

# EPSTEIN INSTITUTE SEMINAR ▪ ISE 651

## Node Degrees in a Random Network

**ABSTRACT** - We investigate node degrees in a network grown from a seed by hooking self-similar components under two models of randomness: a uniform model and a model based on preferential attachment. We study two degree profiles: a local profile tracking the evolution of the degree of a particular node over time, and a global profile concerned about counts of the number of nodes of a particular degree.

For the local profile, under uniform growth, we have the exact mean, variance and probability distribution in terms of standard combinatorial numbers like generalized harmonic numbers and Stirling numbers of the first kind. Asymptotically, we observe phases: The early nodes have an asymptotically normal distribution, intermediate nodes have a Poisson distribution and the late nodes have a degenerate distribution. In contrast, under preferential attachment, the moments of the degree of a node contain Stirling numbers of the second kind and (under appropriate scaling) has a gamma-type limit law.

As for the global profile, we use Polya urns to derive strong laws. Four regimes arise according to the structure of the seed. Within these regimes, we identify a few degenerate cases. Barring these degenerate cases, we uncover an asymptotically normal joint multivariate distribution for nodes of very small degrees.



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**SPEAKER BIO** – Hosam Mahmoud is an elected member of the International Statistical Institute. He currently serves as an Editor of Journal of Applied Probability and Editor of Advances in Applied Probability (publications of the UK Probability Trust). He is also an Associate Editor of the Annals of the Institute of Statistical Mathematics (Japan), an Associate Editor of Methodology and Computing in Applied Probability (USA), and Associate Editor of Applicable Analysis and Discrete Mathematics (Serbia).

He has research interest in the areas of probabilistic analysis of algorithms, networks, big data, searching and sorting, random structures, and randomized algorithms. He has served as department chair in 1998-2001, and visited numerous institutions worldwide. Dr. Mahmoud is a productive scholar with four books and more than 100 peer-refereed papers, of which 25 are single-authored and many are in premier journals.

Professor Mahmoud spent sabbatical visits at University of Waterloo (Waterloo, Canada, 1990), Institut National de Recherche (Rocquencourt, France, 1997), Princeton University (Princeton, New Jersey, USA, 1998), the Institute of Statistical Mathematics (Tokyo, Japan, 2004) and Purdue University (West Lafayette, Indiana, USA, 2012).

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**TUESDAY, JANUARY 15, 2019**

**3:30PM – 4:50PM**

USC ANDRUS GERONTOLOGY CENTER (GER), Room 206