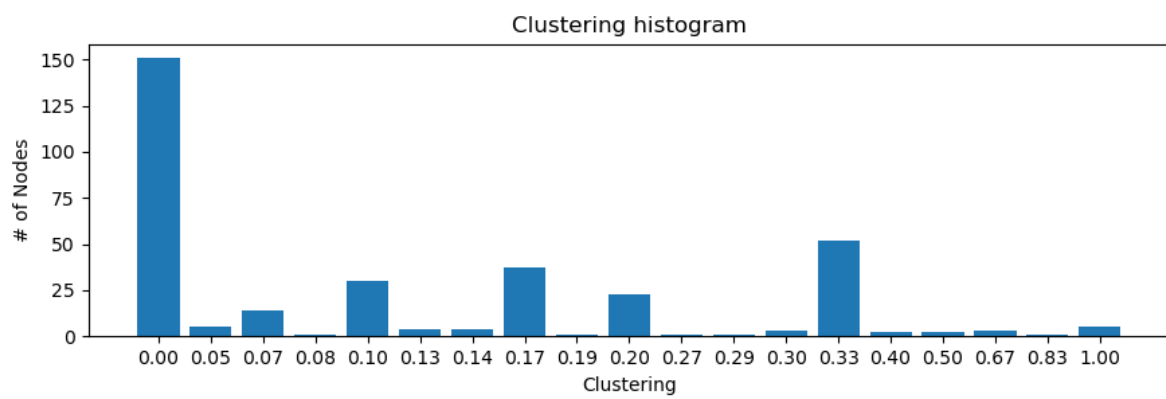
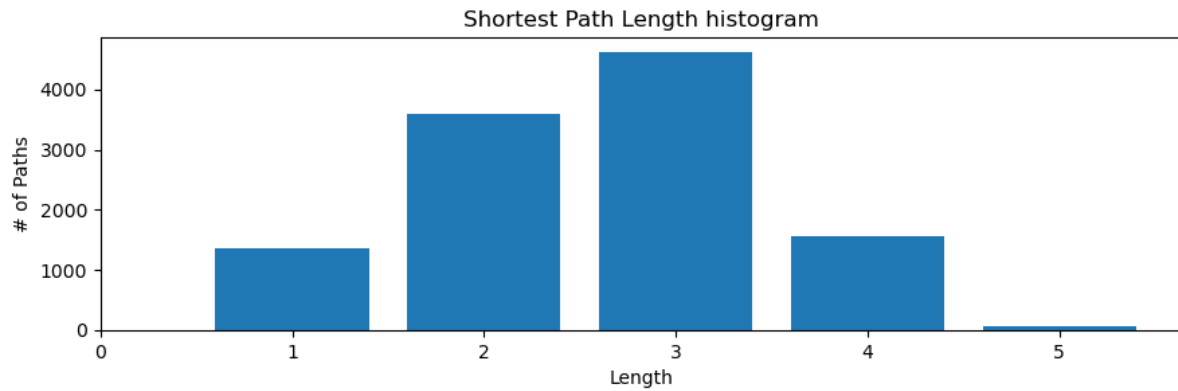
Average Diameter is 5.7

