

Heidelberg University
Institute of Computer Science
Database Systems Research Group

Lecture: Complex Network Analysis

Prof. Dr. Michael Gertz

Assignment 4
Scale-Free Networks

https://github.com/nilskre/CNA_assignments

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1 Problem 4-1 Power laws

Consider the degree distribution functions p_k of the following two undirected networks:

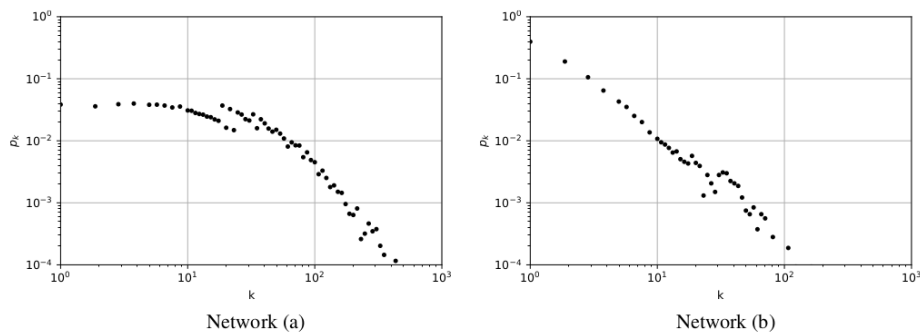


Figure 1: A simple graph with 4 connected triples.

1. One of these networks is approximately scale-free, the other is not. Identify the scale-free network and explain how you came to your conclusion.

Network b is is scale free. The figure 1 shows the log-log plots of the degree distribution of the two networks a and b. For scale-free networks the degree distribution forms a straight line across the diagonal. This is given for network b.

2. A particular network is believed to have a degree distribution that follows a power law. A random sample of nodes is taken and their degrees are measured. The degrees of the first twenty nodes with degrees 10 or greater are:

16 17 10 26 13 14 28 45 10 12 12 10 136 16 25 36 12 14 22 10

For $K_{min} = 10$, estimate the exponent γ of the power law using the estimation method presented in the lecture. Hint: you only have to estimate the exponent (see Slide 4-33)! Calculate the error σ of your estimation using the equation $\sigma = \frac{\gamma-1}{\sqrt{N}}$