Preface

This special issue is devoted to *Analysis of Algorithms*. 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 ranges from mean value estimates of costs to analysis of the probability distributions involved, under natural randomness models of the data.

Over the past forty years, the field has undergone tangible 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. These seminars were repeated in 1995 and 1997. Since 1998, there has been a meeting every year at a different place: Princeton (USA), Barcelona (Spain), Krynica Morska (Poland), Tatihou (France). The next meetings are scheduled to take place in Austria (2002) and Italy (2003).

After each meeting, a special issue of a journal has been edited, which was open to all researchers in the field. One appeared in Theoretical Computer Science, two in Random Structures and Algorithms, and three in Algorithmica. This is the first time that such a special issue appears in the *Journal of Algorithms*, and we are very much grateful to Zvi Galil, the Editor-in-Chief for providing this opportunity.

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

Contributions

Analysis of algorithms typically deals with discrete objects like permutations, words, trees, strings, numbers, and graphs. The characteristic properties of these objects under various probabilistic models are the ones that very often determine (theoretically as well as practically) algorithmic efficiency.

Bourdon, Daireaux, and Vallée's work concerns itself with perhaps the most classic algorithms, the Euclidean algorithm. The authors are able to classify in terms of "speed" several variants, and do so by appealing to an original combination of methods from dynamical systems theory and functional analysis.

Chassaing and Louchard deal with the reflected Brownian bridge area. Brownian motion, as has been recognized relatively recently, serves as a continuous limit model for many discrete objects of algorithmics, like linear probing hashing, tree traversal, merging, and so on. This contribution provides further insight into a previous paper of Janson who analysed Linear Probing Hashing—the subject of Knuth's first analysis!

Chern, Hwang, and Tsai consider Cauchy–Euler differential equations, which are central in the analysis of algorithms based on recursive partitioning and order statistics. (Quicksort, quickselect, and m-ary search trees are primary examples.) Their paper provides a complete discussion of coefficient asymptotics for problems admitting of such analytic models. One particular consequence that is worthy of note is the occurrence of "phase transition" phenomena.

Duch and Martinez address variants of multidimensional tries with special consideration for "complex queries," like orthogonal range search and partial match queries.

Fill and Janson's contribution concerns the analysis of Quicksort, another classic subject in this area. Régnier, Hennequin, and Rösler had identified the limiting distribution of the costs of Quicksort. The present paper precisely quantifies the speed of convergence to this asymptotic limit.

Garefalakis and Panario discuss polynomials over finite fields and some of their statistical properties. This has cryptographical applications. At the same time, the analysis involves the popular Dickman and Buchstab functions that originate from analytic number theory but find ever increasing applications in the field of random discrete structures.

Hubalek, Hwang, Lew, Mahmoud, and Prodinger study bucket digital search trees. This expands on earlier analyses of Flajolet and Richmond as it bases itself on the use of ordinary generating functions. The article is motivated by various application areas including memory management (buddy systems), while being closely related to one of the most fundamental structures of data compression.

Knessl and Szpankowski consider the Height in PATRICIA Tries and, by appealing to the heuristic WKB method from applied mathematics, obtain very sharp estimates which are at the same time highly plausible. This is useful as it describes quantitatively the phenomena that are to be *expected*, so that it should provide a useful guide for developing more traditional rigorous approaches.

Merlini and Sprugnoli consider fountains and histograms. Fountains were previously studied by Odlyzko and Wilf. They can serve as a discrete alternative to classical queueing models in order to quantify waiting times for service stations like a printer.

The contribution of Neininger and Rüschendorf, related to the paper of Fill and Janson, answers one of their questions regarding the speed of convergence to the limit for quicksort under the Zolotarev metric.

(The important instance of the Kolmogorov metric still needs to be worked out.)

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Guest Editors