

ELAVIO 2014 Report

Mirsad Buljubašić
Ecole des Mines d'Ales, LGI2P Research Center, Nimes, France
mirsad.buljubasic@mines-ales.fr

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1 ELAVIO 2014

The Latin American Summer School on Operations Research (ELAVIO - Escuela Latinoamericana de Investigacin en Verano Operation) is organized by the Latin American Society for Operations Research (ALIO). Eighteenth edition of ELAVIO took place in Areia, Brazil from 17. - 21. February 2014. About 60 students and researchers participated in presentations, discussions, tutorials and lectures by internationally renowned professionals. Additional information may be found at <http://www.ci.ufpb.br/eventos/elavio2014>.

2 My activities during the school

I have participated in ELAVIO 2014 as one of the students sponsored by the Association of European Operational Research Societies(EURO) (http://www.euro-online.org/media_site/CfP/ELAVIO_2014_CfC.pdf). The program of the summer school consisted mainly of:

- Tutorials
- Lectures
- Technical Sections - participants presentations

2.1 Tutorials

Five tutorials on different topics in Operations Research have been given. Each tutorial had a total duration of three hours, divided into two periods. Summary of all tutorials is given below.

Discrete facility location problems: an overview , Juan G. Villegas

Facility location constitutes a broad spectrum of mathematical models, methods, and applications in operations research. Basic variants of discrete facility location problems have been introduced and most used methods for solving these variants have been explained. Several real life problems modeled as a facility locations are illustrated.

Graph classes and optimization problems, Flavia Bonomo

This tutorial concerns several structural properties of well known graph classes and their use in solving strategies for optimization problems like maximum clique, maximum independent set, minimum dominating set, graph coloring and minimum clique-cover. The classes that are reviewed are trees, block graphs, chordal graphs, interval graphs and cographs.

Lagrangian Relaxation, Luidi Gelabert Simonetti

Several difficult problems can be divided into problems with some restrictions that complicate the problem. The Lagrangian relaxation idea is to eliminate such restrictions and penalize the objective function if they are not respected. This method is very simple and can be used for dual and primal bound in several problems. Because of its ease and quality it is widely used as an alternative to the linear relaxation of a problem.

Cutting Planes for Integer Programming, Manuel Bezerra Neto Campelo

In these lectures, we study cutting planes for linear mixed integer programming, including Gomory cuts, Mixed Integer Rounding (MIR) cuts, split cuts, disjunctive cuts, intersection cuts. Special attention will be given to Multiple Row cuts.

Hybrid Constraint Programming / Mathematical Programming Methods, Philippe Michelon

Issued from Artificial Intelligence, Constraint Programming is an alternative tool for solving combinatorial optimization problems (and even global optimization problem). It has been very successfully used for scheduling, allocation and planning (among others) problems. After introducing the main concepts of Constraint Programming, the difference and the complementarity that exist between Constraint programming and Integer Programming is addressed. How both approaches can help each other in solving Combi-

natorial Optimization Problems has been illustrated after.

I have attended all five tutorials. I found the tutorials on Facility location problems and Hybrid CP/IP methods the most interesting and useful. Tutorial about graph is interesting, but it does not have many similarities with my research interests. Tutorial on Cutting planes was too technical and difficult to follow. I had an opportunity to ask some questions about these topics and, in general, I am satisfied with these tutorials and the topics covered in them. It would be better if we had more time to think about these problems and maybe do some exercises, but the schedule of the summer school (only five days) did not allow much of that.

2.2 Lectures

Two lectures have been given. Duration of each lecture is 1,5 hours and it is very similar to tutorials. Summary of lectures is given below.

Efficient methods for solving Vehicle Routing Problems, Luiz Satoru Ochi

In this talk the current state of art in terms of heuristic algorithms and hybrid methods in solving Vehicle Routing problems (VRP) is presented. The study is based on significant results obtained by the research group in Intelligence Computational and Combinatorial Optimization (LABIC) of the Institute of Computing of the Federal Fluminense University (UFF-IC) for different variants of the VRP, including spatial and/or temporal constraints. Heuristics and meta-heuristics are presented that have proven most efficient for this class of problems, as well as hybrid versions combining meta-heuristics with exact techniques of Mathematical Programming.

On Complex Scheduling Problems and Some Applications, Rosiane de Freitas

Problems of scheduling tasks and resources is one of the most important and representative classes of problems of the multidisciplinary field of Operations Research (OR), having a great theoretical framework of models, methods and properties. In general, a problem of scheduling is to allocate a set of activities (tasks) to certain resources (machines), usually scarce, while optimizing one or more (objective function) criteria. Problems of assignment and timetabling, for example, may be viewed as special classes

of problems of scheduling. This lecture summarized the classic scheduling problems, classical objective functions (regular or not), with emphasis on late penalties delays and tasks of arbitrary processing times, independent or not (with precedence constraints, among other restrictions. Also, mathematical formulations and exact and approximate algorithmic strategies, obtaining important results generated by the Brazilian group that operates in this area (involving researchers from UFAM, UFF and UFRJ) have been presented.

I found the lectures very interesting and well presented. I am a bit familiar with the topics and I have done some work in related topics before. The most useful was the opportunity to ask some questions related to the topics.

2.3 Technical Sections - participants presentations

The ELAVIO is planned with seven parallel Technical Sessions. The presentations of the technical sessions are held by students attending the event. The presentation time was 15 minutes for each student.

I have presented a work done with my PhD co-advisor Haris Gavranović entitled "Local Search for Google Machine Reassignment problem".

I have attended about 30% of presentations (presentations have been made in parallel in different rooms). I have tried to choose the presentations that have some similarities to my research interests or the presentations that could be interesting. Some of the presentations that I have attended are:

- Heuristic for a Multi-objective Job-Shop Scheduling Problem
- Matheuristic approach for the Pollution-Routing problem
- Depth-First GPGPU Branch-and-Bound Algorithms: a case study on the asymmetric traveling salesman problem
- Multi-depot Vehicle Scheduling Problem in urban public transportation with large instances
- The penalty-free heterogeneous p-median problem: formulations and algorithms
- On the frequency assignment to hard-real time tasks of multicore systems.

- On the storage space allocation problem
- The Multi-Phase Distribution Problem
- Solving the High School Timetabling Problem by using a Fix-and-Optimize heuristic combined with a Variable Neighborhood Descent method

3 Benefits

Some of the benefits from my participation in ELAVIO 2014 are:

- Learning the fundamentals of some important techniques for solving combinatorial optimization problems. Most of the courses were general, but teachers were open for a more detailed discussion
- Meeting with people that work in the same (or similar) research field was very nice and useful. The environment of a summer school is a big advantage and summer school is one of the rare opportunities for such meetings. ELAVIO has a pleasant climate of fellowship among participants from different countries
- Building friendships and possibly establish relationships with some participants for future networking. I have stayed in contact with some of the participants and I hope that we could establish a research (or social) connection in the future
- Gaining experience in presenting and discussing my own research. Presenting the work at ELAVIO was a good presentation exercise