The Hong Kong Polytechnic University
Department of Applied Mathematics

Colloquium

On

Growth rates for preferential attachment random graphs

by

Professor Krishna B. Athreya
College of Liberal Arts and Sciences
Iowa State University, USA

KB Athreya is Professor of Mathematics and Statistics and a Distinguished Professor in the College of Liberal Arts and Sciences, Iowa State University, USA. He is also a visiting professor at the Indian Institute of Science, Bangalore. He was educated at Loyola College, Chennai, India, the Indian Statistical Institute, Kolkata and Stanford University, USA from where he got his Ph.D. He is a Fellow of the Indian Academy of Sciences, and the Institute of Mathematical statistics, USA and a member of the International Statistical Institute. He has written two books:

1. Branching Processes with Peter Ney and
2. Measure Theory and Probability Theory with S. Lahiri both published by Springer.

He has written over 150 research papers on probability, stochastic processes and mathematical statistics. He is on the editorial board of several journals on probability.

Abstract

Start with graph $G_0 \equiv \{V_1, V_2\}$ with one edge connecting the two vertices V_1, V_2. Now create a new vertex V_3 and attach it (i.e., add an edge) to V_1 or V_2 with equal probability. Set $G_1 \equiv \{V_1, V_2, V_3\}$. Let $G_n \equiv \{V_1, V_2, \ldots, V_{n+2}\}$ be the graph after n steps, $n \geq 0$. For each i, $1 \leq i \leq n+2$, let $d_n(i)$ be the number of vertices in G_n that V_i is connected to. Now create a new vertex V_{n+3} and attach it to V_i in G_n with probability proportional to $w(d_n(i))$, $1 \leq i \leq n+2$ where $w(\cdot)$ is a function form $N \equiv \{1, 2, 3, \ldots\}$ to $(0, \infty)$. In this paper, some results on behavior of the degree sequence $\{d_n(i)\}_{n \geq 1, i \geq 1}$ and the empirical distribution $\{\pi_n(j) \equiv \frac{1}{n}\sum_{i=1}^{n} I(d_n(i) = j)\}_{n \geq 1}$ are derived. Our results indicate that the much discussed power law growth of $d_n(i)$ and power law decay of $\pi(j) \equiv \lim_{n\to\infty} \pi_n(j)$ hold essentially only when the weight function $w(\cdot)$ is asymptotically linear. For example, if $w(x) = cx^2$ then for $i \geq 1$, $\lim_n d_n(i)$ exists and is finite w.p. 1 and $\pi(j) \equiv \delta_{j1}$, and if $w(x) = cx^p$, $1/2 < p < 1$ then for $i \geq 1$, $d_n(i)$ grows like $(\log n)^q$ where $q = (1-p)^{-1}$. The main tool used in this paper is an embedding in continuous time pure birth Markov chains.

Date	**:**	**2 June, 2009 (Tuesday)**
Time	**:**	**11:00 a.m. – 12:00 noon**
Venue	**:**	**Departmental Conference Room HJ610** **The Hong Kong Polytechnic University**

*** * *   ALL ARE WELCOME   * * ***