Lynne and William Frankel Center for Computer Science
Department of Computer Science, Ben-Gurion University of the Negev
Beer-Sheva, Israel 84105. Tel: (972-8) 6428032 Fax: (972-8) 6428021
www.cs.bgu.ac.il/~frankel

Seminar Series Supported by Jeffrey and Holly Ullman

Discussing and Exploring Random Walks

26 March, 2008

10:30 Coffee and tagging

10:50 The Cover Time of Random Walks
Uriel Feige, Weizmann

Abstract: **The cover time of a random walk on a finite graph is the expected number of steps taken until all vertices are visited. This talk will survey some of the known bounds on the cover time and some of the techniques that are used in order to establish these bounds. The techniques include connections with electrical resistance, the use of minimum weight spanning trees, and the use of probabilistic arguments. The known bounds refer to the maximum and minimum possible cover time on general graphs (expressed as a function of the number of vertices in the graph), as well as on special families of graphs such as trees and regular graphs. The question of designing an efficient deterministic algorithm that on any given graph produces an accurate estimate of the cover time is still open.**

11:35 Random Walk Methods in Search Engine Measurements
Ziv Bar-Yossef, Technion

Abstract: **Can we use the public user interface of a search engine to estimate the number of pages in its internal index? Can we measure externally the freshness of the documents cached by a search engine? Solutions to questions of this sort are important for the development of objective and reliable benchmarks for search engines.**

The vast size of the data indexed by modern search engines together with the restricted access to the data make the above measurement tasks very difficult. In this talk I will survey several recent algorithms that exploit random walks on appropriately defined graphs to perform reliable and efficient search engine measurements. These algorithms rely on Monte Carlo statistical simulation techniques, like Importance Sampling and the Metropolis-Hastings algorithm.

Joint work with Maxim Gurevich (Technion)

12:20 Lunch

13:00 Eigenvectors of Random Graphs and What They Tell Us
Nati Linial, Hebrew University of Jerusalem

Abstract: **Eigenvalues of random graphs have received considerable attention in recent years. We currently know quite a lot about the extremal properties of eigenvalues as well as about their typical behavior. Much of the interest in eigenvalues of graphs stems from their important role in the theory of expander graphs. Not so much is known, though, about the corresponding eigenfunctions. Extremal problems, as well as the study of the typical behavior of eigenfunctions, are of considerable theoretical and practical interest. In this talk, I will present some recent results found jointly with Y. Dekel and J. Lee concerning the nodal regions of eigenfunctions in random graphs. I will also mention some of the interesting open problems that come up in this fascinating area of research.**

13:45 On Non-Backtracking Random Walks
Sasha Sodin, Tel-Aviv University

Abstract: **We will discuss the non-backtracking random walk on a d-regular graph, and in particular, its spectral analysis and the maximal number of visits to a vertex. The results indicate that the non-backtracking walk may behave better than the usual one in problems related to reduction of randomness.**

Joint work with Noga Alon (TAU), Itai Benjamini (Weizmann), and Eyal Lubetzky (TAU)

14:20 Coffee

14:35 Pseudorandom Walks: Looking Random in the Long Run or All the Way
Omer Reingold, Weizmann

15:20 How to Explore a Fast-Changing World
Chen Avin, Ben-Gurion University

Abstract: **Motivated by real world networks and use of algorithms based on random walks on these networks, we study the simple random walks on dynamic undirected graphs, i.e., graphs which are modified by inserting or deleting edges at every step of the walk. We are interested in the expected time needed to visit all the vertices of such a dynamic graph, the cover time, under the assumption that the graph is being modified by an oblivious adversary. It is well known that on static undirected graphs the cover time is polynomial in the size of the graph. On the contrary and somewhat counter-intuitively, we show that there are adversary strategies which force the expected cover time of dynamic graphs to be exponential, and relate this result to the cover time of static directed graphs. In addition we provide a simple strategy, the lazy random walk, that guarantees polynomial cover time regardless of the changes made by the adversary.**

Joint work with Zvi Lotker (BGU) and Michal Koucky (Academy of Sciences of Czech Republic)

15:55 Spanners: Distributed Spanning Expanders
Nir Tzachar, Ben-Gurion University

Abstract: **We consider self-stabilizing and self-organizing distributed construction of a spanner that forms an expander. Namely, our constructions are extremely local, robust and dynamic, including a distributed local algorithm which reduces the number of edges of a given expander by a constant fraction. Furthermore, as our algorithm is probabilistic, we provide a distributed algorithm based on random walks to validate and monitor the resulting construction.**

Joint work with Shlomi Dolev (BGU)

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