

The many faces of binary search trees

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Abstract

The topic of the presentation is the classical problem of searching for keys in a binary search tree (BST) with rotations. Our current understanding of the power and limitations of this model is incomplete, despite decades of research. The proven guarantees for the best known algorithms are far from the conjectured ones. We cannot efficiently compute an optimal sequence of rotations for serving a sequence of queries (even approximately and even with advance knowledge of the input), but we also cannot show this problem to be difficult. Sleator and Tarjan conjectured in 1983 that Splay-tree, a simple online strategy for tree re-arrangement is as good, up to a constant factor, as the theoretical optimum, for every input. This is the famous dynamic optimality conjecture.

In the talk I overview some recent related results, in particular: (i) a broad family of BST algorithms that generalize Splay and match many of its proven efficiency-properties, (ii) a broad family of query sequences (defined by their pattern-avoiding properties) that can be efficiently served in the BST model, (iii) new connections between the BST problem and various geometric and combinatorial problems.

The talk is based on the following papers:

- [1] Self-Adjusting Binary Search Trees: What Makes Them Tick?, ESA 2015 with Parinya Chalermsook, Mayank Goswami, Kurt Mehlhorn, Thatchaphol Saranurak.
- [2] Pattern-avoiding access in binary search trees, FOCS 2015 with Parinya Chalermsook, Mayank Goswami, Kurt Mehlhorn, Thatchaphol Saranurak.
- [3] Binary search trees and rectangulations, Manuscript, 2016 with Thatchaphol Saranurak.

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