



## An Introduction to Metaheuristics



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**Wednesday, October 5th, 2016  
11:00-12:30 pm EDT**

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### Presentation Abstract

For thirty years, approximate solution approaches known as **metaheuristics** have been the most used methods to tackle difficult combinatorial problems, such as vehicle routing problems, network design, production scheduling, exam timetabling, and many others.

Metaheuristics have been traditionally divided into two broad families: **trajectory-based methods**, in which at any time a single “current” solution is modified (and, hopefully, improved!), and **population-based methods**, which rely on the simultaneous consideration of a large group of candidate solutions. Trajectory-based methods include, among others, techniques, such as simulated annealing, tabu search, variable neighborhood search, etc. The most famous population-based methodology is genetic algorithms, but there are other effective evolutionary solution methods. Nowadays, the distinction between the two families is becoming more and more blurred, since the most effective approaches normally combine algorithmic features of both.

In this talk, after a short historical introduction, I will review the main concepts underlying the most popular techniques. In each case, I will attempt to explain the underlying rationale for the various algorithmic constructs. I will also present in more detail a state-of-the-art metaheuristic developed by a team of CIRRELT and collaborators: Unified Hybrid Genetic Search, which has proved extremely effective for a wide range of vehicle routing problems and which could be applied to a wide range of problems. I will also discuss some of the problems that can be encountered in the development of metaheuristics and why they are not a panacea.

### About the Webinar Series

The **BRIDGE** webinar series is designed to prepare for the next generation of big data analytics, woven into transdisciplinary and intersectoral sciences, policy and innovation, and serving as catalyst for solutions at scale to better address the seemingly intractable problems that lie at the nexus of health and wealth production, distribution and consumption. A key to accelerate change lies in establishing bridges between sectoral big data, and between data and content. To foster real time learning, the **BRIDGE** webinar series brings together a new solution-oriented transdisciplinary translational paradigm for the four *Ms* of big data sciences used on both sides of the health and economic divide (*Machines, Methods, Models and Matter*).