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To whom it may concern

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Report on the thesis of Denis Cornaz
“Structures and Duality in Combinatorial Programming”
presented in order to obtain the “Habilitation a Diriger des Recherches”

Denis Cornaz obtained his Doctoral degree from Université Pierre et Marie Curie Paris under the supervision of Professor Jean Fonlupt. He held postdoctoral positions as ATER at Université Pierre et Marie Curie and at France Télécom RD/CORE/ISS.

Between 2006 and 2009 he served Université Blaise Pascal as a maitre de conférences. He is currently maitre de conférences at Université Paris Dauphine, LAMSADE.

The first chapter of the thesis is devoted to a quick introduction to packing and covering problems for clutters.

Chapter 2 starts with a non-trivial generalization to all graphs of a theorem of Fishburn and Hammer characterizing biclique sets in bipartite graphs. It also provides an integer linear programming formulation for the minimum biclique cover problem in the natural variable space, and a polynomial-time cutting plane algorithm for solving the linear relaxation of the problem. Finally it is shown that these ideas, originally developed to deal with the minimum biclique cover problem, can be generalized to other problems.

Chapter 3 moves from classical Gallai identities for triangle-free graphs. It first presents a chromatic version of those identities, that are called chromatic Gallai identities. It is then shown that Chromatic Gallai identities are interesting for mathematical programming as they allow to improve Lovász' theta lower bound for coloring. A few other results are given. First, the author presents an application of Chromatic Gallai identities to a coloring problem originated from batch scheduling. Then he shows a link between the stable set polytope and that of clique-connecting forests, which are at the basis of chromatic Gallai identities. Finally, the last section deals with the selective coloring problem, and the author provides a characterization of selective perfect graphs.

Chapter 4 deals with min-max relations. First the author provides a linear description of the substar polytope with a TDI system. This leads to a generalization of Konig's edge coloring theorem: namely the author provides a min-max relation involving the maximum degree of a graph G and the minimum number of 2-matchings covering the edges of G . Another min-max

relation, involving multiflows, is given for characterizing series-parallel graphs. It is shown that a graph G is series-parallel if and only if the multicut polytope associated with G is TDI, refining therefore a previous result of Chopra.

Chapter 5 deals again with minimal forbidden structures in hypergraphs, such as forbidden minors or forbidden subgraphs, but the topic is no more graph theory. The authors shows in fact how those concepts can applied to social choice theory. A long list of open question closes the chapter and indeed the thesis.

The thesis shows that Denis Cornaz has a broad range of interests, both in the development of the theory of Integer Programming and Combinatorial Optimization and in the application of theoretical approaches for solving challenging problems arising from the real world. I believe that the most striking results are obtained in the area of Polyedral Combinatorics, however the thesis contains additional contributions on diverse topics in Integer Programming and Combinatorial Optimization, as well as in Graph Theory, Discrete Mathematics, Computational Social Choice etc.

The thesis is a valuable document for a researcher: although the topic is in my area of expertise, I read it with interest and I learned new results, interesting and useful lemmas.

Also the thesis shows that Denis has been able to collaborate very fruitfully with several prominent researchers as J. Fonlupt, A.R. Mahjoub, V. Jost, P. Meurdesoif, V.H. Nguyen, H. Kerivin, O. Spanjaard, and L. Galand.

I add that Denis is a gifted communicator: he gives very good presentations and it is always a pleasure to interact with him: he easily communicates his knowledge and enthusiasm.

Finally, Denis has already a very interesting record as a "supervisor" of young students. Together with Ridha Majoub he is currently supervising Y. Magnouche; in the past he has been able to interact with several young and promising researchers such R. Grappe, S. Borne, M. Lacroix and L. Slama, most of which are now maitre de conférences.

All these things considered, I think Denis Cornaz is a first rate researcher and, given his remarkable curriculum, I very strongly support his "Diplome d'Habilitation a Diriger des Recherches".

Sincerely yours,

Gianpaolo Oriolo

