Using pure integer solutions to solve the travelling salesman problem

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The *travelling salesman problem* (*TSP*) is one of the most studied combinatorial optimization problems. Given a complete graph $G = (V, E)$ and distances $d\colon E(G) \to \mathbb{R}_0^+$, the *TSP* asks for a shortest tour with respect to the distances d.

There are many approaches to solve this problem to optimality. The best of them are based on the *ILP* formulation and use the *branch-and-bound-and-cut* technique. Usually the *integrality constraints* are relaxed first and all separation processes are done on *fractional solutions* (see e.g. [1]).

In our approach we never interfere with fractional solutions but leave those to the ILP-solver. Considering that current ILP-solvers have an impressive performance, we relax the *subtour constraints* only, solve the problem to the optimality, add the violated constraints and repeat the process until a feasible solution is found. Further, in order to speed up the algorithm and to decrease the number of necessary solver runs, we introduce more preprocessing strategies which find some of the needed subtour inequalities.

Finally, we present some computational results on the instances taken from the TSPLIB95 [2].

Keywords. Travelling salesman problem; branch-and-bound

References

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[2] R. Reinelt, TSPLIB95, `http://comopt.ifi.uni-heidelberg.de/software/TSPLIB95/`, 1995.

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