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A Gessel-Viennot-Type Method for Counting Disjoint Unions of Cycles in a Graph

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In the 1980's, Gessel and Viennot presented a determinantal method for counting non-intersecting lattice paths. We present an extension of this method to counting non-intersecting cycle systems (disjoint unions of cycles) in a particular type of directed graph we call a hamburger. This "Hamburger Theorem" gives a purely combinatorial proof of a determinantal formula for the number of domino tilings of an Aztec diamond, as first introduced by Brualdi and Kirkland in 2003. We present this argument and expand upon the Hamburger Theorem's applications to domino tilings of other regions of interest.

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