

A Generalization of Planar Pascal's Triangle to Polynomial Expansion and Connection with Sierpinski Patterns

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Abstract : The very well-known stacked sets of numbers referred to as Pascal's triangle present the coefficients of the binomial expansion of the form $(x+y)^n$. This paper presents an approach (the Staircase Horizontal Vertical, SHV-method) to the generalization of planar Pascal's triangle for polynomial expansion of the form $(x+y+z+w+r+\dots)^n$. The presented generalization of Pascal's triangle is different from other generalizations of Pascal's triangles given in the literature. The coefficients of the generalized Pascal's triangles, presented in this work, are generated by inspection, using embedded Pascal's triangles. The coefficients of I-variables expansion are generated by horizontally laying out the Pascal's elements of (I-1) variables expansion, in a staircase manner, and multiplying them with the relevant columns of vertically laid out classical Pascal's elements, hence avoiding factorial calculations for generating the coefficients of the polynomial expansion. Furthermore, the classical Pascal's triangle has some pattern built into it regarding its odd and even numbers. Such pattern is known as the Sierpinski's triangle. In this study, a presentation of Sierpinski-like patterns of the generalized Pascal's triangles is given. Applications related to those coefficients of the binomial expansion (Pascal's triangle), or polynomial expansion (generalized Pascal's triangles) can be in areas of combinatorics, and probabilities.

Keywords : pascal's triangle, generalized pascal's triangle, polynomial expansion, sierpinski's triangle, combinatorics, probabilities

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