Polynomial Sequences of Binomial Type and Path Integrals

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Abstract. Polynomial sequences \( p_n(x) \) of binomial type are a principal tool in the umbral calculus of enumerative combinatorics. We express \( p_n(x) \) as a path integral in the “phase space” \( \mathbb{N} \times [-\pi, \pi] \). The Hamiltonian is \( h(\phi) = \sum_{n=0}^{\infty} p_n(0)/n! e^{in\phi} \) and it produces a Schrödinger type equation for \( p_n(x) \). This establishes a bridge between enumerative combinatorics and quantum field theory. It also provides an algorithm for parallel quantum computation.

Keywords: Feynman path integral, umbral calculus, polynomial sequence of binomial type, token, Schrödinger equation, propagator, wave function, cumulants, quantum computation

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