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AN ALGORITHM FOR THE PROJECTIVE CHARACTERS OF FINITE CHEVALLEY GROUPS

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ABSTRACT. An algorithm is obtained for the Brauer characters afforded by the projective indecomposable modules (in the defining characteristic) for the finite universal Chevalley groups. Tables of character degrees for the special linear group $SL(4, 2^m)$, $m = 1, 2, 3$, are provided.

In [**4**] we expressed in the language of directed graphs an iterative procedure for finding the irreducible constituents (with multiplicity) of a product of irreducible Brauer characters (in the defining characteristic) of a finite universal Chevalley group. Roughly speaking, the first iteration produces edges which originate at the given product (viewed as a vertex). Each of these edges terminates at either an irreducible Brauer character or a product of such; in the latter case, a second iteration is required. In this manner, paths (sequences of edges) are constructed which eventually terminate at the desired irreducible constituents, the multiplicities of which are then determined by the paths.

The method described uses Steinberg's tensor product theorem and depends on a knowledge of the composition factors (with multiplicity) of products of irreducible modules, with restricted highest weights, for the including infinite algebraic group. Indeed, the method is just a formalization of how one possessing this knowledge would naturally proceed by hand. (Although the required composition factors are not known, in general, they would be known, in principle at least, should Lusztig's conjecture be proven.)

We will show in this paper that if we apply our iterative procedure to a product of just two irreducible Brauer characters, then any paths which terminate at the Steinberg character will have at most two nontrivial edges (provided the characteristic is large enough). Because of this, it is easy to determine all such paths and, hence, the multiplicity

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