PREFACE

This special issue is devoted to the *Average-Case Analysis of Algorithms* and is already the third of its kind appearing in *Algorithmica*. Analysis of algorithms aims at a precise prediction of the expected performances of algorithms and data structures of general use in computer science. Quantification of performance goes from mean value estimates of costs to analysis of the probability distributions involved, under natural randomness models of the data.

The area of analysis of algorithms was initiated on July 27, 1963 when D. E. Knuth analyzed hashing tables with linear probing in his "Notes on Open Addressing".

Since 1963 the field has been undergone substantial changes. We see now the emergence of combinatorial and asymptotic methods that permit us to classify data structures into broad categories that are susceptible to a unified treatment. Probabilistic methods that have been so successful in the study of random graphs and hard combinatorial optimization problems also play an important rôle in the field. These developments have two important consequences for the analysis of algorithms: it becomes possible to predict average-case behaviour under more *general* probabilistic models; at the same time it becomes possible to analyze much more structurally *complex* algorithms.

In July 1993, the first seminar entirely devoted to analysis of algorithms took place in Dagstuhl (Germany), followed by further seminars in 1995 and 1997. From 1998 on, the seminar is held annually, in Princeton (U.S.A.), Barcelona (Spain), Gdansk (Poland), and Tatihou (France).

Since 1997, the Analysis of Algorithms community has a homepage (`http://www-rocq.inria.fr/algo/AofA/index.html`).

Contributions

Analysis of algorithms typically deals with permutations, words, trees, strings, numbers and graphs, under various probabilistic models, as can be seen in the papers of this issue.

Choi and Golin analyze lopsided trees. In these rooted, ordered trees, the length of a node to its ith child depends on the value of i. Such trees model Varn codes as well as the performance of broadcasting algorithms within a postal model of communication. Combining analytic and combinatorial techniques, many interesting counting problems and asymptotic investigations are considered.

Devroye's subject is the analysis of the worst–case number of comparisons of Hoare's selection algorithm FIND (akin to Quicksort). This topic was very popular in recent years in the Analysis of Algorithms community.

Drmota derives an asymptotic equivalent to the number of leftist trees with specified nodes (resp. nodes and leaves) appearing in an arbitrary class of simply generated trees. Although the algorithmic importance of binary leftist trees (originally an efficient representation of priority queues by linked binary trees) is restricted from the current point of view, leftist trees themselves are an interesting class of trees.

Jacquet, Szpankowski and Tang analyze three models of the Lempel–Ziv parsing scheme under the assumption of a Markovian source. The Lempel–Ziv parsing scheme is a corner stone of many data compression algorithms. Using analytic and probabilistic methods, the authors analyze the average behaviour of three characteristic parameters and present some distribution results.

Flajolet and Louchard investigate analytic properties of the Airy distribution. This interesting distribution occurs in a lot of combinatorial contexts, for instance path length in trees, hashing tables, discrete random walks or merge–sorting, and is related to graph or polyomino enumeration.

Hofri and Shachnai analyze some dynamical reorganization strategies for binary search trees with a specified number of items. Their *move once* rule which moves each item at most once, when it is first accessed, is akin to the traditional *move to the root* rule. The authors present upper bounds for the average number of rotations under the new rule and its variants.

Mahmoud and Tsukiji study the distribution of outputs in a random binary recursive circuit, where the number of outputs over the history of growth constitutes a sequence of dependent random variables. They derive new distributional results on these circuits and discuss connections with a non–classical urn model.

Panario and Richmond's paper can be seen as an addition to their paper presented in an earlier special issue. In many instances, the number of so-called decomposable combinatorial structures (for instance permutations, polynomials over a field, etc.) with largest and smallest components of a given size can be computed exactly.

Prodinger presents a q–analogue of the path length of binary search trees. This is done by extending that parameter to words, where the letters are obtained by independent geometric random variables; the standard permutation model is then a limiting case.

Smythe and Wellner analyze the Shell Sort algorithm under the random permutation model. They extend a well-known distribution result on $(2,1)$–Shell Sort to $(h,1)$–Shell Sort. For a more efficient variation of the latter instance of Shell Sort, they analyze its asymptotical behaviour.

In terms of methodology, this issue illustrates the two major paradigms of analysis of algorithms. Objects of low structural complexity (for instance, strings, trees, permutations) can often be described exactly by analytic models, where generating functions, integral transforms, and complex asymptotics are central tools. Objects of higher structural complexity (e.g. graphs) are best approached by probabilistic inequalities, since an analytic model is often out of reach. There is however no firm dividing line, as exemplified by many papers in this volume: on the one hand, the analytic method is often capable of providing information on probability distributions of interest; on the other hand, the probabilistic method is often applicable to problems of low computational complexity.

We are very grateful to C. K. Wong, the Editor–in–Chief of *Algorithmica*, for having again provided the opportunity to prepare this special issue. We hope that the readers will find this volume interesting as well as useful in their scientific endeavours.

Rainer Kemp

Helmut Prodinger

Guest Editors