

Title:

**Markov Bases for Noncommutative Fourier Analysis of Ranked Data**

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Technical Report number (Dept. of Statistics, Stanford Univ.):

**2004-29**

Date:

**November 2004**

Abstract:

To calibrate Fourier analysis of  $S_5$  ranking data by Markov chain Monte Carlo techniques, a set of moves (Markov basis) is needed. We calculate this basis, and use it to provide a new statistical analysis of two data sets. The calculation involves a large Gröbner basis computation (45825 generators), but reduction to a minimal basis and reduction by natural symmetries leads to a remarkably small basis (14 elements). Although the Gröbner basis calculation is infeasible for  $S_6$ , we exploit the symmetry of the problem to calculate a Markov basis for  $S_6$  with 7,113,390 elements in 58 symmetry classes. We improve a bound on the degree of the generators for a Markov basis for  $S_n$  and conjecture that this ideal is generated in degree 3.