Twelfth DIMACS Implementation Challenge: Vehicle Routing Problems
Held in Memory of David S. Johnson

Implementation Challenges trace back to the early years of DIMACS and to the vision of David S. Johnson to use experimentation as a companion to theory to gain more holistic perspective on the performance of algorithms. The over-arching purpose of a Challenge is to assess the practical performance of algorithms for a particular problem class, while fostering interactions that transfer ideas between research areas related to algorithms, data structures, implementation, and applications. Under Johnson's guidance, the eleven DIMACS Implementation Challenges spurred algorithmic advances and helped define the field of experimental computing. DIMACS proposes to hold the Twelfth DIMACS Implementation Challenge in honor of David S. Johnson on the topic of Vehicle Routing Problems.

Dispatch problems, such as the Vehicle Routing Problem (VRP), have been widely studied for over fifty years because they are of both practical relevance and theoretical interest. Designing efficient routes for vehicles performing distribution or service functions translates directly to cost savings, making vehicle routing a topic of great commercial interest. Moreover, the fact that it generalizes the Traveling Salesman Problem, but is substantially more difficult, has kept it in the sights of theoreticians for decades. The VRP exists in a myriad of variations that arise from practical considerations like vehicle capacities, delivery time windows, delays in road networks, and the ability to split deliveries.

Because of the expansive problem space, it is now common practice to evaluate new solution methods with respect to multiple VRP variants with different attributes rather than a specific variant. The VRP Implementation Challenge will support this by targeting a mix of classic VRP variants and newer variants inspired by practical considerations. The Challenge will address 7-10 problem variants, including some of the most challenging of the VRP family. These problems focus on features that are critical to bridging the gap between application and practice but that lead to different structural characteristics favoring different solution approaches. Classic variants addressed will include: 1) Capacitated VRP (CVRP); 2) VRP with Time Windows (VRPTW); 3) Inventory Routing Problem (IRP); and 4) VRP with Split Deliveries (VRPSD). CVRP and VRPTW are fundamental problems that have been studied for decades, while IRP and VRPSD are notoriously difficult for exact algorithms and offer potential for improved heuristics and insights from theory. Newer variants will add essential practical features and may include: 5) Capacitated Arc Routing Problems in realistic city networks; 6) VRP with Transshipment or Transfer Facilities; 7) Online VRP in Mobility-on-demand; and 8) Stochastic VRPs. These VRP variants have true structural differences. We invite participants to submit instances or additional variants for potential inclusion. While we expect some common ideas to be applied across all problems, there will also be some important and necessary differences between methods, creating a rich and multi-faceted exchange throughout the event.

The Challenge will leverage existing problem test sets and augment them with larger and more challenging instances, develop new test cases based on real transportation networks and city maps, and explore methods for benchmarking and comparing performance in dynamic and online settings.

The Challenge will conclude with a workshop held at DIMACS at Rutgers University. Teams participating in the Challenge should plan to present their work during the workshop. The workshop will pay tribute to the many contributions of David S. Johnson during a special banquet and related social activities.

The Challenge organizers bring vast expertise in experimenting with algorithms, both broadly and in the specific context of vehicle routing. The Organizing Committee members are: Catherine McGeoch (D-Wave Systems), Jorge Mendoza (HEC Montreál), Panos Pardalos (University of Florida), Mauricio Resende (Amazon), Eduardo Uchoa (Universidade Federal Fluminense), and Thibaut Vidal (Pontifical Catholic University of Rio). DIMACS has a long history of organizing and hosting research workshops and will contribute to the goals of outreach to diverse participants and dissemination to a wide audience of researchers and students.

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