

Graph Colouring and the Probabilistic Method

Michael Molloy
Bruce Reed



Springer

The Probabilistic Method

Noga Alon, Joel H. Spencer



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majoring in mathematics computer science operations research and statistics The Fourth Edition is also an excellent reference for researchers and combinatorists who use probabilistic methods discrete mathematics and number theory Noga Alon PhD is Baumritter Professor of Mathematics and Computer Science at Tel Aviv University He is a member of the Israel National Academy of Sciences and Academia Europaea A coeditor of the journal *Random Structures and Algorithms* Dr Alon is the recipient of the Polya Prize The G del Prize The Israel Prize and the EMET Prize Joel H Spencer PhD is Professor of Mathematics and Computer Science at the Courant Institute of New York University He is the cofounder and coeditor of the journal *Random Structures and Algorithms* and is a Sloane Foundation Fellow Dr Spencer has written more than 200 published articles and is the coauthor of *Ramsey Theory Second Edition* also published by Wiley *Ten Lectures on the Probabilistic Method* Joel Spencer, 1994-01-01 This update of the 1987 title of the same name is an examination of what is currently known about the probabilistic method written by one of its principal developers Based on the notes from Spencer's 1986 series of ten lectures this new edition contains an additional lecture The Janson Inequalities These inequalities allow accurate approximation of extremely small probabilities A new algorithmic approach to the Lovasz Local Lemma attributed to Jozsef Beck has been added to Lecture 8 as well **Graph Colouring and the Probabilistic Method** Michael Molloy, Bruce Reed, 2002 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 Δ has a Δ/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 [The Probabilistic Method in Combinatorics](#) Researcher in combinatorics He, 2021 The probabilistic method is the art of introducing probability to prove results that often do not involve randomness to begin with In this thesis we present four applications of this powerful technique which has become one of the cornerstones of modern combinatorics First we prove a new lower bound for online Ramsey numbers giving for the first time an exponential separation between the lower bounds for classical and online Ramsey numbers Informally this means that it is quite difficult to adaptively find a monochromatic clique in an edge coloring of a large complete graph Next we determine the growth rate of a certain off diagonal hypergraph Ramsey number answering a question of Erdős and Hajnal from 1972 This is the first nontrivial hypergraph Ramsey number whose exponential order has been determined The proof introduces a new random model for hypergraphs and relies heavily on the entropy method Third we apply the entropy method to extremal graph theory proving Tomescu's graph coloring conjecture

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 Δ has a Δ/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

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Probabilistic Methods for Algorithmic Discrete Mathematics Michel Habib,1998-08-19 The book gives an accessible account of modern probabilistic methods for analyzing combinatorial structures and algorithms Each topic is approached in a didactic manner but the most recent developments are linked to the basic material Extensive lists of references and a detailed index will make this a useful guide for graduate students and researchers Special features included a simple treatment of Talagrand inequalities and their applications an overview and many carefully worked out examples of the probabilistic analysis of combinatorial algorithms a discussion of the exact simulation algorithm in the context of Markov Chain Monte Carlo Methods a general method for finding asymptotically optimal or near optimal graph colouring showing how the probabilistic method may be fine tuned to exploit the structure of the underlying graph a succinct treatment of randomized algorithms and derandomization techniques

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