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Enumeration and Compact Encoding of AVL Trees

An AVL tree is a type of self-balancing binary search tree commonly used in computer science. From an enumerative perspective, an AVL tree is a rooted planar binary tree such that the heights of the left and right subtrees at any node differ by at most one. Because AVL trees are most easily recursively decomposed by height instead of by number of nodes, their enumeration is more difficult than other classes of recursively defined trees.

Motivated by a desire to derive the information-theoretic lower bound on the number of bits needed to encode an AVL tree, we develop a new method for the study of combinatorial classes whose generating functions satisfy certain functional equations and use this tool to derive the growth rate of AVL trees and related structures. We also describe a new encoding for AVL trees that uses less than one bit per node.

Joint work with Stephen Melczer, J. Ian Munro, and Ava Pun.