Average Clustering coefficient is 0.06694316436251921

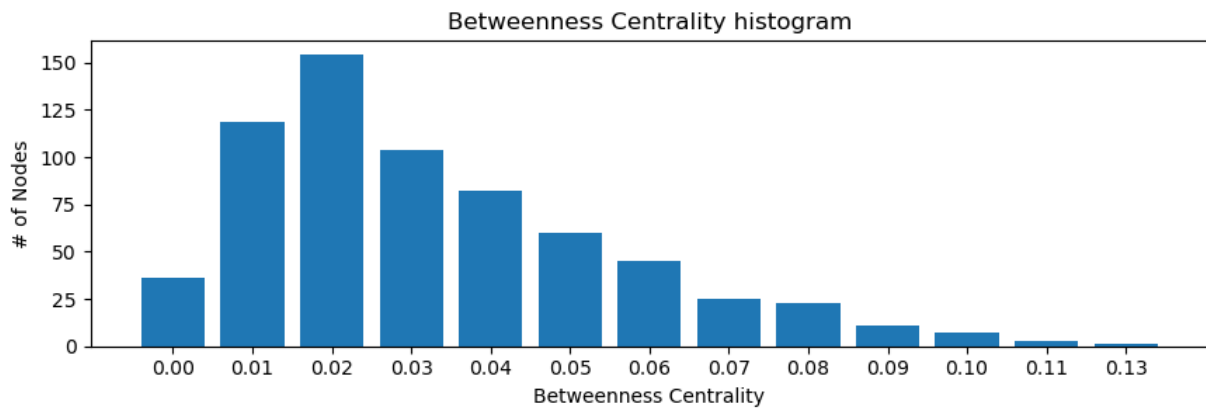
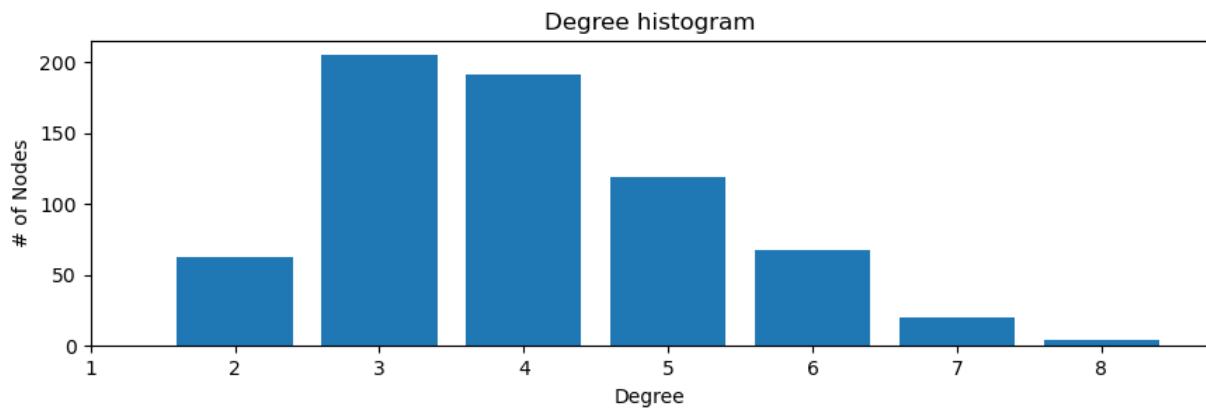
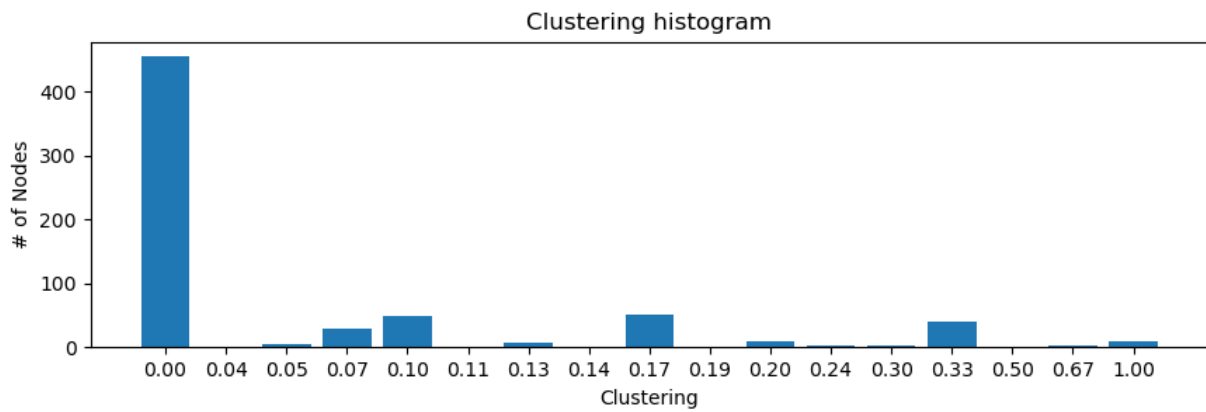
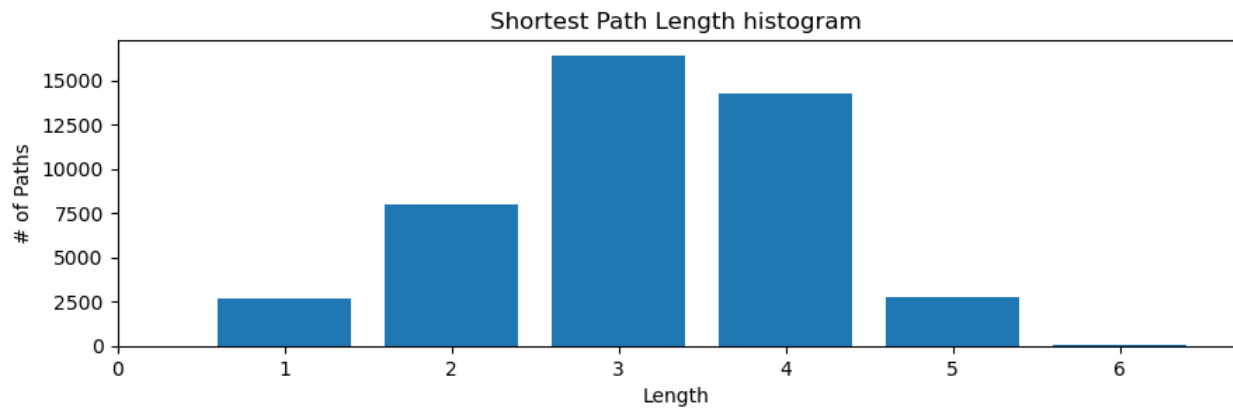
Average Number of connected components is 1.0

