

## Prof. Michael Fuchs / Department of Applied Mathematics

Analytic Combinatorics, Discrete Probability Theory, Analysis of Algorithms, Mathematical Biology, Metric Number Theory

My research work is concerned with several areas in Discrete Mathematics such as Combinatorics, Discrete Probability Theory and Number Theory. Most of the problems I worked on in recent years arose either from Theoretical Computer Science or Biology (for two figures concerning an area in Algorithms and Data Structures I worked on over the last couple of years see below). A practical problem must normally have at least two of the following three flavors in order that it sparks my interest: (i) combinatorial, (ii) probabilistic, or (iii) analytical. On the theoretical side, I am interested in counting problems in Combinatorics and Metric Diophantine approximation.

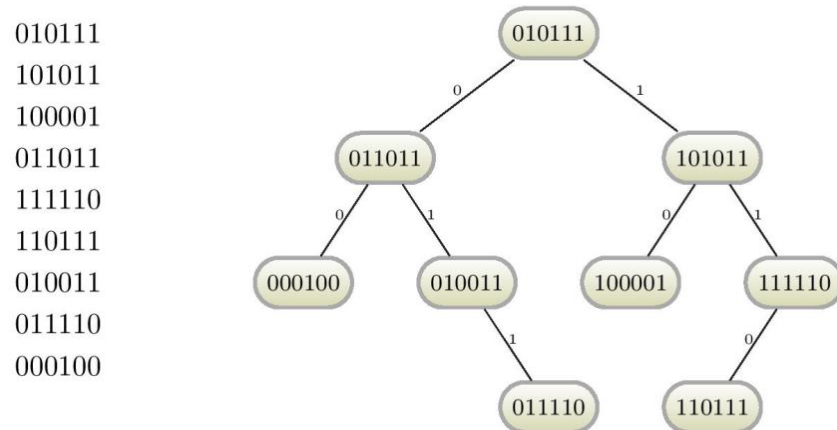


Figure 1: A digital search tree (DST) of 9 nodes

Let

$$G_2(\omega) = Q_\infty \sum_{j,h,\ell \geq 0} \frac{(-1)^j 2^{-\binom{j+1}{2} + j(\omega-2)}}{Q_j Q_h Q_\ell 2^{h+\ell}} \varphi(\omega; 2^{-j-h} + 2^{-j-\ell}),$$

where  $Q_n := \prod_{j=1}^n (1 - 2^{-j})$ ,  $Q_\infty := \lim_{n \rightarrow \infty} Q_n$  and

$$\varphi(\omega; x) = \begin{cases} \frac{\pi(1 + x^{\omega-2}((\omega-2)x + 1 - \omega))}{(x-1)^2 \sin(\pi\omega)}, & \text{if } x \neq 1; \\ \frac{\pi(\omega-1)(\omega-2)}{2 \sin(\pi\omega)}, & \text{if } x = 1. \end{cases}$$

Figure 2: Function from the analysis of the variance of the total path length of a DST (Fuchs, Hwang, Zacharovas; 2010)