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ALEXANDER RAZBOROV AND P =? NP PROBLEM

Alexander Razborov, Visiting Professor at the Institute for Advanced Study, received the "2007 Gödel Prize for Outstanding Journal Articles" in theoretical computer science with Steven Rudich. Razborov is regarded as one of the topmost computer scientists in studying the world famous P=? NP problem, one of the seven Millennium Prize problems listed by the Clay Mathematics Institute. (http: //www.claymath.org/ millennium/)

Razborov is a Russian mathematician and computational theorist who won the Nevanlinna Prize in *the International Congress of Mathematicians in* 1990 for his work on lower bounds for monotone Boolean circuits published in 1985. A function is monotone if it can be computed just using AND or OR Boolean gates. He proved a very important theorem which stated that there are no polynomial size monotone circuits for deciding the existence of a clique of a given size in a graph, a well-known NP-complete problem. (General Boolean circuits include all three types of gates: AND, OR, and NOT.) A lot of computer scientists were expecting that NOT gates were not really helpful for computing monotone Boolean functions, so that the famous P=?NP problem can be solved in such a way.

However, it was Razborov himself in 1994 who came up with the idea of natural proofs showing that "proof techniques using circuit lower bounds are not likely to resolve the P =? NP question."

Despite giving hope for solving the problem, Razborov (and Rudich) later withdrew it from computing theorists. However, his great achievements helped researchers better understand the profoundness and difficulty of the P=?NP problem. His results convey that we need to FIND a new way.

- A. Razborov, Lower bounds on the monotone circuit complexity of some Boolean functions. Dokl. Akad. Nauk SSSR 281, 1985, pp 798-801. (Russian)

- A. Razborov and S. Rudich, "Natural Proofs", Journal of Computer and System Sciences, Vol. 55, No. 1, 1997, pp. 24-35. (It was first presented at the Twenty-sixth Annual ACM Symposium on Theory of computing, Montreal, Quebec, Canada. 1994, pp. 204 - 213.)