

Abstract Submitted
for the MAR10 Meeting of
The American Physical Society

Efficient sampling of graphs with arbitrary degree sequence¹

CHARO DEL GENIO, University of Houston, HYUNJU KIM, ZOLTÁN TOROCZKAI, University of Notre Dame, KEVIN BASSLER, University of Houston — Uniform sampling of graphs from a given degree sequence is a fundamental component of measurements on networks, with applications ranging from epidemics through social networks to Internet modeling. Existing graph sampling methods are ill-controlled, with typically unknown mixing times for edge-swap methods and uncontrolled rejections for stub-matching ones. We propose an efficient, polynomial time algorithm that generates statistically independent graph samples from any given degree sequence. The algorithm provides a weight for each sample, allowing observables to be measured uniformly or following any desired distribution over the graph ensemble. Unlike other algorithms, this method always produces a sample, without back-trackings or rejections. For large number of nodes and degree sequences admitting many realizations, the sample weights follow a lognormal distribution. We also propose a fast implementation of the Erdős-Gallai degree sequence graphicality test that is used in our algorithm, but is also of general utility.

¹CDG and KB are supported by NSF grant DMR-0908286 and by NHARP grant 95921. HZ and ZT are supported by NSF grant BCS-0826958. ZT is also supported by HDTRA grant 201473-35045.

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Date submitted: 20 Nov 2009

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