On Balanced Factorial Designs of Resolution Ten and Balanced Arrays of Strength Nine

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Balanced arrays (B-arrays) are generalizations of orthogonal arrays (O-arrays) and have been extensively used in the construction of balanced factorial designs. An array T with two levels (say, 0 and 1), m constraints (factors), and N treatment-combinations (runs) is merely a matrix T of size $(m \times N)$ with two elements 0 and 1. T is said to be of strength t $(\leq m)$ if, in each t-rowed submatrix T^* of T, the following condition is satisfied: every vector $\underline{\alpha}$ of T^* of weight i $(0 \leq i \leq t)$ (the weight of a vector $\underline{\alpha}$ is defined to be the number of 1's in it) appears with the same frequency μ_i (say, $0 \leq i \leq t$). The set $\{m; \mu_0, \mu_1, \ldots, \mu_t\}$ is called the set of parameters for the array T. If $\mu_i = \mu$, then T is called an O-array with parameter μ. It is quite obvious that N is known if the μ_i's are given. It is well known that B-arrays of strength t, under certain conditions, give rise to balanced factorial designs of resolution $(t + 1)$ in which each of the m factors is at two levels, denoted in design theory by 2^m designs. In this paper, we derive some existence conditions for B-arrays with $t = 9$. We also use these conditions for obtaining $\max(m)$ for a given set $(\mu_0, \mu_1, \ldots, \mu_9)$.