Heuristic Approaches to the capacitated Square Covering Problem

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Abstract: We consider the capacitated square covering problem (CSCP), which is described as follows. Given a set of points, each having a demand, in the two-dimensional Euclidean plane, we find the minimum number of squares with the same size and capacity to cover all the points under the capacity constraint. As CSCP is NP-hard, we focus on heuristic algorithms in this paper. We first test a set covering approach, in which a CSCP is solved as a set covering problem. Since its performance is not always satisfactory, though it works quite well for a certain type of instances, we then propose a more metaheuristic approach. In this approach, starting with a feasible solution using a rather large number of squares, we remove squares one by one. After each removal of a square, the resulting infeasible solution is repaired by a local search method so that is becomes feasible. To increase the performance, we incorporate the idea of tabu search and scatter search as well as adaptive control mechanism of penalty weights. Computational results on randomly generated instances with up to 1600 points indicate the effectiveness of our approaches.