

## Some Combinatorial Statistics over Catalan Polyominoes

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A Catalan word  $w = w_1w_2 \cdots w_n$  is one over the set of positive integers satisfying  $w_1 = 1$  and  $1 \leq w_i \leq w_{i-1} + 1$  for  $i = 2, \dots, n$ . Catalan words of length  $n$  are enumerated by the Catalan number  $C_n = \frac{1}{n+1} \binom{2n}{n}$ . Given a Catalan word  $w = w_1 \cdots w_n$ , its associated polyomino (also called bargraph) has  $n$  columns. The  $i$ -th column of this polyomino contains  $w_i$  unit cells for  $1 \leq i \leq n$  that corresponds to the height of the  $i$ -th horizontal step. In this talk we present several formulas for the generating functions enumerating polyominoes associated with Catalan words according to the area, semi-perimeter, and to the number of interior lattice vertices. As a consequence, we obtain simple and explicit formulas for the total values of these statistics over the set of Catalan words of length  $n$ .

Keywords: Catalan word, generating function, polyomino, combinatorial formula.