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The Convolution Ring of Arithmetic Functions and Symmetric Polynomials

Inspired by Rearick (1968), we introduce two new operators, LOG and EXP. The LOG operates on generalized Fibonacci polynomials giving generalized Lucas polynomials. The EXP is the inverse of LOG. In particular, LOG takes a convolution product of generalized Fibonacci polynomials to a sum of generalized Lucas polynomials and EXP takes the sum to the convolution product. We use this structure to produce a theory of logarithms and exponentials within arithmetic functions giving another proof of the fact that the group of multiplicative functions under convolution product is isomorphic to the group of additive functions under addition. The hyperbolic trigonometric functions are constructed from the EXP operator, again, in the usual way.