



XXVII COMCA

Congreso de Matemática Capricornio

July 25, 26 and 27, 2018, Antofagasta, Chile

Alternating Sign Matrices and Hypermatrices

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Abstract

Alternating Sign Matrices (ASMs) are square $(0, \pm 1)$ -matrices such that, ignoring 0's, the $+1$'s and -1 's in each row and column alternate beginning and ending with a $+1$. Permutation matrices are the ASMs without any -1 's. We shall discuss the origins and properties of ASMs. There is a partial order on permutation matrices, the so-called Bruhat order, which extends in a very natural and surprising way to ASMs. This partial order is ranked and has many interesting properties. There are hypermatrix generalizations of permutation matrices which lead to hypermatrix generalizations of ASMs and latin squares.

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