

The Tour-Library (TOURLIB.DLL)

The Tour-library is a standard software library for Windows (dll) that can be called and used from most programming languages (C++, Java, Delphi, C, VB, C#, etc.). It contains a number of file reading/writing routines to get the problem specification and to write solutions in a compact and readable form as well as pictural solution output. It also contains a number of routines that allow one to store, retrieve, transform and build different variants of tour and routing problems. The core, however, are the solution procedures of a TSP (Traveling Salesman Problem) and similar routing problems either by mathematical model optimization or general heuristics that find an approximate solution with hundreds of locations.

The TSP problem can be described as following: Given a number of locations and a number of connecting routes between these locations, find the cost minimal round trip that visits each location exactly once and returns to the location where the tour started.

There exist a number of variations of the TSP problem which are very important from a practical point of view and it would be very cost efficient in using them in the context of transportation of goods etc. Suppose a distributor of electric material has a huge warehouse that stores all articles at one place (location). He must deliver various clients each day. He must decide now in which order the clients have to be visited by his trucks in order to traverse the total minimal distance for all trucks. Using sophisticated mathematical methods to solve such problems can make a difference of 10% and more of the whole transportation costs (from not using them). Such a distributor in Switzerland has total transportation costs of sFR 10'000'000.-- per year. A reduction of 10% is a pure benefit of 1'000'000.-- per year. This is a real example!

Different practically relevant variants of the TSP problem are as follows:

- The CVRP (Capacitated Vehicle Routing Problem): A number of vehicles with a given capacity deliver or collect goods at a number of clients. Each vehicle leaves the depot and visits and number of clients and return to the depot.
- The TSPTW (round-trip with time windows: The clients have to be visited within given time windows.
- The BH problem (backhaul): A vehicle must first visit the clients to deliver goods before it can collect good.
- The PDP problem (pickup and delivery): A vehicule load goods at a particular place and unload it later on another place.

These various variations are all integrated in the Tour-library.

The main features of the Tour-library are:

- Reading problem specification from various sources (direct from Excel sheets or the well-known TSPLIB library in the Internet),
- Unified specification of various types of routing problems: TSP, TSPTW, BH, PDP, CVRP, etc. (time windows, backhaul, pickup and delivery, capacity vehicle routing).
- Very flexible and powerful linking to commercial and non-commercial solvers, linking eventually directly to Internet solvers,
- Also includes also fast heuristic method to find good solutions,
- Easy to use callback functionality of the library to log the progress of the optimization and to stop the optimizer at any time,
- Full integration of the LPL mathematical modeling environment in order to run large mathematical models,
- Very modular in the sense that additional solution methods can be added on the fly,
- Standard library that can be integrated into various programming applications, called by various programming languages (C++, Java, Delphi, C, VB, C#, etc.).