SOME CHARACTERIZATIONS OF MINIMAL MARKOV BASIS FOR SAMPLING FROM DISCRETE CONDITIONAL DISTRIBUTIONS

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Abstract. In this paper we give some basic characterizations of minimal Markov basis for a connected Markov chain, which is used for performing exact tests in discrete exponential families given a sufficient statistic. We also give a necessary and sufficient condition for uniqueness of minimal Markov basis. A general algebraic algorithm for constructing a connected Markov chain was given by Diaconis and Sturmfels (1998, *The Annals of Statistics*, **26**, 363–397). Their algorithm is based on computing Gröbner basis for a certain ideal in a polynomial ring, which can be carried out by using available computer algebra packages. However structure and interpretation of Gröbner basis produced by the packages are sometimes not clear, due to the lack of symmetry and minimality in Gröbner basis computation. Our approach clarifies partially ordered structure of minimal Markov basis.

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