

A SERIES OF BALANCED INCOMPLETE BLOCK DESIGNS

BY C. C. YALAVIGI

Government College, Mercara, Coorg

1. Introduction. The available literature on BIBD, shows that the series with parameters

$$(1) \quad v = 4t, \quad r = v - 1, \quad k = 4, \quad \lambda = 3, \quad b = v(v - 1)/4,$$

seem not to have been considered with the following constraint:

I(a) Each block consists of 2 pairs of elements that oppose one another.

(b) Each element appears with every other element once in a pair and twice in opposed pairs.

Our object is therefore to determine its solution with I for $v = p^n + 1$ where p denotes an odd prime in the form $12\tau + 7$ and $12\tau - 1$.

It is interesting to note that the proposed solution (see R. C. Bose [1]) is applicable to designing ordinary doubles tournaments where each player associates with every other player once as a teammate and twice as an opponent.

The application is left to the reader.

2. Design for $v = p^n + 1$ where $t = 3\tau + 2$. We identify $v - 1$ elements with elements of $GF(p^n)$ and let

$$(2) \quad B_i = (P_i, Q_i; R_i, S_i), \quad i = 0, 1, \dots, t - 1,$$

generate all the blocks of a design, viz.,

$$(3) \quad B_{0a} = (P_0 + a, v; R_0 + a, S_0 + a);$$

$$B_{ia} = (P_i + a, Q_i + a; R_i + a, S_i + a)$$

$$i = 1, 2, \dots, t - 1, \quad a = 0, 1, \dots, 4t - 2.$$

This system of blocks will not produce the desired design unless 6 sets of numbers called the differences of elements in pairs and differences of elements in opposed pairs satisfy certain conditions. They are designated as:

Differences of elements in pairs:

$$P_i Q_i \text{ differences} = \pm(P_i - Q_i), \quad R_i S_i \text{ differences} = \pm(R_i - S_i).$$

Differences of elements in opposed pairs:

$$P_i R_i \text{ differences} = \pm(P_i - R_i), \quad P_i S_i \text{ differences} = \pm(P_i - S_i),$$

$$Q_i R_i \text{ differences} = \pm(Q_i - R_i), \quad Q_i S_i \text{ differences} = \pm(Q_i - S_i).$$

These differences must satisfy the hypothesis of the following theorem.

THEOREM a. *A set of t initial blocks B_0, B_1, \dots, B_{t-1} generate the design of this*

Received 16 January 1967; revised 30 October 1967.