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Randomized simplex algorithms on Klee-Minty cubes. (English) Zbl 0947.90066

Summary: We investigate the behavior of randomized simplex algorithms on special linear programs. For this, we use combinatorial modes for the Klee-Minty cubes [V. Klee and G. J. Minty, Inequalities III, Proc. 3rd Symp. Los Angeles 1969, 159-175 (1972; Zbl 0297.90047)] and similar programs with exponential decreasing paths.

The analysis of two most natural randomized pivot rules on the Klee-Minty cubes leads to (nearly) quadratic lower bounds for the complexity of linear programming with pivots. Thus we disprove two bounds (for the expected running time of the RANDOM-EDGE simplex algorithm on Klee-Minty cubes) conjectured in the literature.

At the same time, we establish quadratic upper bounds for the expected length of a path for a simplex algorithm with random pivots on the classes of linear program under investigation. In contrast to this, we find that the average length of an increasing path in a Klee-Minty cube is exponential when all paths are taken with equal probability.

MSC:
90C05 Linear programming
52B12 Special polytopes (linear programming, centrally symmetric, etc.)
68Q25 Analysis of algorithms and problem complexity

Keywords: simplex algorithms; Klee-Minty cubes

Full Text: DOI