Histogram

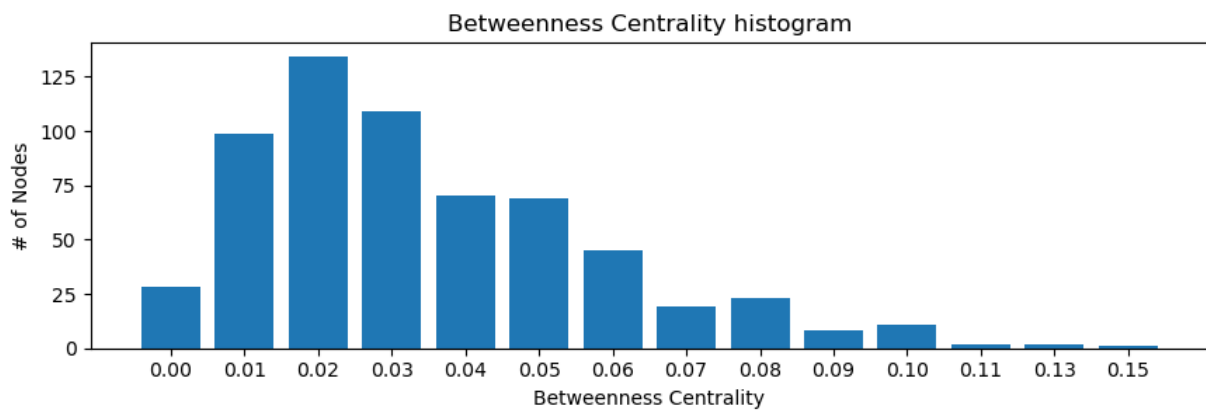
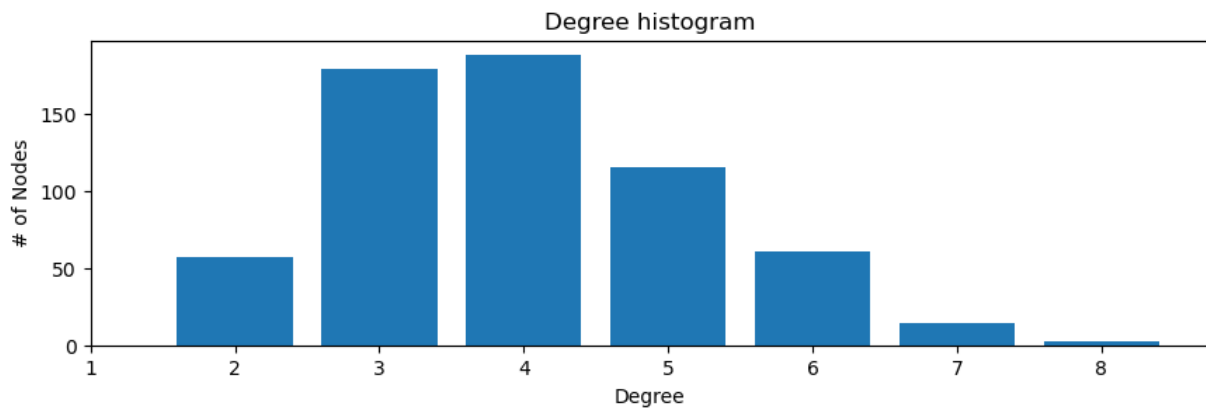
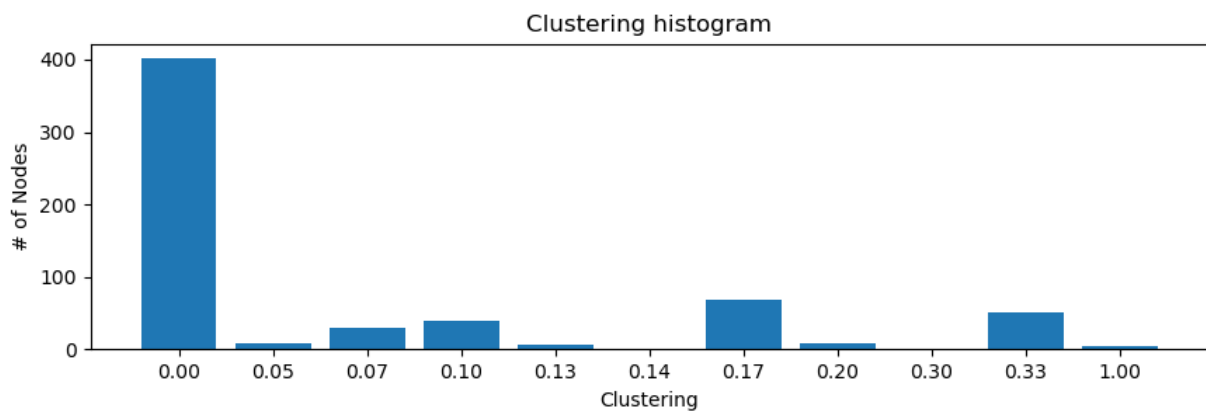
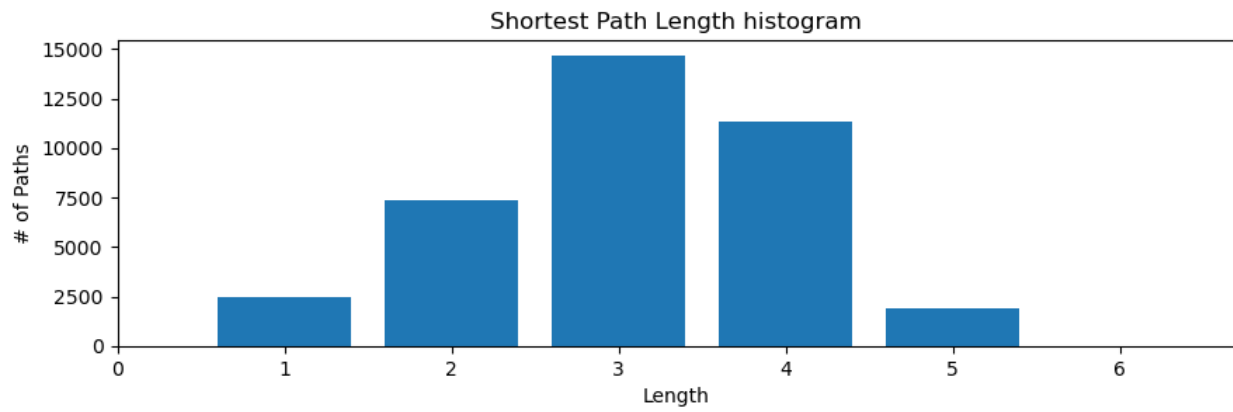
- Karate Club



