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Mathematics > Number Theory

Gaussian Behavior in Generalized Zeckendorf Decompositions

Steven J. Miller, Yinghui Wang

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A beautiful theorem of Zeckendorf states that every integer can be written uniquely as a sum of non-consecutive Fibonacci numbers ${ n} {n-1}^{n-1}$ {\infty}\$; Lekkerkerker proved that the average number of summands for integers in F_n, F_{n+1} is $n/(\rho i^2 + 1)$, with $\rho i^ the golden mean.$ Interestingly, the higher moments seem to have been ignored. We discuss the proof that the distribution of the number of summands converges to a Gaussian as \$n \to \infty\$, and comment on generalizations to related decompositions. For example, every integer can be written uniquely as a sum of the \$\pm F_n\$'s, such that every two terms of the same (opposite) sign differ in index by at least 4 (3). The distribution of the numbers of positive and negative summands converges to a bivariate normal with computable. negative correlation, namely \$-(21-2\phi)/(29+2\phi) \approx -0.551058\$.

Comments:	This is a survey article based on talks given at CANT 2010 and CANT 2011
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