# On Unimodality of Hilbert Function Graded Algebras

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We will survey the problem of determining Unimodality of Hilbert Functions especially for graded algebras of small codimensions. Let $R = \oplus R_n$ be a standard graded algebra over a field $k$ an $I$ be a homogeneous ideal so that $S = R/I = \oplus S_n$ is a graded algebra of dimension zero. Then the Hilbert function of $R/I$, denoted by $h_I(n) = h_S(n) = dim_k S_n$ is a function such that $h_S(0) = 1, h_S(1) = e$, the embedding dimension of $S$ and $h_S(n) = 0$, for $n > s$, where $s$ is the socle degree of $S$. Hilbert function is called unimodal if $h_0 \leq h_1 \leq \cdots \leq h_{t-1} \leq h_t \geq h_{t+1} \geq cdots \geq h_s \geq h_{s+1} = 0$ for some $t$. Hilbert functions of Gorenstein algebras are also symmetric. So, if they are unimodal, $t = s/2$ or $(s+1)/2$. It is known that Hilbert function of Goresntein algebras are unimodal in codimensio three and it is as yet open in codimension 4. There are examples of non unimodal Cohen Macaulay algebras codimension 3 and Gorenstein algebras in codimension 5 and higher. We will discuss the problem and some recent resutls in Codimension 3 level algebras and Gorenstein algebras of codimension 4.