- Prison



- Dolphin



Configuration model

Metrics

- **Karate Club**

Average Diameter is 5.1

Average Clustering coefficient is 0.17444601150483502

Average Number of connected components is 1.0

- **Prison**

Average Diameter is 5.5

Average Clustering coefficient is 0.0738600205764385

Average Number of connected components is 1.0

- **Dolphin**

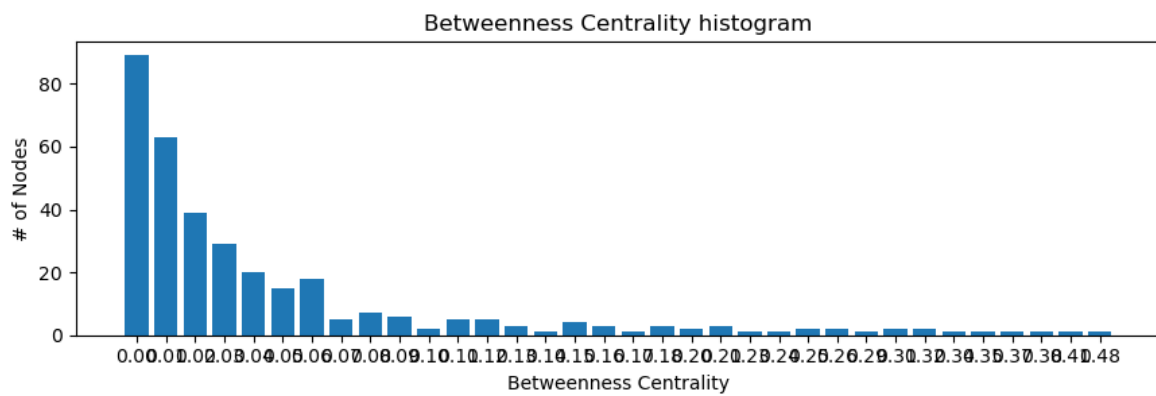
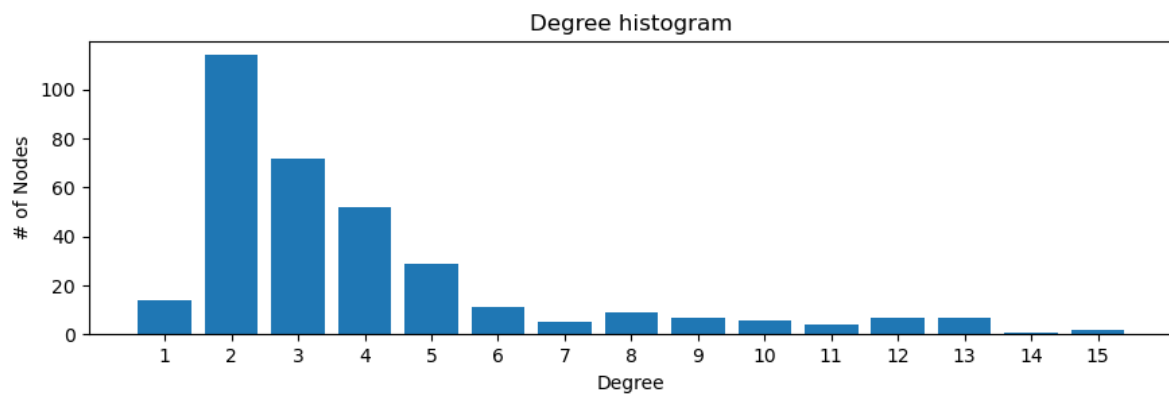
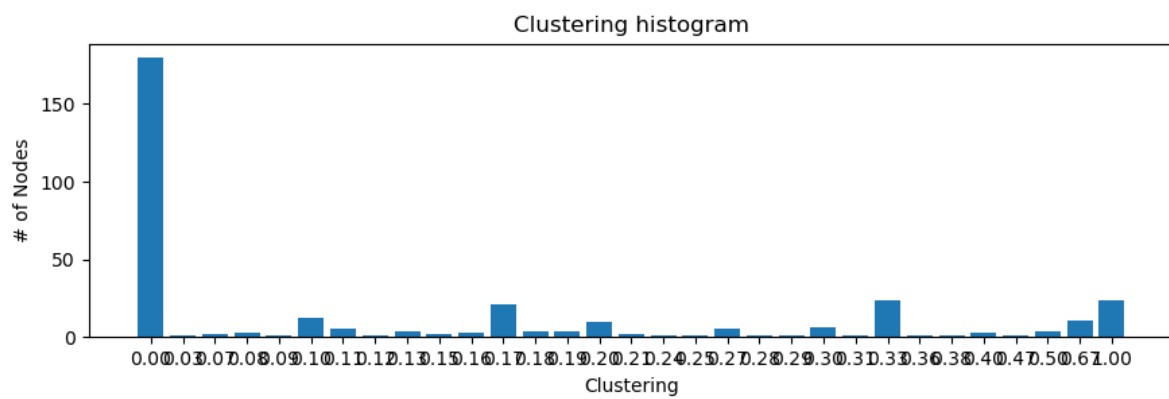
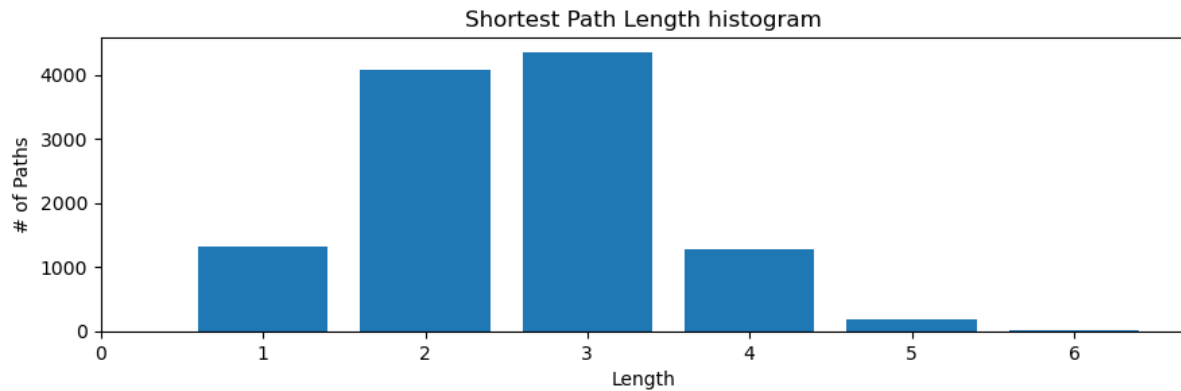
Average Diameter is 5.8

