

# Graph Colouring and the Probabilistic Method

Michael Molloy  
Bruce Reed



Springer

# The Probabilistic Method

**A. C. W. M. Vrouwenfelder**



## **The Probabilistic Method:**

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from 1971 This determines the maximum number of proper  $k$  colorings of any graph with chromatic number  $k$  and  $n$  vertices In the proof we use an entropy inequality related to sequential importance sampling an estimation technique from statistics Finally we present a result in probabilistic combinatorics outside graph theory An  $n$  permutation is called  $k$  universal if it contains every  $k$  permutation as a pattern and it is known that the shortest  $k$  universal permutation has length  $O(k^2)$  It was suggested by Alon that actually almost all  $n$  permutations are  $k$  universal for some  $n = O(k^2)$  and he proved that a random permutation of length  $O(k^2 \log k)$  is  $k$  universal with high probability Using a structure versus randomness approach we improve this bound to  $O(k^2 \log \log k)$  almost closing the gap to the conjecture

**The Probabilistic Method and Random Graphs** Brian Ketelboeter, 2012 [Graph Colouring and the Probabilistic Method](#) Michael Molloy, Bruce Reed, 2013-06-29 Over the past decade many major advances have been made in the field of graph colouring via the probabilistic method This monograph provides an accessible and unified treatment of these results using tools such as the Lovasz Local Lemma and Talagrand's concentration inequality The topics covered include Kahn's proofs that the Goldberg Seymour and List Colouring Conjectures hold asymptotically a proof that for some absolute constant  $C$  every graph of maximum degree  $\Delta$  has a  $\Delta/C$  total colouring Johansson's proof that a triangle free graph has a  $O(\Delta / \log \Delta)$  colouring algorithmic variants of the Local Lemma which permit the efficient construction of many optimal and near optimal colourings This begins with a gentle introduction to the probabilistic method and will be useful to researchers and graduate students in graph theory discrete mathematics theoretical computer science and probability

[Probabilistic Method, The. Wiley-Interscience Series in Discrete Mathematics and Optimization](#) Joel Spencer, 2008 This Third Edition of The Probabilistic Method reflects the most recent developments in the field while maintaining the standard of excellence that established this book as the leading reference on probabilistic methods in combinatorics Maintaining its clear writing style illustrative examples and practical exercises this new edition emphasizes methodology enabling readers to use probabilistic techniques for solving problems in such fields as theoretical computer science mathematics and statistical physics This book begins with a description of tools applied in probabilistic arguments including basic techniques that use expectation and variance as well as the more recent applications of martingales and correlation inequalities Next the authors examine where probabilistic techniques have been applied successfully exploring such topics as discrepancy and random graphs circuit complexity computational geometry and derandomization of randomized algorithms Sections labeled The Probabilistic Lens offer additional insights into the application of the probabilistic approach and the appendix has been updated to include methodologies for finding lower bounds for Large Deviations The Third Edition also features a new chapter on graph property testing which is a current topic that incorporates combinatorial probabilistic and algorithmic techniques an elementary approach using probabilistic techniques to the powerful Szemerédi Regularity Lemma and its applications new sections devoted to percolation and liar games and a new chapter that provides a modern treatment of the Erdős-Rényi phase transition in the Random Graph

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