Randomized Algorithms

Overview

The powerful role played by randomness in computation has been among the central discoveries of computer science over the last four decades. Randomized algorithms are algorithms that make random choices as they proceed, and have had a fundamental impact on several areas of computer science (e.g., in processing massive datasets and high-dimensional data, distributed algorithms, cryptography, social networks, networking, and resource allocation in cloud computing). This course is an introduction to randomized algorithms. It aims to teach rigorous methods to design and analyze such algorithms, and to present some of the key applications of randomization in diverse fields of computer science such as processing massive datasets, distributed computing, resource allocation, and reducing the dimensionality of data in machine learning.

Students will learn: (i) the paradigms that underlie the power of randomization (e.g., abundance of witnesses, symmetry-breaking, the probabilistic method, and laws of large numbers that enable statistical approaches for massive datasets); (ii) techniques to analyse randomized algorithms, with an emphasis on concentration inequalities such as moment inequalities, Chernoff-Hoeffding bounds, and negative association, and (iii) representative applications such as randomized sorting and selection, the Lovasz Local Lemma for network algorithms, data communications, sampling and sketching for large datasets, dimension-reduction in machine learning, and approximation algorithms in combinatorial optimization using relaxations of integer-programming formulations.

The students will solve assignments given regularly in small groups (each with two or three students), and will be strongly encouraged to keep the class interactive. There will also be an exam that will be done individually.

Dates for the Course	**18th July, 2016 to 31st July, 2016**
Host Institute	**IIT Madras**
No. of Credits	**2**
Maximum No. of Participants	**50**
You Should Attend If…	▪ You are a person who knows the techniques in the Design and Analysis of Algorithms as presented in a textbook like Introduction to Algorithms by Cormen, Leiserson, Rivest, and Stein. ▪ You are a person interested in the analysis and design techniques associated with algorithms that encounter stochastic input behavior or in the power of randomized choices made by an algorithm.
Course Registration Fees	**Student Participants:** Rs.1000 **Faculty Participants:** Rs. 6000 **Government Research Organization Participants**: Rs.10000 **Industry Participants:** Rs.20000 The above fee is towards participation in the course, the course material, computer use for tutorials and assignments, and laboratory equipment usage charges. **Mode of payment: Demand draft in favour of "Registrar, IIT Madras" payable at Chennai**
Accommodation	The participants may be provided with hostel accommodation, depending on the availability, on payment basis. Request for hostel accommodation may be submitted through the link: http://hosteldine.iitm.ac.in/iitmhostel

Course Faculty

Aravind Srinivasan is a Professor with the Department of Computer Science and the Institute for Advanced Computer Studies at the University of Maryland, College Park. His research interests are in randomized algorithms, networking, social networks, and combinatorial optimization, as well as in the growing confluence of algorithms, networks, and randomness, in fields including the social Web, machine learning, public health, biology, and energy. He is Editor-in-Chief of the *ACM Transactions on Algorithms*, Managing Editor for *Theory of Computing*, Associate Editor of *Networks*, and has served on the program committees of various conferences. Aravind Srinivasan serves on the Board of Advisors of ZeroFOX, and as Vice Chair of the *IEEE Technical Committee on the Mathematical Foundations of Computing*.

C. Pandu Rangan is a Professor in the Department of Computer Science and Engineering. His research focus is on Problems of practical interest in Graph Theory, Combinatorics, Computational Geometry, and Cryptology. In Cryptology his current focus is on Secure message transmission and Provable security of cryptographic protocols / primitives. He is a Fellow of Indian National Academy of Engineering (INAE). He has served as a member of board of Directors for IACR from 2002 to 2005. He is currently in the editorial board of LNCS published by Springer Verlag and editorial board of Journal of Parallel and Distributed Computing. He served as PC chair/General chair for a number of leading conferences such as ASIACRYPT and INDOCRYPT.

Course Coordinator

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