ABCD: An Algorithmic Toolkit for Big Data and e-Commerce

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Overview

Algorithms are a central part of Computer Science. In this course we will start with the basic principles and techniques for the design, analysis, and implementation of efficient algorithms and data representations. We will consider general techniques such as greedy algorithms, divide-and-conquer algorithms, dynamic programming and linear programming. Initial topics will also include the notion of computational tractability and intractability, sorting, graphs, paths, spanning trees, and network flows, We will then focus on the notion of NP-completeness (intractability) and ways to cope with it, including use of randomness and obtaining approximate, rather than exact, solutions. We will study several examples of how randomization serves to simplify and speed up algorithms. We will describe several illustrative uses of widely used approximation techniques such as primal-dual and Lagrangian relaxation. Finally we will cover the in-fashion topics of big data and algorithmic game theory. Both these topics rely on notions of approximations and randomization. We will present useful algorithmic techniques developed for handling large amounts of data. Topics that will be covered include sampling, sketching and streaming techniques, dimensionality reduction, sparsification (with applications to signals, matrices, and graphs) and compressed sensing. Algorithmic game theory lies at the interface of theoretical computer science and economics. We will introduce the notion of FNP and several of its syntactic sub-classes including PPAD. We will study the concept of Nash equilibrium in the mathematical and computation context and show how it applies to several natural problems in auctions, matching markets network routing and security. We will examine the PPAD-completeness of some of these problems and way to deal with (e.g. price of anarchy).

Dates for the Course	**17th October, 2016 to 28th October, 2016**
Host Institute	**IIT Madras**
No. of Credits	**2**
Maximum No. of Participants	**50**
You Should Attend If…	▪ You are an a computer science student or researcher or an IT professional interested in big data and their algorithmic aspects.
Course Registration Fees	The participation fees for taking the course is as follows: **Student Participants:** Rs.1000 **Faculty Participants:** Rs.5000 **Government Research Organization Participants**: Rs.5000 **Industry Participants:** Rs.10000 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** The demand draft is to be sent to the Course Coordinator at the address given below.
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

Prof. Ravi Sundaram is a faculty in the College of Computer and Information Science at Northeastern University. His primary research interests lie in algorithms with a focus on network performance and approximation algorithms for the design and efficient utilization of networks.

Dr.C Pandu Rangan is a faculty in the Computer Science Department, IIT Madras. He obtained his PhD from IISC, BANGALORE and is a FELLOW, INDIAN NATIONAL ACADEMY OF ENGINEERING SINCE 2006. His areas of research include Algorithms and Cryptography.

Course Coordinator

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