11. *On 2p-Fold Transitive Permutation Groups. II*

By Mitsuo YOSHIZAWA
Department of Mathematics, Gakushuin University

(Communicated by Shokichi IYANAGA, M. J. A., Jan. 12, 1980)

§0. Introduction. The purpose of this paper is to extend the results of Yoshizawa [7] and Bannai [2].

In §§1 and 2, we shall prove the following results which are obtained by improving some parts of the proofs of [7].

Theorem 1. *Let p be an odd prime $\geqslant 11$, and let q be an odd prime with $p<q\leqslant p+\frac{p-1}{2}$. Let G be a $2p$-fold transitive permutation group on a set $\Omega=\{1,2,\cdots,n\}$. If the order of $G_{1,2,\cdots,2p}$ is not divisible by q, then G is S_n $(2p\leqslant n\leqslant 2p+q-1)$ or A_n $(2p+2\leqslant n\leqslant 2p+q-1)$.*

Theorem 2. *Let p be an odd prime $\geqslant 11$, and let q be an odd prime with $p<q\leqslant p+\frac{p-1}{2}$. Let G be a $2p$-fold transitive permutation group on a set $\Omega=\{1,2,\cdots,n\}$. If $G_{1,2,\cdots,2p}$ has an orbit on $\Omega-\{1,2,\cdots,2p\}$ whose length is less than q, then G is S_n $(2p+1\leqslant n\leqslant 2p+q-1)$ or A_n $(2p+2\leqslant n\leqslant 2p+q-1)$.*

As an immediate corollary to Theorem 2, we have the following

Corollary. *Let p be an odd prime $\geqslant 11$, and let q be an odd prime with $p<q\leqslant p+\frac{p-1}{2}$. Let D be a $2p$-$(v,k,1)$ design with $2p<k<2p+q$. If an automorphism group G of D is $2p$-fold transitive on the set of points of D, then D is a $2p$-$(k,k,1)$ design, namely a trivial design.*

In §3, by making use of the above results and the proof of [2, Theorem A], we shall prove the following

Theorem 3. *Let p be an odd prime $\geqslant 11$, and let q be an odd prime with $p<q\leqslant p+\frac{p-1}{2}$. Let G be a $2p$-fold transitive permutation group on a set $\Omega=\{1,2,\cdots,n\}$. If a Sylow q-subgroup Q of $G_{1,2,\cdots,2p}$ is semiregular on $\Omega-I(Q)$, then G is S_n $(2p\leqslant n\leqslant 2p+2q-1)$ or A_n $(2p+2\leqslant n\leqslant 2p+2q-1)$.*

§1. Proof of Theorem 1. Lemma 1. *Let p be a prime $\geqslant 11$ and q be a prime with $p<q\leqslant p+\frac{p-1}{2}$, and let r be an integer with*