Average Clustering coefficient is 0.08403668016571242

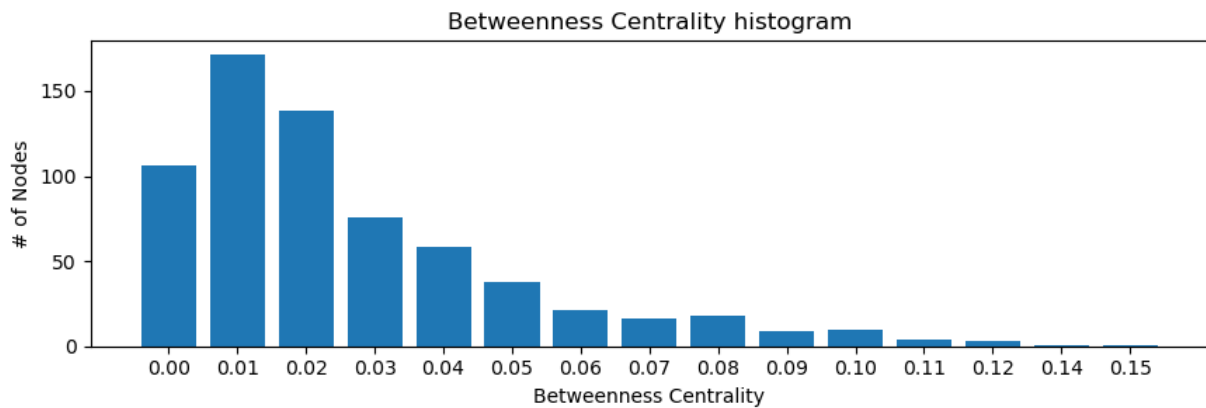
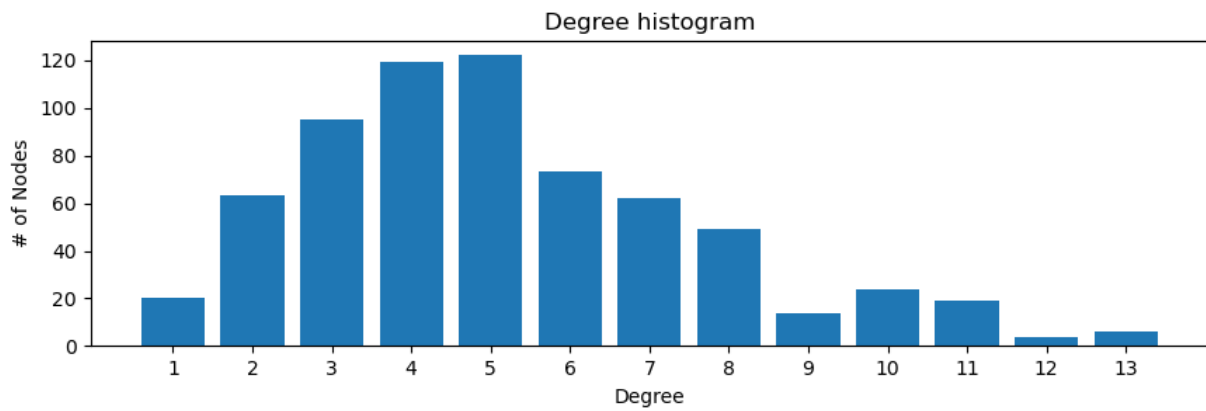
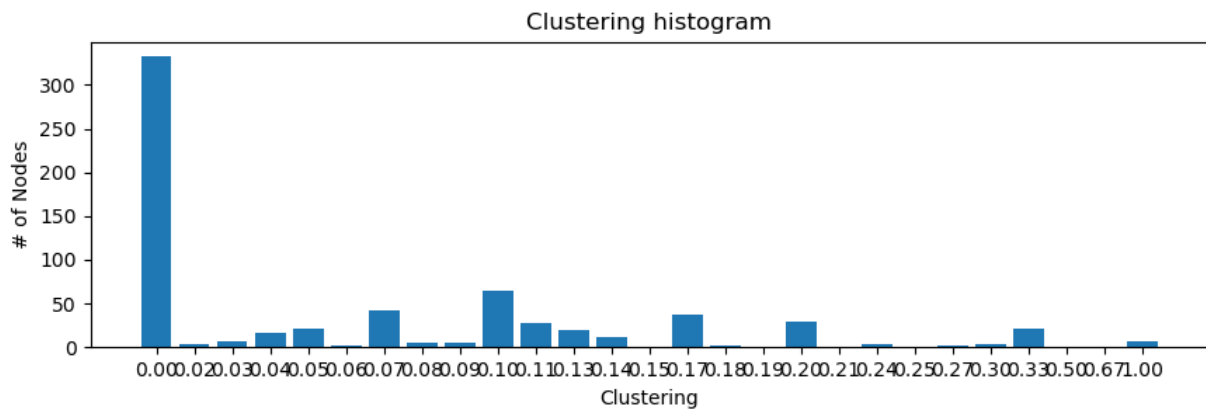
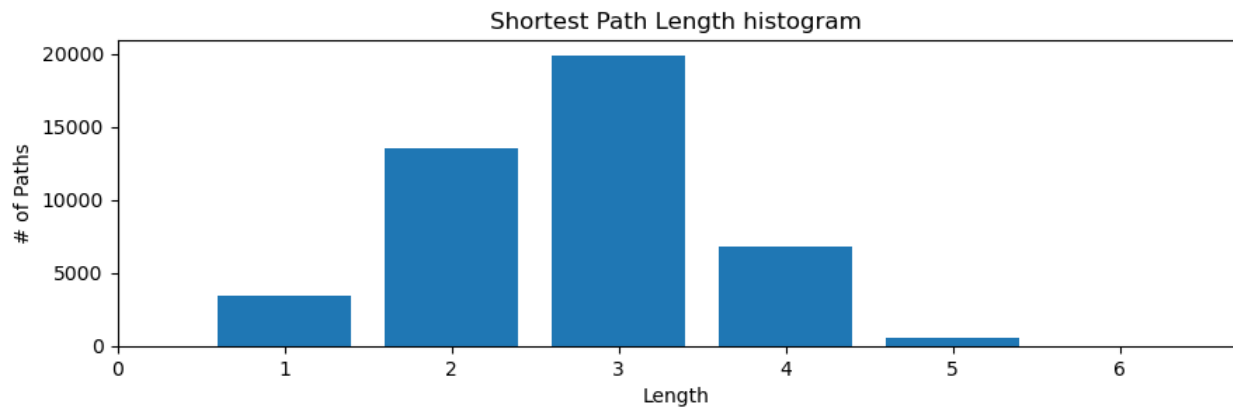
Average Number of connected components is 1.1

