COMP0123: Complex Networks and Webs Coursework 1 Report

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Task 1 - (15 marks)

1.1 Details

- Calculate the average node degree and the maximum node degree of the 3 networks.
- Plot their degree distribution $P(k)$ on linear-linear scale and log-log scale, respectively.
- Estimate the power-law exponent of the degree distribution $P(k)$ of the author network only.
  - You can fit a curve by using the function polyfit from the numpy library.
  - Ideally, you can do the fitting on CCDF (the complementary cumulative distribution function) on log-log scale.
- Briefly discuss your results, e.g. difference of the networks.

1.2 Results

Task 2 - (15 marks)

2.1 Details

- Calculate and plot the nearest neighbour's average degree k_{nn} as a function of degree k, on log-log scale.
- Calculate the assotative coefficient of the networks.
- Briefly discuss your results

2.2 Results

Task 3 - (15 marks)

3.1 Details

- Calculate the diameter and the average shortest path length of the network

- Calculate and plot the average node between of k-degree nodes as a function of node degree k, where node betweenness is normalised, on log-log scale.
- Briefly discuss your results.

3.2 Results

Task 4 - (15 marks)

4.1 Details

- Calculate and plot the rich-club coefficient as a function of node rank on log-log scale
- Calculate and plot the rich-club coefficient as a function of node degree on log-log scale
- Briefly discuss your result

4.2 Results

Task 5 - (15 marks)

5.1 Details

- Obtain the community structure (with the largest modularity value) of the 3 networks
- Give the number of communities and the size (i.e. number of nodes) of the top 3 largest communities in each netwoork.
- Visualise the network and show each community with a different colour.
- Briefly discuss your result

5.2 Results

Task 6

6.1 Details

- Randomly rewire the 3 networks while preserving the degree distribution; and obtain the maximal random case of each network
- For the 3 randomised networks, plot their degree distribution
- Calculate the average clustering coefficient, the assortative coefficient, and the average shortest path length of the 3 networks and the 3 randomised networks; show and compare the results in a table
- Briefly discuss you result.

6.2 Results

References