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On linearizable irreducible projective representations of finite groups

By G. KARPILOVSKY

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Let G be a finite group and K an arbitrary field. Yamazaki ([4], Theorem 1) proved that there exists a finite central group extension of G by which all "linearizable" projective representations of G are linearized (cf. Section 1). This result motivates consideration of the following problem. Given a finite group G and an arbitrary field K of characteristic 0, what is the number of equivalence classes of irreducible linearizable projective representations of G over K? The aim of this paper is to give the solution of this problem. As a corollary we obtain the group theoretical characterization of the number of equivalence classes of irreducible projective representations of G over K, where K is an algebraically closed field of characteristic 0, or the real number field.

I. Preliminaries.

All groups in this paper are assumed to be finite.

NOTATION. K is any field and $K^*=K-\{0\}$.

$GL(V)$ is the group of all nonsingular linear transformations of a finite dimensional vector space V over K.

A K-character is a character of a linear representation of a group G over K.

K^*1_V is the centre of $GL(V)$ where 1_V denotes the identity mapping of V onto itself.

$PGL(V)=GL(V)/K^*1_V$ is the group of projective transformations of the projective space $P(V)$ associated to V.

π is the natural projection of $GL(V)$ onto $PGL(V)$.

$|S|$ is the order of the set S.

G' is the derived group of G.

$\mathrm{Hom}(G, K^*)$ is the multiplicative group of all linear characters (one-dimensional linear representations) of the group G over K.

An ordered pair (G^*, ϕ) of a group G^* and a surjective homomorphism $\phi: G^*\to G$ is called a central group extension of the group G if the kernel $\mathrm{Ker}\,\phi$ of ϕ is included in the centre $Z(G^*)$ of the group G^*.

If T is a permutation group acting on the set S then S/T is the quotient