

One Problem, Two Structures, Six Solvers and Ten Years of Personnel Scheduling.

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Abstract. The shift-scheduling problem was originally introduced by Edie in 1954 in the context of scheduling highway toll booth operators. It was solved a short time later, by Georges Dantzig, using a set covering formulation. However, the Multi-Activity Shift Scheduling (MASSP) version of that problem, where one not only needs to schedule when employees are working or resting, but more precisely, what activity they are performing, still remains a challenge. During this invited lecture, we will recall the turning points of this 60-year journey, focusing particularly on the efforts of the last decade to solve MASSPs. We will cover the introduction of the Regular, and two years later, the Context-free Grammar constraint. We will discuss how the structures of these two constraints were exploited by several researchers in Constraint Programming, Integer Programming, Dynamic Programming embedded in Large Neighbourhood Search and Branch-and-Price, Hybrid CP-MIP Branch-and-Bound, as well as Lazy Clause Generation. The industrial importance of these techniques will also be discussed.