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Explicit Diagonal Asymptotics of Symmetric Multi-Affine Rational Functions via ACSV

Multivariate sequences are often best studied via their generating functions, which are multivariate power series whose coefficients are the terms of the sequence. Analytic combinatorics in several variables (ACSV) provides a framework for deriving asymptotics for certain “diagonal” univariate subsequences using these generating functions and tools from topology, complex analysis, and algebraic geometry. In this work we show how to use ACSV to derive explicit asymptotics for diagonals of multivariate rational functions whose denominators are symmetric (invariant under permutations of the variables) and multi-affine (linear in each variable). By “explicit” we mean that all quantities involved in the asymptotic formula are effectively computable, and we give our asymptotic not in terms of a Big-O term, but instead in terms of explicit constants which bound the error between our asymptotic and the true sequence of interest. Applications will be discussed, including coefficient positivity problems which are concerned with detecting whether a sequence, univariate or multivariate, has all positive terms.