Heuristics for optimal data arrangement problem on a tree

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This master thesis deals with the *data arrangement problem on complete d-ary trees* (*DAPTree*). The goal of the *DAPTree* is the embedding of the nodes of a given undirected (unweighted) graph G onto the leaves of a given complete d-ary tree T, so as to minimize the overall sum of the distances between any two leaves of T which correspond to an edge of G. Similarly as the *linear arrangement problem* (*LAP*) the *DAPBaum* is an *NP-hard* special case of the well investigated *graph embedding problem* (*GEP*).

In this thesis we present some *heuristics* for the DAPTree and analyse their performance over a *set of test instances*, while hoping that these investigations could serve as a first basis for further research work on the DAPTree.

In the first chapter we *state the problem* and describe some *problem specific properties*. Then we introduce a *lower bound* which is a generalization of an already known lower bound for the LAP.

In the next chapter we introduce some *heuristics* for the DAPTree and test their *performance on a class of random graphs*. As an important result of this thesis we give a closed formula for the *expected value* and the *variance* of the objective function value of a random arrangement over a special class of graphs. Further we present some *Greedy-like heuristics* and some *local search* heuristics.

At the end we focus on some *polynomially solvable special cases* of the problem.

All heuristic approaches are illustrated by *examples*. We have also generated a *set of test instances* which allows us to compare the performance of the proposed heuristics on different types of test instances. This kind of analysis could be relevant in case of a practical application of the presented heuristics.

Keywords. Embedding; embedding problem; arrangement; heuristic; greedy; local search; combinatorial optimization; random graph

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