

*Summer School on
Commutative Algebra and Algebraic Geometry, September 7-10, 2014
School of Mathematics, IPM, Tehran*

Stanley Depth of Monomial Ideals

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In his fantastic paper, “Linear Diophantine equations and local cohomology” in 1982, Stanley defined what is now called the Stanley depth of a multigraded module over the polynomial ring. Stanley depth is a combinatorial invariant of a module that, by a conjecture of Stanley, is an upper bound for the depth of module. During the last decade, several researchers with different approaches have tried to prove or disprove Stanley’s conjecture. However, the conjecture is still widely open. In this lecture, we present the recent developments on this topic and introduce some open problems concerning the Stanley depth of modules. In particular, we explain an algorithm invented by Herzog, Valadoiu and Zheng for computing the Stanley depth of the quotient of monomial ideals. We introduce a method for comparing the Stanley depth of monomial ideals and provide some lower bounds from lattice theory for the Stanley depth of monomial ideals. Finally, we prove that the residue class ring of the polynomial ring by a weakly polymatroidal ideal satisfies Stanley’s Conjecture.