Histogram

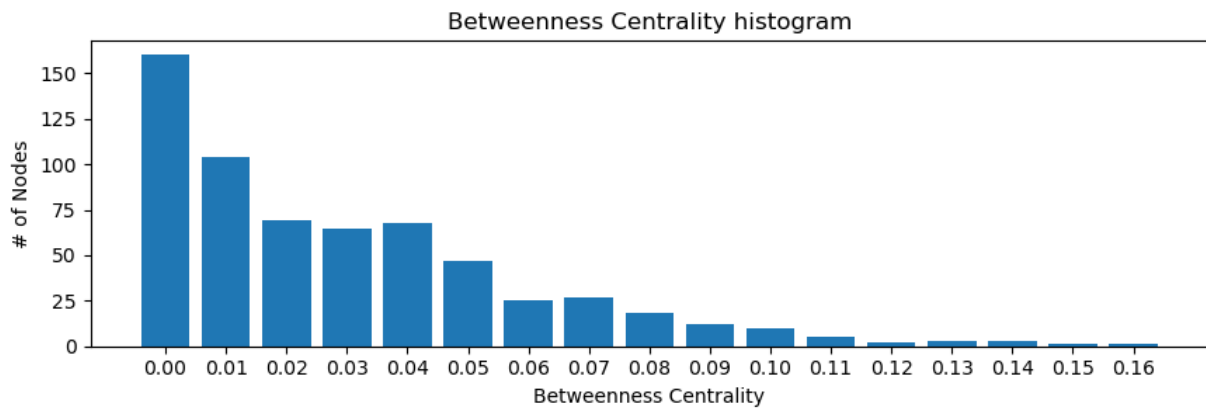
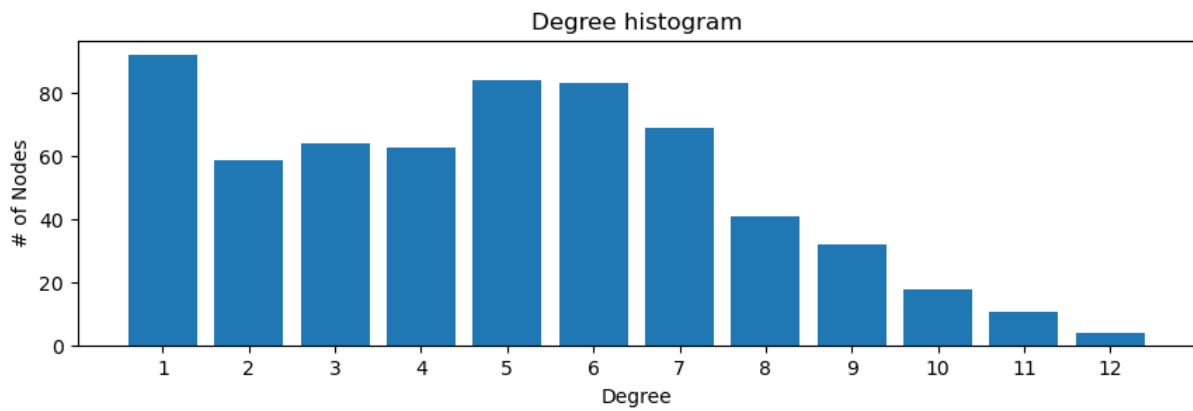
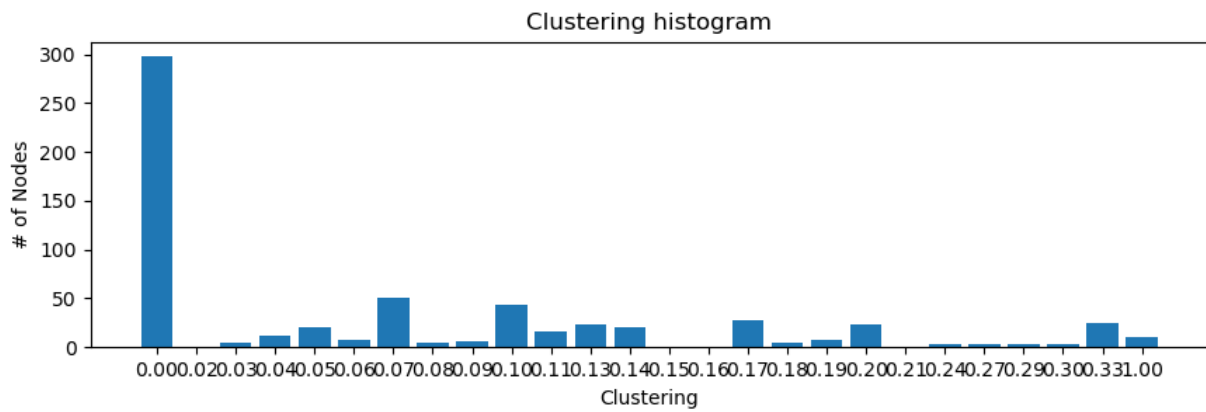
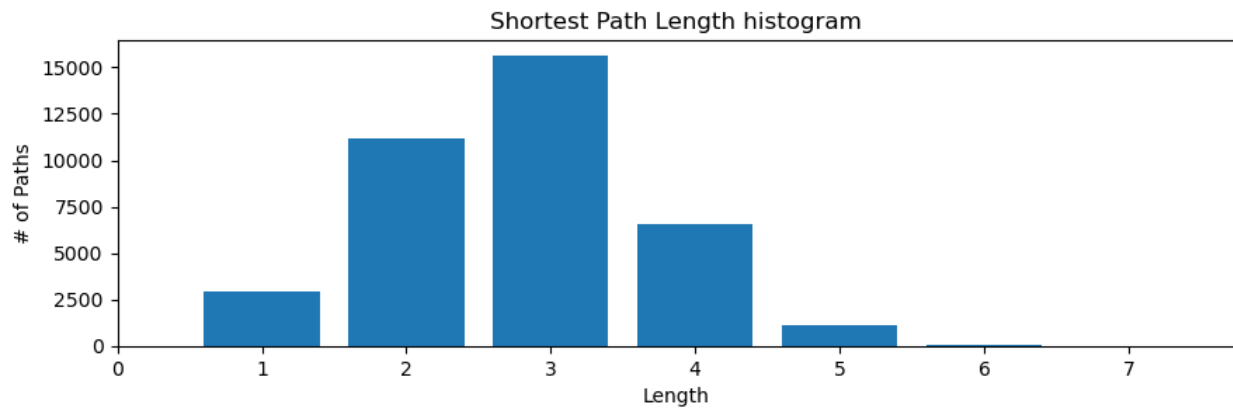
- Karate Club



