

SOME NEW LATIN SQUARE TYPE PBIB DESIGNS

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Summary

Some partial geometry designs and miscellaneous designs are identified as triangular and latin square type PBIB designs. Two of these latin square type designs are new.

Keywords: PBIB design, Partial geometry, Triangular association scheme, Latin square association scheme.

Introduction

Clatworthy [1] tabulated two-associate-class partially balanced incomplete block (PBIB) designs with $r, k \leq 10$. These designs are based on triangular, latin square, partial geometry and miscellaneous association schemes. Here, some partial geometry designs and miscellaneous designs are identified as triangular and latin square designs. Two of these designs are new, in the sense that these are not found in Clatworthy [1] and Dey [3].

2. Triangular designs

Solution 1 : The partial geometry design PG 1 with parameters :

$$v = 15 = b, \quad r = 3 = k, \quad n_1 = 6, \quad n_2 = 8, \quad \lambda_1 = 1, \quad \lambda_2 = 0,$$

is isomorphic to the triangular PBIB design T16 with parameters:

$$v = 15 = b, \quad r = 3 = k, \quad n_1 = 8, \quad n_2 = 6, \quad \lambda_1 = 0, \quad \lambda_2 = 1.$$

The triangular association scheme for PG1 is given below, where the association classes are interchanged :

*	1	10	3	11	12
1	*	13	2	14	15
10	13	*	7	6	5
3	2	7	*	8	9
11	14	6	8	*	4
12	15	5	9	4	*

As a consequence, the designs M8 and M9 are isomorphic to the designs T17 and T19 respectively.

3. Latin Square Type Designs

Solution 2 : The miscellaneous design M10 with parameters :

$$v = 16 = b, r = 3 = k, n_1 = 6, n_2 = 9, \lambda_1 = 1, \lambda_2 = 0$$

is a latin square design LS 18 with parameters :

$$v = 16 = b, r = 3 = k, n_1 = 9, n_2 = 6, \lambda_1 = 0, \lambda_2 = 1.$$

The latin square association scheme $L_3^*(4)$ is given below, where the association classes are interchanged as ;

1A	3B	4C	2D
9D	11A	12B	10C
13C	15D	16A	14B
5B	7C	8D	6A

Again as a consequence, the designs M11 and M12 are also latin square designs with parameters of LS 19 and LS 21 respectively.

Solution 3 : The miscellaneous design M28 with parameters :

$$v = 16 = b, r = 7 = k, n_1 = 6, n_2 = 9, \lambda_1 = 4, \lambda_2 = 2$$

is a new latin square design LS 116a with parameters :

$$v = 16 = b, r = 7 = k, n_1 = 9, n_2 = 6, \lambda_1 = 2, \lambda_2 = 4,$$

and association scheme $L_3^*(4)$ given in solution 2 above.

Solution 4 : The miscellaneous design M34 with parameters :

$$v = 16 = b, r = 9 = k, n_1 = 6, n_2 = 9, \lambda_1 = 6, \lambda_2 = 4$$

is a new latin square design LS 83a with parameters:

$$v = 16 = b, r = 9 = k, n_1 = 9, n_2 = 6, \lambda_1 = 4, \lambda_2 = 6,$$

and with association scheme $L_3^*(4)$ given in solution 2 above. The design LS 83a is complement of the design LS 116a.

REFERENCES

- [1] Clatworthy, W.H., 1973. Tables of two-associate-class partially balanced designs, National Bureau of Standards, Washington, D.C.
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- [3] Dey, A., 1988. Some new partially balanced designs with two- associate classes, Sankhya 50B, 90-94.