Combinatorial optimization: Theory, computation, and applications

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Combinatorial Optimization: Theory, Computation and Applications

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This special issue of *Discrete Applied Mathematics* is devoted to ECCO XXVII-CO 2014, a joint conference of the *European Chapter on Combinatorial Optimization* (ECCO) and the *International Symposium on Combinatorial Optimization* (CO), a series of conferences that started in the UK in 1977. The conference took place at the Technical University of Munich in Germany, March 2–3, 2014.

ECCO XXVII-CO 2014 was a truly international event with 105 participants from 21 different countries. The scientific program included more than 80 talks on a broad range of subjects within combinatorial optimization. Subjects included integer programming, global optimization, multi-objective programming, exact and approximation algorithms, heuristics, and metaheuristics. There was also some focus on specific applications in logistics and supply chain optimization, manufacturing, energy production and distribution, bio-informatics, finance, and discrete and hybrid dynamical systems, and even a mini-workshop on discrete tomography.

Plenary lectures were given by Martin Grötschel (ZIB, TU Berlin, and MATHEON, Berlin, Germany) on *Combinatorial Optimization in Transport and Logistics*; David S. Johnson (Columbia University, USA) on *Open and Closed Problems in NP-Completeness*[1]; and Salvatore Greco (U Portsmouth,

[1] We are deeply saddened that David S. Johnson passed away on March 8, 2016; see, e.g., http://www.ifors.org/newsletter/ifors-news-june2016.pdf, p. 4, for an obituary.

UK and U Catania, Italy) on *Interactive Multiobjective Optimization using Dominance-based Rough Set Approach*.

The Scientific and the Organizing Committee of ECCO XXVII-CO 2014 were both chaired by Peter Gritzmann, TU Munich. Munich, the capital of Bavaria within the Federal Republic of Germany, is a very lively and fascinating city with its great Alpine vicinity. Of course, the conference program focused on the scientific exchange, addressing, however, the unity of brain, body and soul. In addition to a welcome reception in TU Munich's bel étage, with a splendid view over the city, the joy of the parabola slide in the mathematics building (see, e.g., `http://www.or.deis.unibo.it/staff_pages/martello/Martello.avi` ☺) and other treats, there was a guided tour through the residence of the former Bavarian emperors and a Bavarian style conference dinner at the Ratskeller below the city hall at the Marienplatz. More information (including a picture) can be found on `http://ifors.org/newsletter/sept2014-newsletter.pdf`, p. 8.

The ECCO conferences are held on a regular basis (once a year, in Spring) and are devoted to all aspects of combinatorial optimization. They are usually attended by around 100 participants and nicely combine scientific works and the exchange of new ideas within an exciting atmosphere. Since 2006, every forth year the ECCO annual conference is jointly organized with CO. The latest ECCO (and ECCO-CO) conferences (2000–) were held in Capri, Bonn, Lugano, Molde, Beirut, Minsk, Porto, Cyprus, Dubrovnik, Jerusalem, Malaga, Amsterdam, Antalya, Paris, and Munich. In the same period, twelve special issues dedicated to the ECCO conferences have appeared: eight in the *European Journal of Operational Research* ([2], [4], [5], [6], [7], [8], [9], [12]) and one in each of *Computational Optimization and Applications* [10], *Journal of Scheduling* [1], *Annals of Operations Research* [3], *Optimization* [11], and *Discrete Applied Mathematics* [13].

The present issue of *Discrete Applied Mathematics* is devoted to the presentation of a selection of papers presented at the conference (or submitted later by ECCO and CO members). Twenty-four manuscripts were submitted. After a thorough refereeing process, six papers have been accepted for publication. Their brief descriptions are given below.

Darmann, Pferschy, and Schauer consider a game theoretic variant of the shortest path problem. Two decision makers move together along the edges of a graph from a given starting vertex s to a given destination t. Taking turns, a player decides which edge both will traverse next; the cost is charged to the decider. The authors show that finding a minimum-cost path

is PSPACE-complete even for bipartite graphs. They also give polynomial time algorithms for directed acyclic graphs and for cactus graphs.

