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BOOK REVIEW

E. G. COFFMAN, JR., AND GEORGE S. LUEKER, *Probabilistic Analysis of Packing and Partitioning Algorithms*. Wiley, New York, 1991, xiv + 192 pages, $46.95.

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Asked to provide an application of probability theory to computer science, a probabilist would no doubt respond with an example from the field of performance evaluation, where applications of queuing theory and the like to the analysis of real-time systems are by now well known. In these examples, probability enters through the interaction of a "reactive" program with an environment which behaves stochastically.

But suppose that instead of reactive programs we consider simple "transducers": programs that accept an input, compute for some time and eventually provide an output. Since the designers of computer hardware usually take great pains to ensure that the behaviour of their products is entirely deterministic, it might be imagined that the scope for applying probability theory to computer programs viewed as transducers is distinctly limited. Therefore, it may come as a surprise that the probabilistic analysis of algorithms has been a thriving area of theoretical computer science for at least fifteen years. The stochastic element may take one of two forms, which might be termed internal and external randomisation.

Internal randomisation arises when the model of computation is extended to include the potential to make random choices. Using such a model, one can describe and analyse *randomised algorithms*, whose execution proceeds stochastically. (In implementations of randomised algorithms, true random choice is replaced by some approximation based on pseudorandom number generators, since, as we have noted, real computers are deterministic.) Interest in randomised algorithms was sparked in the mid-1970s by the discovery of fast randomised tests for primality. Since then, many further applications of randomised algorithms have been found, particularly in computational algebra and geometry, and combinatorial enumeration. It would be moving away from the point to describe these applications in detail here, and the reader is directed instead to the excellent lecture notes of Prabhakar Raghavan (1990) or the survey paper of Welsh (1983), which although missing the more recent developments has the advantage of wider availability.

External randomisation arises when a deterministic algorithm is presented with problem instances drawn from a specified probability distribution. Quantities such as the execution time of the algorithm or the quality of the solution it produces become random variables of the input, and the aim is now to make

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