Solving a 2-depot driver-and-vehicle routing problem

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This paper deals with a routing problem arising when planning the sequence of legs that each crew and aircraft of an airline company must perform. This is a real-world problem in Canary Island, where the airline operates flights between 10 airports. There are no flights during the night, there are about 180 flights (legs) during a day, and the flying time between two airports is around 30 minutes. The crews of the airline company live in the two major islands (Tenerife and Gran Canaria). The airport of Gran Canaria concentrates all the equipment to perform the maintenance of the aircrafts, which must be performed immediately after two operating days. Thus, an aircraft starting the journey outside Gran Canaria must finish in Gran Canaria. Instead, each crew is expected to return to the island where it started that day. There is no limitation on the number of legs that an aircraft can fly in a day, but the number of legs assigned to a crew in a day is limited by law. There is also a limitation in the activity time of each crew in a day. The aim of the problem is to find a sequence of legs to each crew and each aircraft minimizing a cost function while satisfying the above constraints.

The above problem can be seen as a routing problem with 2 depots, where one must find routes to crews (drives) and to aircrafts (vehicles). The crew routing subproblem is the classical Capacitated VRP with 2 depots. The aircraft routing subproblem aims finding uncapacitated paths between the 2 depots. The routes from the two subproblem must coincide as much as possible. The whole problem is a 2-depot vehicle routing problem with driver exchanges.

We give a mathematical formulation of the whole routing problem and a branch-and-cut algorithm to solve it. The performances of our implementation is evaluated and discussed on real-world instances.