The Monte Carlo Tree Search (MCTS) algorithm has recently proved to be able to solve difficult problems in the field of optimization as well as game-playing. It has been able to address several problems that no conventional techniques have been able to solve efficiently. In this thesis we investigate possible ways to use MCTS in the field of planning and scheduling. We analyze the problem theoretically trying to identify possible difficulties when using MCTS in this field. We propose the solutions to these problems based on a modification of the algorithm and preprocessing the planning domain. We present the techniques we have developed for these tasks and we combine them into an applicable algorithm. We specialize the method for a specific kind of planning problems - the transportation problems. We compare our planner with other planning system.