With a strengthened SDP relaxation in his polyhedral study for some well-studied vertex ordering problems such as the linear ordering problem and the traveling salesman problem, Hungerländer provides new polynomial-time convex approximations of these problems with a rich mathematical structure.

Lodi, Monaci, and Pietrobuoni study a variant of the 2-dimensional bin packing problem, in which items to be packed have to be obtained by a series of guillotine cuts and cannot be rotated. They present a heuristic algorithm based on some partial enumeration. On a large set of instances from the literature, their algorithm is able to produce proven optimal solutions for a large number of instances, and near optimal solutions for the remaining cases.

Obszarski and Jastrzębski study the edge-coloring of 3-uniform hypergraphs, a natural generalization of the classical problem of edge-colorings of graphs. They discuss various classes of hypergraphs with the aim of establishing the border between polynomial and NP-complete cases. It turns out that the problem is computationally difficult even for relatively simple classes of hypergraphs.

Rosat, Elhallaoui, Soumis, and Chakour study sequences of augmenting adjacent solutions to the set partitioning problem with a particular focus on the influence of normalization. The authors extend and strengthen the related decomposition theory, derive properties of the generic and specific convexity constraints, propose new normalization constraints and report on numerical results for scheduling instances.

Sarto Basso and Strusevich study the problem of minimizing a half-product function, a special form of a pseudo Boolean quadratic function. They show how to convert known fully polynomial-time approximation schemes to differential approximation schemes that can handle an additional linear knapsack constraint, thereby settling the issue of differential approximation for a range of scheduling problems.

References

[1] J. Błażewicz, V. Boljuncic, S. Martello, and J. Skorin-Kapov, editors. *Combinatorial Optimization*, volume 14 of *Journal of Scheduling*. 2011.

[2] R.E. Burkard, M. Labbé, M.T. Ramos, and J. Sicilia, editors. *Advances in Theory and Practice of Combinatorial Optimization*, volume 123 of *European Journal of Operational Research*. 2000.

[3] L.F. Escudero, S. Martello, and V. Strusevich, editors. *Computational Issues in Combinatorial Optimization*, volume 207 of *Annals of Operations Research*. 2013.

[4] L.M. Gambardella and S. Martello, editors. *Metaheuristics and Worst-case Guarantee Algorithms: Relations, Provable Properties and Applications*, volume 166 of *European Journal of Operational Research*. 2005.

[5] G. Hasle, A. Løkketangen, and S. Martello, editors. *Rich Models in Discrete Optimization: Formulation and Resolution*, volume 175 of *European Journal of Operational Research*. 2006.

[6] G. Improta and S. Martello, editors. *Graphs and Scheduling*, volume 142 of *European Journal of Operational Research*. 2002.

[7] M. Kovalyov and S. Martello, editors. *Combinatorics for Modern Manufacturing, Logistics and Supply Chains*, volume 189 of *European Journal of Operational Research*. 2008.

[8] J. Krarup and D. Pisinger, editors. *Feature Issue: ECCO XI*, volume 125 of *European Journal of Operational Research*. 2000.

[9] S. Martello and E. Pesch, editors. *Logistics: From Theory to Application*, volume 162 of *European Journal of Operational Research*. 2005.

[10] S. Martello and H. Vladimirou, editors. *Developments in combinatorial optimization*, volume 48 of *Computational Optimization and Applications*. 2011.

[11] S. Martello, G.-W. Weber, and R. Kasimbeyli, editors. *An Overview of Advances in Combinatorial Optimization Related Topics*, volume 62 of *Optimizaton*. 2013.

[12] J.-F. Maurras and S. Martello, editors. *Graphs and Scheduling*, volume 137 of *European Journal of Operational Research*. 2002.

[13] B. Ries and S. Martello, editors. *Advances in Combinatorial Optimization*, volume 196 of *Discrete Applied Mathematics*. 2015.