[INFO-F409] Learning Dynamics
Second assignment

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Contents

1 Part I: Complex networks

1.1 1 - Erdos-Renye network

1.1.1 Q1 statement

Generate Erdos-Renye network (Random networks) [1,2]. Generate the network from scratch and present/describe the part of the code you used to generate the network in your document.

Algorithm / Pseudo-code

1.1.2 Q2 statement

Plot the degree distribution of the generated network. Calculate the mean and standard deviation and plot the normal distribution with these same parameters

Degree distribution

Mean and standard deviation

1.2 2 - Barabasi-Albert network

1.2.1 Q3 statement

Generate a Barabasi-Albert network (Scale Free network) [1,3]. Generate the network from scratch and present/describe the part of the code you used to generate the network in your document.

Algorithm / Pseudo-code

1.2.2 Q4 statement

Plot the degree distribution of the generated network using a linear scale on both axes. Plot in the same figure an exponential distribution which looks similar and reports on the parameters of that distribution.

Degree distribution result (linear scale)

Exponential distribution

1.2.3 Q5 statement

Plot the same distribution on log-log scale. Fit the distribution using Least Square fit. You can use existing functions for fitting and plot the fit next to the data. What are the parameters of the fit? How does it fit? Why? Write a paragraph about why we should not use Least Square fit to fit power laws.

Distribution on log-log scale

Fitting using Least Square Fit

1.2.4 Q6 statement

Plot cumulative distribution and fit it with Least Square Fit, report the obtained parameters and plot of the fitted function.

Plotting result and parameters

1.2.5 Q7 statement

Now fit your distribution using maximum likelihood method. You can use any of the packages which has the method developed.

1.2.6 Q8 statement

Report the parameters of the fit and plot them next to distribution.

1.2.7 Q9 statement

Compare the power law fit with the exponential fit (using the same package). Report the log likelihood ratio R and the p-value. What do these numbers mean?

1.2.8 Q10 statement

What is the mathematical formula for scale free distribution you generated? Calculate the mean and the standard deviation of function? What would be the mean and standard deviation if the exponent would be 2.5?