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New Algorithm for Linear Inequalities, Linear Programs (LP), using no Matrix Inversions

The dawning of mathematics occurred with the first steps to model some problems faced in daily living, mathematically, perhaps 10,000 years ago. Earliest mathematical models constructed were small systems of linear equations, the elimination method for solving them was discovered over 2500 years ago in China and India; leading to the development of linear algebra. The ancient texts Chiu-Chang Suanshu (in Chinese) and Sulabhasuutrah (in Sanskrit) describe the method. The method was unknown in Europe until the 19th century when Gauss with his very favorite number 17 popularized it.

However, there was no computationally viable method until recently to solve systems of linear constraints including inequalities. Beginning in the 19th century, Fourier, De la Vallée Poussin, Farkas, Kantarovich, and others developed some methods or did initial work for solving such systems. This work culminated in the mid-20th century paper on the Simplex method for LPs and linear inequalities by Dantzig.

¿From the nature of the simplex method, LP can be viewed as the 20th century extension of linear algebra to handle systems of linear constraints including inequalities. Dantzig very successfully promoted LP as an appropriate mathematical model for solving decision making problems with numerous applications in all areas of science, engineering, and business management.

Among the most successful methods used for solving LPs today are the simplex methods, primal-dual interior point methods, and the gravitational methods. All are descent methods based on matrix inversion operations, limiting applicability to problems with sparse data sets.

I will discuss the features of a new interior point method which is a descent method that does not need matrix inversions, and the nice geometric results on which it is based.