Fixed-parameter tractable algorithms for the Workflow Satisfiability Problem with user-independent constraints

The Workflow Satisfiability Problem (WSP) is a problem that arises whenever tasks/steps of a process need to be performed by authorized users, subject to constraints defined by business rules. We are required to decide whether there exists a valid plan, i.e. an assignment of tasks/steps to authorized users such that all constraints are satisfied. The problem is NP-hard even when restricted to the simple separation-of-duty constraints. However, the number of steps k is usually small in practice, and it's natural to consider WSP parameterized by k. In this case, WSP is not fixed-parameter tractable (FPT) in general, but several subclasses of WSP have been shown to be FPT. We provide a generic algorithmic framework with encodings of equivalence classes of (partial) solutions and devise FPT algorithms to solve the problem. We describe two efficient implementations of this FPT algorithmic approach in case of user-independent constraints, and discuss their performance in comparison to a reduction to the pseudo-Boolean SAT problem solved by a generic off-the-shelf PB SAT solver.