

What This Book Is About and How It Came into Being

Ramsey theory is a fascinating, approximately 100-year-old field of mathematics that has a non-empty intersection with combinatorics, number theory, geometry, ergodic theory, topology, combinatorial geometry, set theory, measure theory, and so on. Ramsey theory possesses its own unifying ideas, and some of its results are among the most beautiful theorems of mathematics. The main mathematical idea of Ramsey theory is this: no matter how large and elaborate a system S is, and how large a positive integer n is, we can choose a large enough super system Q containing S , so that no matter how Q is colored in n colors, Q contains a monochromatic copy of S . Thus one can say that Ramsey theory studies *mathematics of coloring*.

In 2008 the director, Fred Roberts, and the executive committee of DIMACS¹ invited me to organize a three-day workshop on Ramsey theory. In response to Dr. Roberts' desire to host a nongeneric original view of the field, I proposed *Ramsey Theory: Yesterday, Today, and Tomorrow*. This was approved, and the workshop took place on May 27–29, 2009 at the Busch Campus of Rutgers University in Piscataway, New Jersey. The workshop looked at the emergence and history of Ramsey theory (*Yesterday*), its results (*Today*), and its future (*Tomorrow*) through its open problems, conjectures, and aspirations. In addition to mathematical and historical research, we also looked at how Ramsey theory can harness the power of computing in discovering mathematical results.

The workshop turned out to be an international event. It attracted researchers from the United States, England, Czech Republic, Hungary, and Germany. The speakers included world-renowned leaders of the field, such as Ronald L. Graham, Joel H. Spencer, and Jaroslav Nešetřil. It also included some of the most promising young researchers such as Jacob Fox of Princeton University, Andrzej Dudek of Carnegie Mellon University, Lynn Scow of the University of California Berkeley, and Dmytro Karabash of the Courant Institute of Mathematical Sciences.

¹ The Center for Discrete Mathematics and Theoretical Computer Science, a collaborative project of Rutgers and Princeton Universities, AT&T Labs – Research, Alcatel–Lucent Bell Labs, Cancer Institute of New Jersey (CINJ), NEC Laboratories America, and Telcordia Technologies.

The workshop inspired Ann Kostant, the executive editor of mathematics at Birkhäuser, to propose that I organize and edit this volume of surveys authored or coauthored by workshop participants under the title of the workshop *Ramsey Theory: Yesterday, Today, and Tomorrow* for its “Progress in Mathematics” Birkhäuser series.

This volume opens with “Yesterday”, surveys of the prehistory and early history of Ramsey theory. They are followed by surveys of progress that has been made in Ramsey theory and in areas that arose from Ramsey theory, the descendants of Ramsey theory; these surveys point out directions in which Ramsey theory and its descendants may move in the future. The last three surveys address Euclidean Ramsey theory and related coloring problems. The survey on open problems is coauthored by Ronald L. Graham, one of the authors of Euclidean Ramsey theorems I, II, and III, 1973–1975, which constitute a major portion of the foundation of the subject. This survey is followed by a history of the mysterious problem of the chromatic number of the plane, and the final survey is on similar problems for the rational points in real Euclidean spaces.

In addition to invited and contributed talks, the workshop featured a “Problem Posing Session.” Accordingly, this volume includes a section of open problems proposed at the workshop.

On behalf of all contributors to this volume, I thank Fred Roberts and the DIMACS Executive Committee for inviting and supporting the workshop, and the National Science Foundation for financial support. I thank the entire DIMACS’ staff for their wonderful help, especially Nicole Clark, Linda Casals, and Mel Janowitz. I thank Ann Kostant of Birkhäuser for offering us such a fine vehicle for spreading the Ramseyan word, and the editors of the “Progress in Mathematics” series Hyman Bass, Joseph Oesterlé, and Alan Weinstein for accepting this volume in their enlightened series.

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Some of the plenary speakers of the workshop, from the right: Ronald L. Graham, Jaroslav Nešetřil, Joel H. Spencer, and Alexander Soifer

Ramsey Theory

Yesterday, Today, and Tomorrow

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