Abstract. The effective application of probabilistic reasoning in the study of problems in diverse areas is one of the most exciting recent developments in Mathematics. Probabilistic methods turned out to be very powerful in Discrete Mathematics, Analysis, Number Theory and Theoretical Computer Science. The meeting was dedicated to recent developments in these areas, focusing on the investigation of combinatorial problems for random sets and probabilistic methods, on the study of of questions in percolation, on the design and analysis of randomized algorithms and derandomization techniques, and on applications of probabilistic ideas in the study of questions in Combinatorial Number Theory and in Combinatorial Geometry.

Mathematics Subject Classification (2000): 05C35, 05C80, 05D05, 05D10, 05D40, 60C05, 68Q25.

Introduction by the Organisers

The conference was organized by Noga Alon (Tel Aviv), Béla Bollobás (Cambridge and Memphis) and Ingo Wegener (Dortmund). The programme consisted of 12 main lectures, supplemented by 17 shorter contributions, and covered many areas in Extremal and Probabilistic Combinatorics as well as in Theoretical Computer Science.

A few months before the meeting, we were devastated to hear that the third organizer of this conference, Professor Ingo Wegener, died in November 26, 2008. Ingo was the friend and colleague of many of us, and his spirit was with us during the meeting. The meeting started with a tribute to his memory and one of the technical lectures focused on recent developments in the investigation of a problem he raised in the previous Oberwolfach meeting we organized with him in 2006.
The basic Probabilistic Method is the technique of proving the existence of structures with unexpected properties by showing that a randomly chosen object from an appropriate probability distribution has the properties with positive probability. This method has been strikingly successful in Combinatorics, Graph Theory, Geometry and Combinatorial Number Theory, and the probabilistic point of view has had an enormous influence on theoretical computer science.

The speakers reported on recent developments in Ramsey theory, including variants that deal with Random Graphs and random structures, on new results in Combinatorial Geometry and on advances in the study of colouring problems for graphs and hypergraphs. Novel results in percolation, extremal graph theory and additive combinatorics have been described as well, combining combinatorial, probabilistic and analytic ideas. Additional active topics discussed included results on hashing, a new efficient algorithm for the local lemma, better algorithms for the random \( k \)-set problem, new developments on random walks in random graphs, and a discussion of reachability games.

The workshop focused on the connection and common themes of Combinatorics, Discrete Probability and Theoretical Computer Science, and the lectures, many of which given by young participants, stimulated fruitful discussions. The fact that the participants work in different and yet related topics, and the open problems session held during the meeting, encouraged interesting discussions and collaborations.

Forty nine scientists, including forty from countries other than Germany participated in the meeting. The organizers and participants thank the Mathematisches Forschungsinstitut Oberwolfach for providing an inspiring setting for this conference.