Advanced Fibonacci Identities

Ivica Martinjak
Seminar in Combinatorics and Discrete Mathematics
University of Zagreb
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Combinatorial and number theoretical definition of the Fibonacci sequence. Visual and combinatorial proofs of a few basic identities. Remarks on the four classical proofs of the Cassini identity. Catalan identity. Vajda’s identity. Fibonacci numbers and board tilings. Lucas numbers and bracelet tilings. The most elementary relation between Fibonacci and Lucas sequences. Two binomial Fibonacci identities. Binomial identity \( f_{kn+c-1} = \sum_{i=0}^{k} \binom{k}{i} f_{c-i-1} f_{n-1}^{i} f_{n}^{k-i}, \quad k, c \in \mathbb{N}_0 \) and its corollary. Further binomial identities. Further advanced identities. Sury’s identity. Sketch of the proof of the identity \( \sum_{k=0}^{n} \binom{n}{k} 5^{\lfloor k/2 \rfloor} = 2^n f_n \). Polynomial identities.

References


