Project title: Solution methodologies for binary quadratic optimization problems

Location: Montreal and Quebec City, Canada

Supervisors: Leandro Coelho (Université Laval) and Franklin Djeumou Fomeni (Université du Québec à Montréal)

Start date: 1 January 2022
Application deadline: 15 August 2021
Duration: 4 years

Summary of the project:

Binary Quadratic Optimization (BQO) is a special class of discrete optimization, which amounts to optimizing a quadratic objective function of binary decision variables subject to a set of linear constraints. Some applications of BQO include portfolio optimization, projects selection, sustainable development, facilities location and vehicle routing problems. BQO problems are known to be very challenging to solve due to the non-linear nature of their objective functions and the discrete nature of their decision variables. Indeed, even simple special cases of BQO, such as the quadratic knapsack problem, the quadratic assignment problem, etc., are known to be strongly NP-hard. The aim of this research project is to develop a host of innovating solution methodologies for solving BQO problems. These methodologies will include heuristic, meta-heuristics and exact algorithms. Some of the techniques to be used include, but not limited to, dynamic programming, cutting planes, polyhedral studies, branch-and-cut and decision diagram.

We invite applications from highly motivated candidates for full-time PhD or Postdoc positions to develop advanced methodologies for solving BQO problems and use them for some applications in finance, in energy and in transportation.

Work environment:
The successful candidates will be jointly supervised by Leandro Coelho (professor at Université Laval in Quebec City) and Franklin Djeumou Fomeni (professor at Université du Québec à Montréal, UQAM, Montreal). They will also have the opportunity to become members of both GERAD (www.gerad.ca) and CIRRELT (www.cirrelt.ca).

Qualifications:
Masters in Operations Research or equivalent
Knowledge of optimization methods (e.g.: heuristics, linear programming)
Programming skill: C/C++ (preferred) or Python/Matlab

Conditions:
A financial support of up to 22 000$ per year for PhD. For postdoc, it will be comensurate with experience

Required documents:
Degrees certificates, Academic transcripts, CV, Cover letter and two reference letters

To apply: Email all documents to djeumou_fomeni.franklin@uqam.ca / leandro.coelho@fsa.ulaval.ca