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Representation of integers base d with digits $0, 1, \cdots, q-1$

Let d and q be positive integers, and consider representing a positive integer n with base d and digits $0, 1, \cdots, q-1$. Clearly if $q < d$, then not all positive integers can be represented. If $q = d$, every positive integer can be represented in exactly one way. If $q > d$, then there may be mutliple ways of representing the integer n. For example, if $d = 2$ and $q = 3$ we might represent 6 as $110 = 1 \cdot 2^2 + 1 \cdot 2^1 + 0 \cdot 2^0$ as well as $102 = 1 \cdot 2^2 + 0 \cdot 2^1 + 2 \cdot 2^0$. (This list is not complete.) Let $f_{d,q}(n)$ be the number of representations of n with base d and digits $0, 1, \cdots, q-1$. In this talk we will look at the asymptotics of $f_{d,q}(n)$ as $n \to \infty$. This depends in a rather strange way on the Generalized Thue-Morse sequence. Many of the results are computationally/experimentally true, although no proofs are known.