Parallel and Distributed Algorithms

An Introduction to the Minitrack

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A great diversity of emergent architectures promises to move the impact of parallel and distributed computing from the classroom and laboratory to the marketplace. Many scientists around the world are now studying the design, analysis and efficient implementation of algorithms for parallel and distributed platforms.

This minitrack has been organized to bring together researchers working on advanced algorithms for these environments. Its main topics include graph theory, nonnumerical techniques and complexity analysis. The application of tools from these fields to parallel and distributed computing is also covered, as is the study of computational models.

Seven papers have been selected for this minitrack. Five are regular, full-length papers; two are short papers. They are printed herewith in the order of oral presentation in Maui. These papers have been chosen from a host of submissions from countries all over the world. Each paper was reviewed by at least five referees for content, accuracy and relevance.

In the first paper, Dahlhaus designs fast parallel algorithms to recognize interval graphs and hypergraphs. Such graphs have been studied for many years, and are used in a wide variety of applications. The algorithms developed use a linear number of processors and take $O(\log n)$ time on the CRCW PRAM model.

When PRAM-style algorithms are implemented in a distributed computing environment, the number of communication phases can be critical. In the second paper, Zhou, Dymond and Deng consider the problem of minimizing communication costs for parallel graph algorithms. Deterministic algorithms are presented for the list ranking and shortest path problems that reduce this cost.

Edge-disjoint spanners can be useful in partitioning parallel computer systems and other applications. In the third paper, Laforest, Liestman, Shermer and Sotteau address the problem of finding such spanners in complete graphs. A number of upper and lower bounds are presented.

In the fourth paper, Brockmann and Wanka present a study of deterministic sorting methods on an SIMD machine, the MasPar MP-1. Three oblivious methods are described and compared analytically. Experiments are conducted over large data sets.

In the fifth paper, Breshears discusses the problem of transporting non-numeric parallel algorithms from shared-memory to distributed-memory machines. Time-space optimal merging and sorting are studied in an effort to establish the conditions under which message passing is required. Empirical results are also reported.

The multi-message multicasting problem models communication costs within a network of processors. The objective is to determine how best to transmit messages so that all communication can be carried out in the minimum amount of time. In the sixth paper, Gonzalez studies this problem, devising approximation algorithms and connections to scheduling theory.

In the seventh and final paper, Erlebach and Jansen investigate complexity-theoretic issues for the call scheduling problem. Motivated by the potential of ATM networks, this problem seeks to complete a given set of calls in minimum time. It is shown that the problem is $\mathcal{NP}$-hard on arbitrary trees, rings and meshes, but solvable in polynomial time on bounded-degree trees.

This slate of papers highlights many of the important issues facing designers and users of parallel and distributed algorithms. The authors and referees are to be commended for their assistance in making this a high-quality session. We thank each of them for their efforts. Thanks also go to Nina Mobrak, who has tirelessly handled the many administrative chores associated with running this minitrack.

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