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Computing Artinian Gorenstein k-algebras with the weak Lefschetz property and largest graded Betti numbers

Let k be a field and recall that an SI-sequence is a Hilbert function of a cyclic k-module whose first half is a differentiable $\mathcal{O}$-sequence. Harima demonstrated that the collection of SI-sequences characterizes the Artinian Gorenstien k-algebras with the weak Lefschetz property. Migliore and Nagel showed that fixing an SI-sequence $\mathcal{H}$, the collection of Betti diagrams for Artinian Gorenstein k-algebras with the weak Lefschetz property and Hilbert function $\mathcal{H}$ has a unique largest element. Establishing an upper bound for the Betti diagrams in question turns out to be the easier step – showing the bound is sharp requires a fairly difficult construction utilizing 'generalized stick figures.' We give a new proof that the bound is sharp by way of monomial ideals and a doubly iterative procedure, making the description more compact and the overall proof shorter and more naive (in the sense that it relies mostly on double induction). Admittedly, our machinery obfuscates the geometric intuition and insight inherent in Migliore and Nagel's pioneering work; we gain economy as well as computability since, being monomial until the last possible moment, it is easy to actually compute the ideals in question on the computer algebra system Macaulay 2 even for 'large' $\mathcal{H}$.