Hybrid elitist-ant system for a symmetric traveling salesman problem: case of Jordan

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This work investigates the performance of a hybrid population-based meta-heuristic with an external memory structure of a hybrid elitist-ant system (elitist-AS). This memory is known as an elite pool, which contains high quality and diverse solutions to maintain a balance between diversity and quality of the search. This may guarantee the effectiveness and efficiency of the search, which could enhance the performance of the algorithm across different instances. A very well known and intensively studied NP-hard optimization problem has been selected to test the performance of the hybrid elitist-AS via its consistency, effectiveness and efficiency. This famous problem is the symmetric traveling salesman problem. The elitist-AS is a class of ant colony optimization techniques which are known to be outstanding for the traveling salesman problem where they have the ability to find the shortest tours guided by the heuristic and the pheromone trail information. An iterated local search is combined with elitist-AS to intensify the search around elite solution and maintains the solution's exploitation mechanism. Experimental results showed that the performance, compared to the best known results, is optimal for many instances. This finding indicates the effectiveness, efficiency and consistency in diversifying the search while intensifying high-quality solutions. This outstanding performance is due to the utilization of an elite pool along with diversification and intensification mechanisms. In addition, this work proposes two instances that consist of 26 Jordanian cities and 1094 Jordanian locations which have been generated based on coordinates and distances similar to the format of the selected symmetric traveling salesman problem. This step is meant to contribute to finding a solution for a real-world problem and further test the performance of the hybrid elitist-AS.