

Non-commutative association schemes having divisible design graphs as relations from pseudo-cyclic association schemes

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Abstract

It is known that by replacing the entry $+1$ by I_2 and the entry -1 by $J_2 - I_2$ in a Hadamard matrix, the resulting matrix forms an incidence matrix of a symmetric group divisible design. Gibbons-Mathon [1] generalized this construction of symmetric group divisible designs based on balanced generalized weighing matrices.

In this talk, we modify Gibbons-Mathon's construction by using d -class pseudo-cyclic symmetric association schemes to obtain $(2d - 1)$ -class non-commutative association schemes such that exactly d nontrivial relations are divisible design graphs. Furthermore, we discuss the problem on isomorphism between non-commutative association schemes obtained by our construction, which is related to a problem on normalization of balanced generalized weighing matrices. In particular, when $d = 2$, the problem is described in terms of Godsil-McKay switching for conference graphs. For example, we claim the following. Let \mathcal{A}_1 and \mathcal{A}_2 be two non-isomorphic 2-class pseudo-cyclic symmetric association schemes. If any association scheme obtained by applying Godsil-McKay switching to the conference graphs in \mathcal{A}_1 is not isomorphic to \mathcal{A}_2 , then the non-commutative association schemes obtained by applying our construction to \mathcal{A}_1 and \mathcal{A}_2 are non-isomorphic.

References

- [1] P. B. Gibbons, R. Mathon, Construction methods for Bhaskar Rao and related designs, *J. Austral. Math. Soc. Ser. A* **42** 5–30, (1987).