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CONSTRUCTION OF A SET OF 512-RUN DESIGNS OF RESOLUTION $\geqq 5$ AND A SET OF EVEN 1024-RUN DESIGNS OF RESOLUTION $\geqq 6$

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1. Introduction. In a previous paper [2], the authors constructed and blocked the complete set of even 512-run two-level fractional factorial designs of resolution $\geqq 6$ and the complete set of 256-run two-level fractional factorial designs of resolution $\geqq 5$. (An even design is one whose defining relation is composed entirely of words of even length.) The motivation for undertaking this previous work was to discover the maximum number of variables which can be accommodated in a 256-run resolution V design. It was in fact shown [2] that the maximum number of variables which can be accommodated in a 512-run design of resolution VI is 18, and hence that the maximum number of variables which can be accommodated in a 256-run design of resolution V is 17. In each case, the saturated design (i.e., the design which contains the largest number of variables, subject to the restrictions imposed by the specified resolution and run length) was found to be unique. (Note that, as in our previous papers, we are using a broadened definition of the word "saturated," which has often been restricted to designs having no degrees of freedom for experimental error.)

The purpose of the present paper is to tackle a similar question at the next stage of difficulty, namely, how many variables can be accommodated in a 512-run design of resolution V? The answer, as we shall see, appears to be 23.

We first briefly recapitulate the previous work. The construction algorithm for the earlier designs was described in [1]. In general, for specified (odd) resolution R and run length 2^q, $q = k-p$, the method involves:

(i) the stage-by-stage construction of the set of distinct even $2^{(k+1)-p}$ designs of resolution $\geqq R+1$, followed by

(ii) the erasure of variables from these designs (i.e., the removal of a variable from each word in the defining relation of each design) to obtain the set of distinct odd 2^{k-p} designs of resolution $\geqq R$.

At each stage of (i), the exhaustive enumeration of all designs at that stage is coupled with the discarding of all designs which are equivalent to a design previously constructed at the same stage. (Two designs are equivalent if the defining relation of one can be obtained from the defining relation of the other by relabeling the variables.) As a result, only one representative of each equivalence class of designs is saved at each stage.

In the present paper, we extend the procedure, with certain modifications

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