Schedule For Summer Program 2015

Date	9:30 - 11:00	11:30 - 13:00	14:00 - 15:15
June 1	Combinatorial Nullstellensatz and its applications: Arvind	Randomized Algorithms by Swaroop	Algorithms Tutorial by Diptapriyo
June 2	Do	Do	Do
June 3	Do	Do	Do
June 4	Do	Communication Complexity Anuj	Data Structures tutorial by Divyarthi
June 5	Do	Do	Do
June 8	Range Queries: Data structures and applications by Venkatesh	Computational Geometry by Pradeesha	Graph Algorithms tutorial by Diptapriyo
June 9	Basics of Graph Coloring by Mathew	Do	Pigeonhole Principle Tutorial by Swaroop
June 10	Range Queries: Data structures and applications by Venkatesh	Do	Self-adjusting binary search trees: What makes them tick? Talk by Laszlo Kozma
June 11	Basics of Graph Coloring by Mathew	Do	Finite Automata Tutorial by Jayakrishnan
June 12	Range Queries: Data structures and applications by Venkatesh	Do	Pushdown Automata Tutorial by Jayakrishnan
June 15	Games and Distributed Algorithms: Ramanujam	Upper and Lower Bounds for Selection by Venkatesh	Tutorial Followup Discussions
June 16	Do	Do	Do
June 17	Do	Algebraic Automata Theory by Ramanathan	Do
June 18	Do	Do	Do
June 19	Do	Do	Do
June 22	Learning formal languages using queries: Kamal	On Graceful Tree Conjecture and its present status by Ragukumar	Tutorial Followup Discussions or Student Presentations
June 23	Do	Harmonious coloring of graphs by Ragukumar	Do
June 24	Do	B-coloring of graphs by Ragukumar	Do
June 25	Do	Introduction to succinct data structures by Sankardeep	Do
June 26	Do	Do	Do
June 29 onwards	Student Presentations	Student Presentations	

Abstracts of Lectures

0.1 Computational Geometry by Pradeesha

We will see geometric algorithms, especially those designed for geometric query problems like range searching and nearest neighbor search. This also covers many geometric data structures and some techniques in designing geometric approximation algorithms.

No previous exposure in geometry is assumed. However,a familiarity with data structures and design and analysis of algorithms is useful.

References: Mark de Berg, Otfried Cheong, Marc van Kreveld, and Mark Overmars, Computational Geometry: Algorithms and Applications Sariel Har-Peled, Geometric Approximation Algorithms : Mathematical Surveys and Monographs

0.2 Communication Complexity by Anuj

We will see Yao's two-party communication model. This model consists of two parties, Alice and Bob holding inputs $x \in X$ and $y \in Y$ respectively. They exchange messages in order to compute a function $f : X \times Y \to \{0, 1\}$ at (x, y) and the goal is to do this with minimum amount of interaction. We will prove some lower bounds for some specific functions.

References:

1. Eyal Kushilevitz and Noam Nisan. Communication Complexity
2. Lecture notes available at `http://www.tcs.tifr.res.in/~prahladh/teaching/2011-12/comm/lectures`

0.3 Randomized algorithms by Swaroop

The goal of this lecture series would be to understand the use of randomness in obtaining algorithms that perform better than their usual deterministic counterparts. We shall start with some basic tools from discrete probability and use it to understand how randomness improves the quick sort method. Then, we shall see another application of randomness in determining whether a polynomial given as a black box is identically zero.

0.4 Algebraic Automata Theory by Ramnathan

In this introduction to Algebraic Automata Theory, we will see how a monoid can be associated in a natural way with any regular language. This allows us to use algebraic tools and gives us algorithms to determine meta-properties of a given regular language : for example, how can we find out if a given regular language can be described using a star-free regular expression?

Suggestions for presentations:

1. Logic and regular languages `http://www.cmi.ac.in/~kumar/words/lecture02.pdf` and `http://www.cmi.ac.in/~kumar/words/lecture02a.pdf`
2. Regular languages over infinite words `http://www.cmi.ac.in/~kumar/words/lecture07.pdf`

0.5 Basics of Graph Colouring by Mathew

A vertex-colouring of a graph is an assignment of colours to the vertices of a graph in such a way that no two adjacent vertices get the same colour. The chromatic number of a graph is the minimum number of colours required in any vertex-colouring of the graph. Similarly, an edge-colouring of a graph is an assignment of colours to the edges of a graph such that no two edges incident on the same vertex get the same colour. The chromatic index of the graph is the minimum number of colours required in any edge-colouring of the graph. We take a look at some basic theorems about vertex-colouring and edge-colouring of graphs.