Computer Science Seminar

Matchings in the Permutation Lattice

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Modern lattice theory, the abstract study of order and hierarchy, was reborn at Harvard in the 1930's, a creation of Professor Garrett Birkhoff. His colleague Gian-Carlo Rota wrote, citing a prediction of I. M. Gelfand, that "lattice theory will play a leading role in the mathematics of the twenty-first century".

Using the g-Theorem on polytopes, Anders Bjorner proved a result about how the number of totally ordered subsets of a finite distributive lattice grows as the subsets increase in size. He then asked in 1997 if that result could be proven combinatorially. One day, on a flight from Maine to Austria, I had an idea.

Problem: Find a bijection from the set of permutations with k descents to the set of permutations with k ascents that sends a permutation to a permutation greater than or equal to it in the weak Bruhat order on the symmetric group of permutations on n letters (where $k<n/2$).

Reference: Knuth, D. E. The Art of Computer Programming, vol 3: Sorting and Searching (Addison–Wesley Publishing Company, Reading, Massachusetts, 1973), pp. 24–29, 43–44.
Markowsky, George. "Permutation lattices revisited," Mathematical Social Sciences 27 (1994), 59–72.

Bio: Jonathan Farley graduated summa cum laude from Harvard University with the second-highest grade point average in his graduating class. He obtained his doctorate in mathematics from Oxford University, after winning Oxford's highest mathematics awards for graduate students, the Senior Mathematical Prize and Johnson University Prize.

He has been an Associate Professor of Computer Science at the University of Maine, an Associate Professor of Mathematics at the University of Maine, a Visiting Professor of Mathematics at the California Institute of Technology (Caltech), a Science Fellow at Stanford University's Center for International Security and Cooperation, a Visiting Scholar in the Department of Mathematics at Harvard University, and a Visiting Associate Professor of Applied Mathematics at the Massachusetts Institute of Technology (MIT).

Seed Magazine named Dr. Farley one of "15 people who have shaped the global conversation about science in 2005." Professor S. Allen Counter of Harvard University told Jet Magazine in 2004, "Jonathan Farley is one of the world's most impressive young mathematicians…." The City of Cambridge, Massachusetts (home of course to both Harvard University and MIT) officially declared March 19, 2004 to be "Dr. Jonathan David Farley Day."

Dr. Farley wrote about display list interrupts for A.N.A.L.O.G. Computing Magazine in 1986 and he knows C++, PL/I, PASCAL, LISP, FORTRAN, 6502 machine language, and, most importantly, BASIC.

Date: April 23, 2018

Time: 10:00 am - 10:50 am

209 Computer Science Building

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