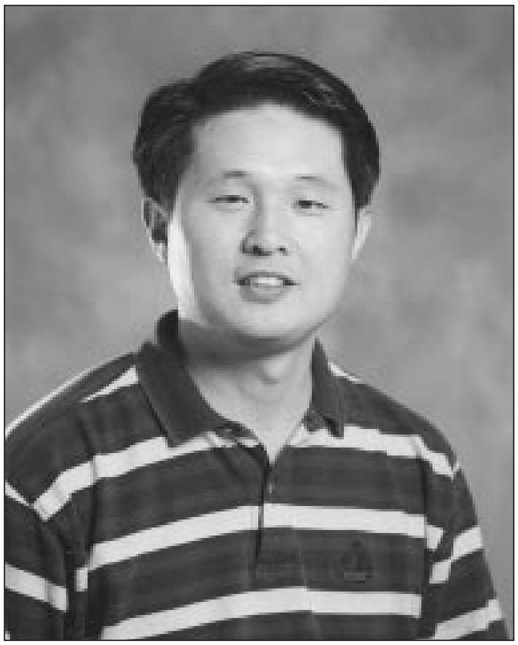
1997 Fulkerson Prize



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Jeong Han Kim

The D. Ray Fulkerson Prize in Discrete Mathematics was awarded on August 25, 1997, at the opening session of the XVIth International Symposium on Mathematical Programming in Lausanne, Switzerland. The prize of $1,500 is jointly sponsored by the AMS and the Mathematical Programming Society.

The prize committee for the 1997 prize consisted of Ronald Graham, AT&T Research; Ravi Kannan, Yale University; and Éva Tardos (chair), Cornell University. To be eligible, papers had to be published in a recognized journal during the six calendar years preceding the year of the Symposium. The term "discrete mathematics" is intended to include graph theory, networks, mathematical programming, applied combinatorics, and related subjects. While research in these areas is usually not far removed from practical applications, the judging of papers is based on their mathematical quality and significance.

The 1997 Fulkerson prize was awarded to Jeong Han Kim of Microsoft Research for the paper "The Ramsey Number $R(3,t)$ Has Order of Magnitude $\frac{t^2}{\log t}$", which appeared in *Random Structures and Algorithms*, volume 7, issue 3, 1995, pages 173–207.

The Ramsey number $R(s,t)$ is the minimum n such that every red-blue coloring of the edges of the complete graph K_n includes either a red complete graph on s nodes or a blue complete graph on t nodes. The Ramsey number was introduced by Erdős and Szekeres in a paper in 1935. The 1947 paper by Erdős on the symmetric Ramsey number $R(t,t)$ is generally viewed as the start of the probabilistic method in combinatorics. Since then developments in bounds on the Ramsey number have been intertwined with developments of the probabilistic method.

After the symmetric case, the Ramsey number $R(3,t)$ is the most studied. Erdős and Szekeres proved that $R(3,t)$ is $O(t^2)$. This upper bound was improved by Graver and Yackel in 1968 to $O(t^2\frac{\log\log t}{\log t})$, and then in 1990 by Ajtai, Komlós, and Szemerédi to $O(\frac{t^2}{\log t})$. The best-known lower bound for $R(3,t)$ was $\Omega(\frac{t^2}{\log^2 t})$, proved in a 1961 paper by Erdős.

Jeong Han Kim's paper solves this sixty-year-old problem by improving the Erdős lower bound to match the upper bound of Ajtai, Komlós, and Szemerédi. The paper is a veritable cornucopia of modern techniques in the probabilistic method; it uses martingales in a sophisticated way to obtain strong large deviation bounds.

Kim received his Ph.D. in 1993 from Rutgers University, where his advisor was Jeff Kahn. He worked at AT&T Research for four years before joining the Theory Group at Microsoft Research in 1997.

Past recipients of the Fulkerson Prize are: Richard M. Karp, Kenneth Appel, Wolfgang Haken, and Paul D. Seymour (1979); D. B. Judin, A. S. Nemirovskii, L. G. Khachiyan, G. P. Egorychev, D. I. Falikman, M. Grötschel, L. Lovasz, and A. Schrijver (1982); Jozsef Beck, H. W. Lenstra Jr., and Eugene M. Luks (1985); Éva Tardos and Narendra Karmarkar (1988); Martin Dyer, Alan Frieze, Ravi Kannan, Alfred Lehman, and Nikolai E. Mnev (1991); and Lou Billera, Gil Kalai, Neil Robertson, Paul D. Seymour, and Robin Thomas (1994).

—Éva Tardos, for the prize committee