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Linear time uniform generation of random matrices with prescribed marginals

We give a linear time algorithm to uniformly generate a random $m \times n$ matrix with nonnegative integer entries, where the sums for each row and each column are prescribed. Our algorithm is based on switchings and a novel rejection scheme. Our rejection scheme requires small computation time, and is key to obtaining a linear run time. Using this rejection scheme we improve several switching-based algorithms on generation of other discrete objects. For instance, we obtain a linear time algorithm to uniformly generate random d -regular graphs. All previously known samplers have run time at least $d^3 n$.