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A SERIES OF TOURNAMENTAL DESIGNS

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1. Introduction. Let

$v =$ a given number of elements,

$m^* =$ number of varieties associated with each element,

$k =$ number of varieties in a block with k_1 varieties in one configuration and k_2 varieties in another,

$\nu_1 =$ number of times 2 varieties occur together in a configuration except the varieties associated with the same element,

$\nu_2 =$ number of times 2 varieties occur in the opposite configurations except the varieties associated with the same element,

$r_1 =$ number of times each variety occurs in configurations of k_1 elements,

$r_2 =$ number of times each variety occurs in configurations of k_2 elements,

$b =$ total number of blocks.

In a tournamental design (see C. C. Yalavigi [2]), these parameters satisfy the following system of equations viz.,

$$(1) \qquad (k_1-1)r_1+(k_2-1)r_2 = \nu_1(v-1), \qquad k_2 r_1 + k_1 r_2 = \nu_2(v-1),$$
$$b(k_1+k_2) = v(r_1+r_2)$$

and designs of this type do not seem to have been considered for $k_1 \neq k_2$. Our aim is therefore to determine the solution of a general series given by

$$(2) \qquad \begin{array}{lll} v = 2(2t+1)+1, & b = v(2t+1), & k_1 = t+1, \\ k_2 = t, & r_1 = (2t+1)(t+1), & r_2 = (2t+1)t, \\ \nu_1 = t^2, & \nu_2 = t^2+t, & m^* = 1, \end{array}$$

where v denotes a prime integer or a power of a prime integer of the form p^n.

2. Designs for $k_1 = t+1$, $k_2 = t$ and $v = 2(2t+1)+1 = p^n$. This section will employ the method of generators due to R. C. Bose [1], for constructing balanced incomplete block designs. We identify the elements with the elements of the Galois field GF(p^n) and let

$$(3) \qquad B_i = (A_{0+i}, A_{1+i}, \cdots, A_{t+i}; A_{t+1+i}, \cdots, A_{2t+i}), \qquad i = 0, 1, \cdots, 2t$$

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