

# Tuning degree distributions of scale-free networks

C.C. Leary<sup>1,2</sup>, M. Schwehm<sup>\*1</sup>, M. Eichner<sup>1</sup>, H.P. Duerr<sup>1</sup>

<sup>1</sup> Department of Medical Biometry, University of Tübingen, Westbahnhofstraße 55, 72070 Tübingen, Germany

<sup>2</sup> Department of Mathematics, State University of New York at Geneseo, 1 College Circle, Geneseo, NY 14454, USA

\* Corresponding author: [schwehm@informatik.uni-tuebingen.de](mailto:schwehm@informatik.uni-tuebingen.de)

(Received 20 February 2006)

## ABSTRACT

Scale-free networks are characterized by a degree distribution with power-law behavior and have been shown to arise in many areas, ranging from the World Wide Web to transportation or social networks. Degree distributions of observed networks, however, often differ from the power-law type and data based investigations require modifications of the typical scale-free network.

We present an algorithm that generates networks in which the skewness of the degree distribution is tuneable by modifying the preferential attachment step of the Barabási-Albert construction algorithm. Skewness is linearly correlated with the maximal degree of the network and, therefore, adequately represents the influence of superspreaders or hubs. By combining our algorithm with work of Holme and Kim, we show how to generate networks with skewness  $\gamma$  and clustering coefficient  $\kappa$ , over a wide range of values.

Keywords: scale-free networks, degree distribution, clustering, superspreaders, hubs, simulation, skewness, beta distribution

PACS numbers: 89.75 Hc, 87.23 Ge, 89.65 -s