Algorithmic Operations Research

Preface

John R. Birge and Abraham P. Punnen

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Preface

This inaugural issue of Algorithmic Operations Research is dedicated to the memory of George Bernard Dantzig and his contributions to the development of operations research and more broadly to the development of algorithms, sequential approaches to problem solving, and their numerical implementations. The first article by Katta G. Murty, which introduces a new algorithm for linear programming, describes some of these contributions and their impact on operations research and related fields. As described in Murty's article, Professor Dantzig's work led to much of the development of mathematical programming and operations research in both theory and practice. In fact, each of the articles in this first issue, as we will describe below, continues a path that Professor Dantzig began in his early work. As Dantzig noted in the foreword to his book on linear programming , his fundamental accomplishments include the introduction of an objective function to measure progress and of inequalities as fundamental relations to characterize possible choices. These concepts remain central to many algorithms as those in this issue and to many others that extend well beyond operations research.

Murty's article goes on to describe a new centering direction strategy for the gravitational method (introduced in References 11 and 3 of his paper) for linear programming with additional computational advantages. The algorithm runs in strongly polynomial time if some corresponding subproblems can be solved in strongly polynomial time. The result also leads to a new method for linear programming that involves no matrix inversion.

The second article from Donohue and Birge addresses dynamic stochastic optimization problems, which were of particular interest to Professor Dantzig throughout his life, beginning with his first formulation of the two-stage stochastic program (Reference 7 in their paper). In this article, the authors provide an enhancement to decomposition methods for these problems that allows restricted sampling to achieve bounds used in a convergence test. The paper also provides computational results demonstrating improvement over previous approaches.

In the third paper by Forlizzi, Hromkovic, Proetti, and Seibert, the authors use results from the stability of approximations for the travelling salesperson problem (TSP) to obtain approximation algorithms with constant approximation ratios to find the least cost Hamiltonian path spanning a complete graph. We note that this paper in some sense continues another path from Professor Dantzig's early contributions with his 1954 paper on TSP approximation with Fulkerson and Johnson in the Journal of the Operations Research Society .

Sierksma and Tijssen's paper on simplex adjacency graphs, fourth in this issue, follows another line of research that extends not only from Dantzig's introduction of the simplex method, but also from his early work on degeneracy and its resolution with lexicographic orderings in his paper with Orden and Wolfe . In their paper, Sierksma and Tijssen provide results on the connectivity of graphs formed by adjacency in the simplex method.

The fifth paper by Gutin, Koller, and Yeo again reflects back to Dantzig's work on approximation of the TSP. In this paper, the authors show how to obtain bounds on the domination number of a heuristic, the maximum integer d such that the heuristic does not produce a tour worse than d tours.

The last paper in this issue by Gil, Baos, Montoya, and Gmez addresses the performance of different methods (simulated annealing, tabu search, and evolutionary algorithms) for practical problems in network partitioning. In this case, while Professor Dantzig did not work significantly with random algorithms and multiple objectives, we can find some early work on the duality of networks and their partitions in his paper with Fulkerson on the max-flow min-cut theorem .

George Dantzig's influence will continue to be felt on operations research, algorithms, and their applications for many years to come. We are proud to dedicate this issue to his memory.

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John R. Birge, Chicago
Abraham P. Punnen, Vancouver