

1155-11-188

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Bridging combinatorial triangles with linear algebra.

Combinatorial triangles like the Pascal triangle maybe used to study properties of various number theoretic sets. For example, the Hosoya (or Fibonacci) triangle has been the source of many geometric, combinatorial, and linear algebraic properties of Fibonacci and by extension generalized Fibonacci numbers. Using the idea of Hosoya triangle, yet another triangle maybe constructed called the determinant Hosoya triangle (See sequence A108038 in www.oeis.org), which has as its entries determinants of specific two-by-two Fibonacci matrices. One of the most interesting features arise from matrices embedded in this triangle mod 2. In fact, certain family of symmetric matrices in this triangle give rise to a family of integral graphs. A graph is integral if its eigenvalues are all integral. The integral graphs are extremely rare and the techniques used to find them are quite complicated. The determinant Hosoya triangle presents a way to uncover infinitely many of these graphs. The techniques used to uncover the integral graphs will be discussed in details in this presentation. (Received January 13, 2020)