- Prison



- Dolphin



Barabasi-Albert preferential attachment model

Metrics

- **Karate Club**

Average Diameter is 3.9

Average Clustering coefficient is 0.28815354597748516

Average Number of connected components is 1.0

- **Prison**

Average Diameter is 3.3

Average Clustering coefficient is 0.24784004206727622

Average Number of connected components is 1.0

- **Dolphin**

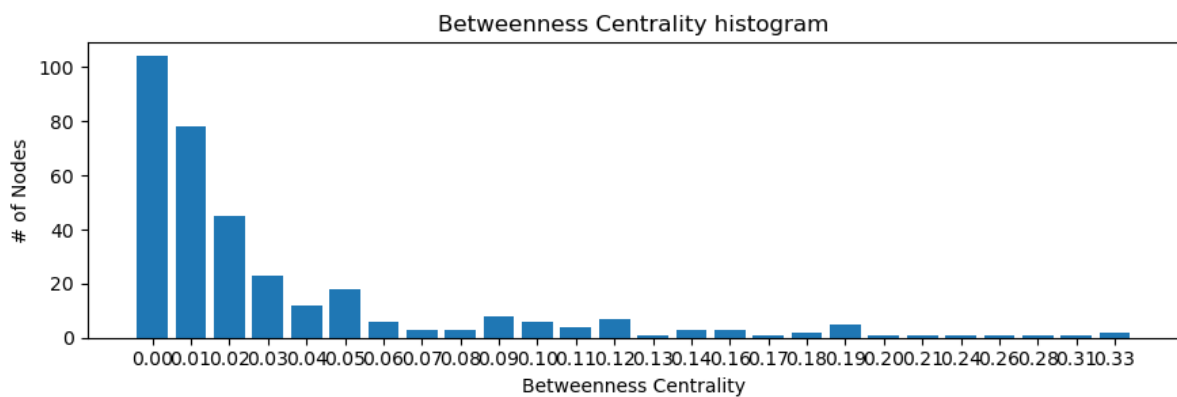
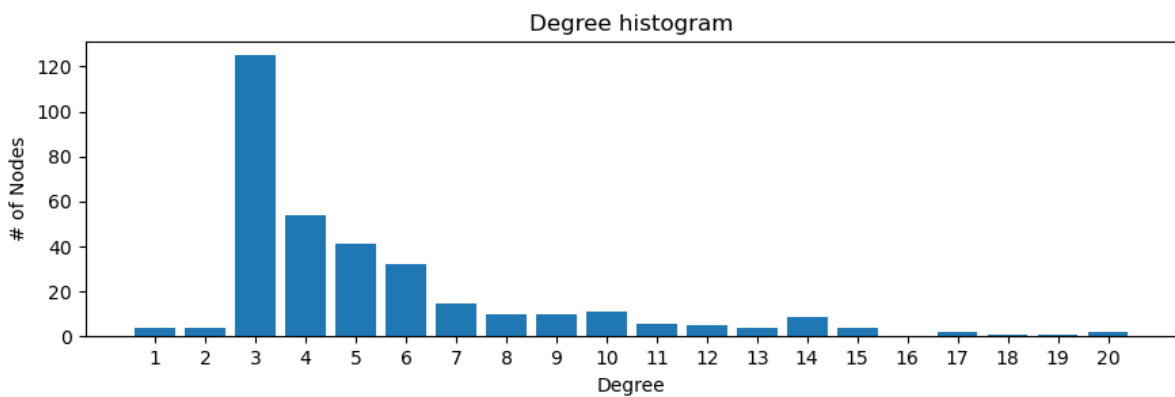
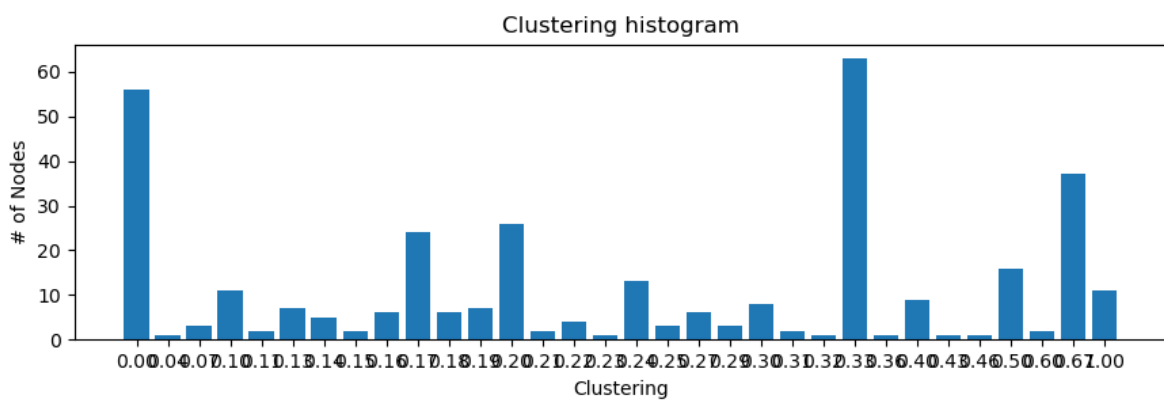
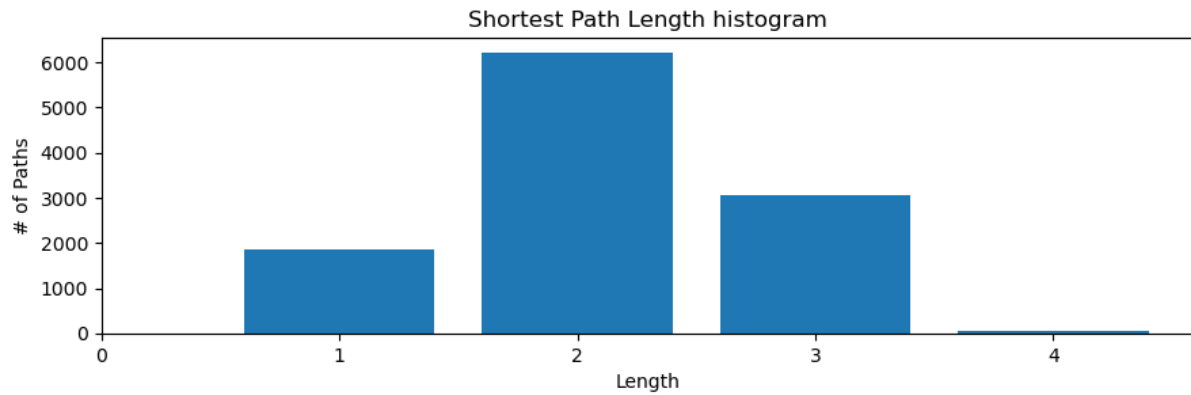
Average Diameter is 4.0

