Prof. Andrzej Proskurowski

Department of Computer and Information Science, University of Oregon (Eugene, USA)

Lecture series:
From Algorithms to Theory and Back: Dynamic Programming, Width Parameters of Graphs, Monadic Second Order Logic, Abstract Data Types

from 19.05 to 5.06.2014

Monday – Thursday, from 3:15 p.m. to 5:30 p.m.,
room 146, 1st fl., WETI Building (Wydział Elektroniki i Technik Informacyjnych),
Warsaw University of Technology, ul. Nowowiejska 15/19

In this course we will study both concrete and abstract complexity of discrete optimization problems. We present tools for design and analysis of efficient algorithms. We emphasize ways of structuring data in algorithms through layers of Abstract Data Types, using as a case study the Network Flows problem. Recent developments in graph theory and logic have allowed to codify polynomial-time computability of a wide class of problems on a large class of graphs. We discuss the concept of graph width parameters in conjunction with the related embedding problems.

Lecture 1: Models of computation, measures of efficiency, determinism vs. non-determinism. Chomsky, Myhill-Nerode, Cook and Karp. (2.5)

Lecture 2: Back to basics: abstract data type, loop invariants, complexity analysis (2.5)

Lecture 3: Efficient computation of tree parameters. Dynamic Programming paradigm. Tree-like graphs: k-trees. Bounded-decomposability graphs: partial k-trees. (2.5)

Lecture 4: Treewidth of graphs. Pathwidth of graphs. Pursuit-evasion models of graph parameters. (2.5)

Lecture 5: Computations on graphs with bounded treewidth. Things to remember: table size in DP algorithms. (2.5)

Lecture 6: Tree-decompositions and width parameters. Branchwidth, Cliquewidth, Rankwidth. (2)

Lecture 7: Linear width parameters (2)

Lecture 8: MSOL: Problems easy on graphs of bounded width. Courcelle's Theorem. (2)

Lecture 9: Embeddings: Minors, Vertex minors, Pivot minors. (2)

Lecture 10: Definition and implementation of ADT Paths with Cost (2)

Lecture 11: Cutting and Linking Trees (2.5)

Lecture 12: Definition and implementation of ADT Trees with Cost (2.5)

Lecture 13: Finding blocking flows using operations on ADT Trees with Cost (2.5)

COURSE TOTALS: 30 hours

Biography

Educated at Warsaw University of Technology, Stanford University, and the Royal Institute of Technology in Stockholm, where he earned his doctorate in 1974, Dr. Proskurowski has been on Computer Science faculty at the University of Oregon since 1975.

Dr. Proskurowski is an associate editor of the international journals *Networks* (Wiley) and *Frontiers of Computer Science* (Springer), served on the editorial board of *Applicationes Matematicae* and also as guest editor of several special volumes of *Discrete Applied Mathematics* and *Parallel Processing Letters* . He has served as an organizer and a member of Program Committees of several international workshops and conferences on combinatorics, graph theory, algorithms, and networking.

Research Interests

Dr. Proskurowski's current research is in the area of graphs and combinatorial algorithms. His main interest remains within the width parameters of graphs. Another sub-area of interest is that of modeling the topology of the Internet using graph-theoretical tools. Dr. Proskurowski's recent research involves also models of scheduling via coloring and labeling of graphs and hypergraphs.

Dr. Proskurowski's research has been supported by grants from the Office of Naval Research, the National Science Foundation, and the National Academy of Sciences. As a Fulbright scholar, he has lectured in Finland. He has collaborated abroad with researchers in Australia, Canada, Czech Republic, Denmark, Finland, France, Germany, Hong Kong, Iceland, Israel, Italy, Mexico, The Netherlands, Norway, Poland, Spain, Sweden and United Kingdom.

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