

# HISTORY OF COMBINATORICS AT UCLA

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UCLA's Mathematics Department was a small department for the first years of UCLA's existence in the 1920's and 1930's, growing to a faculty of about fifteen by the late 1930's. Although combinatorics was not commonly recognized as a 'separate' field yet, and UCLA did not have anyone who we would look back on as a 'combinatorialist', there were already in place a couple of members of the faculty who had significant influence on the development of combinatorics. One was Ed Beckenbach, who was here from 1938, and eventually edited one of the earlier books in the area, "Applied Combinatorial Mathematics", in 1964 when combinatorics was beginning to become widely recognized as a distinct discipline.

Perhaps the first significant single development at UCLA for combinatorial mathematics was the establishment of the Institute for Numerical Analysis (INA), which brought many combinatorial practitioners to the UCLA campus. The INA was set up at UCLA in 1947 by the National Bureau of Standards to develop computational techniques and algorithms for using the newly emerging digital computers. A thorough history of this program is available at <http://nvlpubs.nist.gov/nistpubs/Legacy/SP/nistspecialpublication730.pdf>). From that history we see that Beckenbach was crucial in establishing that institute, initiating the actual proposal to the NBS for the institute. The INA continued until 1954.

During the years of the INA (1947-1954) among the mathematicians who visited the Institute were a number of mathematicians who were at least partly combinatorial in their interests. These included G. Dantzig, R. Greenwood, W. Feller, A. Dvoretzky, M. Kac, P. Erdős, L. Paige, G. Polya, I.J. Schoenberg, A.J. Hoffman, J. Selfridge, G. Hedlund, A. Gleason, M. Hall, E. G. Straus, J.D. Swift, R.H. Bruck, R. Dilworth, and most significantly, T.S. Motzkin.

Motzkin arrived in 1950 and after 1956 became a permanent member of the Math Department. There he joined E.G. Straus, who came to the department in 1949. The combinatorics group in the later '50's and '60's began to grow with the addition of Basil

Gordon, Dave Cantor and Al Hales, and in the later '60's Kirby Baker and Bruce Rothschild. Up to this time almost all the people doing combinatorics came from other areas, algebra, number theory, logic, geometry.

By 1968, for example, Motzkin's entry in the UCLA catalog for the first time included 'combinatorics' as one of his specialties. But by the mid '60's combinatorics was a part of the Department configuration, and of course there were regular courses taught at the undergraduate and graduate levels. The faculty acquired (for shorter or longer times as visiting faculty, etc.) many practitioners of the trade, among others W. Deuber, R. Jewett, Ph. Kolaitis, J. Spencer, R. Graham, N. Linial, E. Gyori, R.J. Proctor, J. Stembridge, H.-J. Proemel, N. Sloane, S. Cokus, M. Rombach, G. Panova, M. Tassy, S. De Salvo, E. Lamken, A. Sarkozy, and D. Yeliussozov. The regular faculty has included B. Sudakov, I. Pak, and T. Tao.

From early on also there was a strong group in set theory, including infinite combinatorics, with C.C. Chang on the faculty and later from 1956, and later Tony Martin, J.R. Steele, and, in 2015, A. Marks. There were others passing through for shorter and longer periods with strong combinatorial connections, F. Galvin, R. Laver, S. Shelah, J. Baumgartner, J. Larsen, K. Prikry, these mostly in the '70's, and A. Kechris. Also, early on in the 1950's, T. Skolem.

The first major journal devoted to combinatorics, The Journal of Combinatorial Theory, after a few years split into two 'series', and from 1970 until 2002 Series A of the JCT was edited at UCLA, with Motzkin originally as Editor-in-Chief, and then Marshall Hall at Caltech, while Basil Gordon and Bruce Rothschild served as Managing Editors, continuing after Hall retired and left Caltech.

Starting with the INA and continuing to the present there has been regular exchanges and even joint seminars with other nearby institutions, including USC, Caltech, JPL, RAND (in the 50's and 60's mostly), UCI, UCR, UCSD, CSULA, CSUN), and some of the major aerospace companies in the area. Some of the people with regular interactions were J. Folkman, M. Hall, H. Ryser, A. Whiteman, R. Wilson, S. Golomb, and L. Harper.

In 2000, half a century after the INA, another institute, IPAM, the Institute for Pure and Applied Math was established at UCLA by the NSF. The Institute sponsors many programs, bringing in mathematicians and scientists from all over to concentrate on specific areas of mathematics and its applications. These programs regularly deal with combinatorial subjects, both pure and applied, graph theory, asymptotics, geometry, algorithms, etc. This brings regularly many combinatorial mathematicians and combinatorics activity to UCLA.

Combinatorics continues to be an active area in the Department.

January 16, 2017