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Toric \(g\)-Vectors of Convex Polytopes from Gale Diagrams. Preliminary report.

If \(P\) is a convex \(d\)-polytope with \(n\) vertices, then the combinatorial structure of \(P\) can be represented by a certain set of \(n\) points in \(\mathbb{R}^e\) (a Gale diagram), where \(e = n - d - 1\). Associated with \(P\) is its flag-\(f\)-vector, which enumerates the numbers of chains of faces of the various possible types. The toric \(g\)-vector is a certain linear transformation of this vector. For simplicial polytopes, Lee defined the winding number \(w_k\) in a Gale diagram corresponding to a given polytope. He showed that \(w_k\) in the Gale diagram equals \(g_k\) of the corresponding polytope. We will extend these results to many non-simplicial cases by explaining how to determine \(g_k\) of the polytope by only considering the corresponding Gale diagram. In particular, we determine \(g_k\) for every possible Gale diagram in dimension 2. (Received September 22, 2015)