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Characterization of Cofree Representations of $SL_n \times SL_m$

Given a finite dimensional representation V/k of a group G, we consider the space $k[V]^G$ of all polynomial functions which are invariant under the action of G. At its heart, invariant theory is the study of $k[V]^G$ and its interactions with $k[V]$. We are particularly interested in the situation where $k[V]$ is free as a $k[V]^G$-module, which is equivalent to V/G being smooth and the quotient map $V \to V/G$ behaving as nicely as possible. We call such representations *cofree*. The classification of cofree representations is a motivating problem for a field of research that has been active for over 70 years. In the case when G is finite, the Chevalley-Shephard-Todd theorem says that V is cofree iff G is generated by pseudoreflections. Several classifications of cofree representations have been found for certain connected reductive groups, but unlike the Chevalley-Shepard-Todd theorem, these results consist of a list of cofree representations, rather than a general group-theoretic characterization. In 2020, D. Edidin, M. Satriano, and S. Whitehead stated a conjecture which intrinsically characterizes irreducible cofree representations of connected semisimple groups and verified it for simple Lie groups and tori. In this talk, we will discuss this conjecture and the work towards verifying it for $SL_n \times SL_m$.