

DEPTH IN BUCKET RECURSIVE TREES WITH VARIABLE CAPACITIES OF BUCKETS

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Abstract: We consider bucket recursive trees of size n consisting of all buckets with variable capacities $1, 2, \dots, b$ and with a specific stochastic growth rule. This model can be considered as a generalization of random recursive trees like bucket recursive trees introduced by Mahmoud and Smythe [1] where all buckets have the same capacities. In this work we provide a combinatorial analysis of these trees where the generating function of the total weights satisfies an autonomous first order differential equation. We study the depth of the largest label (i.e., the number of edges from the root node to the node containing label n) and give a closed formula for the probability distribution. Also we prove a limit law for this quantity which is a direct application of quasi power theorem and compute its mean and variance. Our results for $b = 1$ reduce to the previous results for random recursive trees.

Key words: bucket-increasing tree, bucket-recursive tree, exponential generating function, complete and incomplete nodes, depth.

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