Heuristics for NP-hard Optimization Problems - Simpler is Better!?

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***Abstract*—Transportation and location problems are among the most studied problems in combinatorial optimization and operational research. Even the most simply stated problems such as the traveling salesman problem are known to be NP-hard, which roughly speaking means that there is no practical optimization algorithm provided the famous P≠NP conjecture is correct. The question is among the most challenging theoretical problems that was included into a list of seven millennium problems. Practical problems are usually more complex as we have to take into account various additional constraints and goals when designing a model. Knowing the problem is computationally intractable implies that we may use heuristics approaches and that we also should aim to find a nearly optimal solutions for which sometimes but not always approximation bounds can be given. It is well known that best results a obtained when a special heuristics is designed and tuned for each particular problem. This means that the heuristics should be based on considerations of the particular problem and perhaps also on the properties of the most likely instances. On the other hand, it is useful to work within a framework of some (one or more) metaheuristcs which can be seen as a general strategies to attack an optimization problem. Hundreds of research papers were published on general and even on particular heuristics, for example evolutionary algorithms, ants algorithms,… even neural networks, to name just a few.**

In the talk I will provide several examples by which I will try to show that also here "simpler is better". More precisely, I claim that local search, the most basic metaheuristics, is a very competitive choice. For generation of a starting solution(s), (careful) greedy heuristics should be at least considered as one of possibilities. Examples include the traveling salesman, resource-constrained project scheduling, channel assignment, and bounds for the Shannon capacity.

***Key words*— Heuristics, optimization, traveling salesman problem.**

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