

# Start Strategies of ACO Applied on Subset Problems

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Many combinatorial optimization problems are fundamentally hard. This is the most typical scenario when it comes to realistic and relevant problems in industry and science. Examples of optimization problems are Traveling Salesman Problem, Vehicle Routing, Minimum Spanning Tree, Multiple Knapsack Problem, etc. They are NP-hard problems and in order to obtain solution close to the optimality in reasonable time, metaheuristic methods are used. One of them is Ant Colony Optimization (ACO).

ACO algorithms have been inspired by the real ants behavior. In nature, ants usually wander randomly, and upon finding food return to their nest while laying down pheromone trails. If other ants find such a path, they are likely not to keep traveling at random, but to instead follow the trail, returning and reinforcing it if they eventually find food. However, as time passes, the pheromone starts to evaporate. The more time it takes for an ant to travel down the path and back again, the more time the pheromone has to evaporate and the path to become less prominent. A shorter path, in comparison will be visited by more ants and thus the pheromone density remains high for a longer time. ACO is implemented as a team of intelligent agents which simulate the ants behavior, walking around the graph representing the problem to solve using mechanisms of cooperation and adaptation.

Our novelty is to use estimations of start nodes with respect to the quality of the solution and thus to better manage the search process. On the basis of the estimations we offer several start strategies and their combinations. Like a benchmark problem is used Multiple Knapsack Problem (MKP), which is a representative of the class of subset problems, because a lot of real world problems can be represented by it and MKP arise like a subproblem in many optimization problems.