Evaluating heuristics via search tree size estimation

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D. A. Knuth has pointed out that the size and the profile of the search tree associated with a given back-track algorithm can reasonably be well estimated by certain random exploration. We propose to use this random exploration technique to estimate the computational costs such as running time in connection with an exhaustive back-track search. Many combinatorial optimization problems resort on exhaustive searches. From reason of practicability it is necessary to combine the search with various heuristic principles. The possibility of estimating the running time of a search without actually carrying out the computation is far reaching and be can be exploited beneficially. Usually there are more than one choice for a particular component of an algorithm. In other words there maybe competing candidates to employ as a part of an algorithm to produce a certain effect. In these cases one can base the choice between the contenders on the estimations of the respective running times.

We will compile a battery methods to overcome a given obstacle or accomplish a certain result in the course of a computation. We do not decide which technique should be used a priory. Rather we estimate the running times of the task under each scenario in running time (on line) and we place our bet on the fastest. We will illustrate the methodology in connection with the k-clique problem as a typical example of a computationally challenging, NP-complete combinatorial optimization problem. Based on the Carraghan–Pardalos algorithm [1] one can choose among several different coloring techniques as heuristics for cutting off the branches of the search tree. Such are the b-fold coloring [5], triangle-free and s-clique free colorings [3] and special edge colorings [4]. Also rearranging the branches can result in reducing the size of the search tree [2].

References

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