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On the Theory of Representation of Finite Groups.

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The ordinary representations of finite groups by linear transformations were first treated by G. Frobenius[1] and W. Burnside[2] in case that the coefficients are complex numbers, and the theory were extended by I. Schur[3] to the case where the field of coefficients is any algebraically closed field of characteristic 0. Later E. Noether gave a new foundation of the theory in her theory[4] of representation of algebras.

The modular representation of finite groups were first studied by L. E. Dickson[5] but the complete extension of the theory of ordinary representations to the modular case has been recently established by R. Brauer and C. Nesbitt in their remarkable joint paper.[6]

It seems to us that the main theorems in the general theory of group representations are the orthogonality relations for group characters and the theorems concerning the induced representations and the Kronecker product of two representations, and the existing constructions of the theory are all, even in the theory of R. Brauer and C. Nesbitt in the modular case, based on the orthogonality relations for ordinary characters.

In this paper we shall intend to construct the theory in the most general manner which involves the ordinary and the modular cases and further the case of collineations.

The representations of finite groups by collineations in the ordi-

1) G. Frobenius; Sitzungsberichte der Preussischen Akademie der Wissenschaften, 1896, p. 1343, 1897, p. 994, 1899, p. 482, 1903, p. 401.

For the Frobenius' theory, see the accounts in L. E. Dickson, *Modern Algebraic Theories*, Chicago, 1926, Chapter XIV ; G. A. Millar, H. F. Blichfeldt, L. E. Dickson, *Theory and Application of Finite Groups*, Chicago, 1917, Chapter VI.

2) W. Burnside; Acta Mathematica, 28 (1904), p. 369, Procceedings of the London Mathematical Society (2), 1 (1904) p. 117.

3) I. Schur; Sitzungsber. der Preussischen Akad. der Wiss. (1905) p. 406.

4) E. Noether: Mathematische Zeitschrift, 30 (1907), p. 389.

5) L. E. Dickson; Transactions of the American Mathematical Society, 8 (1907), p. 389.

6) R. Brauer and C. Nesbitt; *On the modular representations of groups of finite ordcr* 1, University of Toronto Studies, Math. Series No. 4, (1937), refered to as B. N. M.