Average Clustering coefficient is 0.2289561279016795

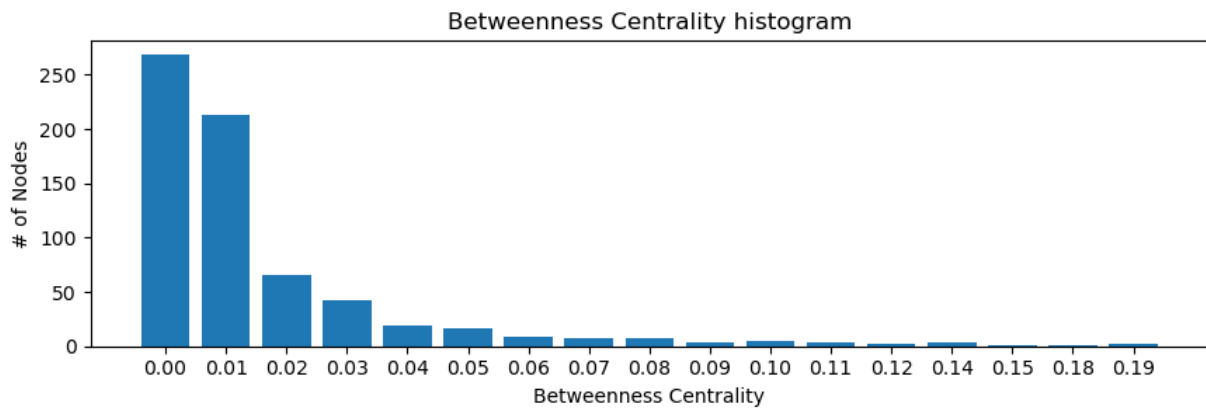
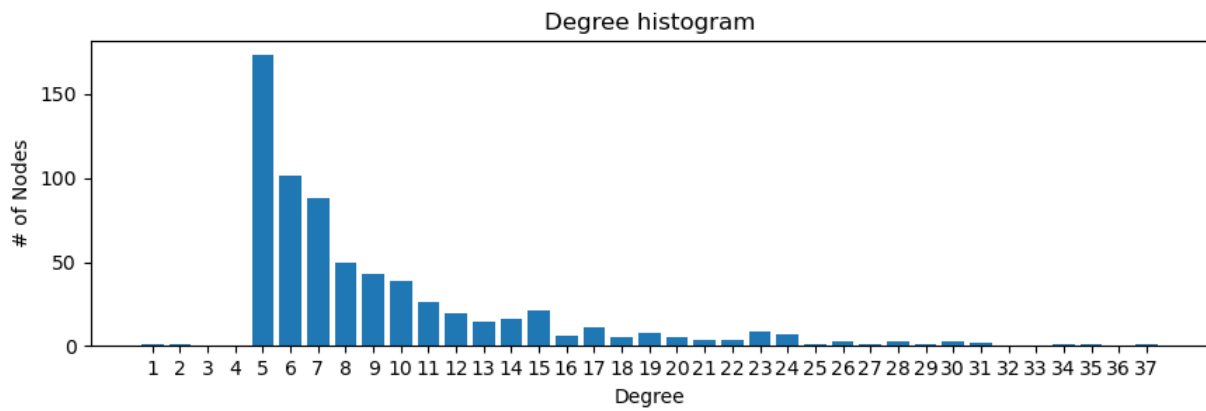
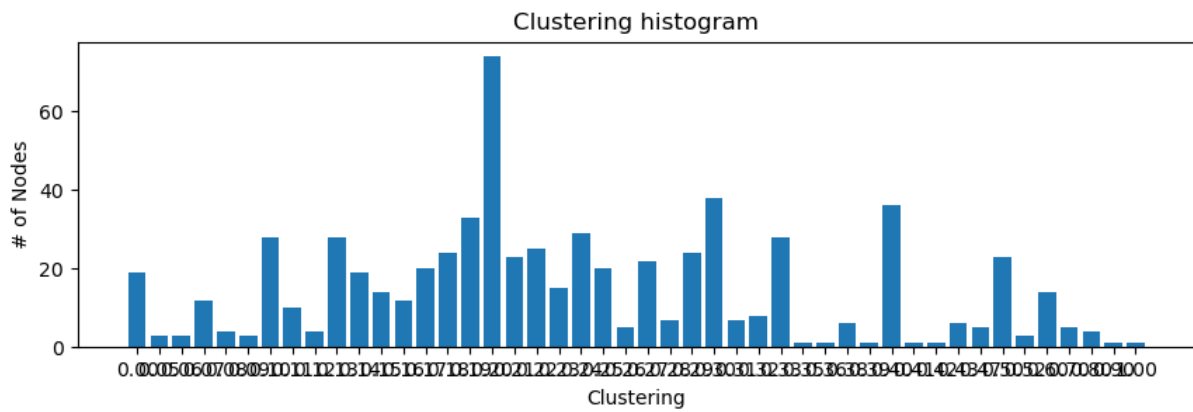
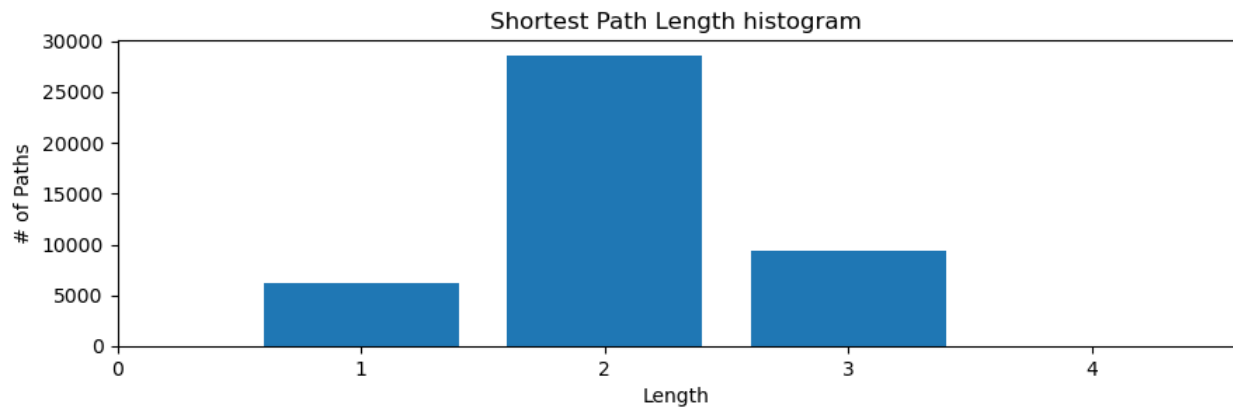
Average Number of connected components is 1.0

Histogram

- Karate Club



- Prison



- Dolphins

