



# Non-existence of quasi-symmetric designs with restricted block graphs

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## Abstract

Quasi-symmetric designs (QSDs) with particular block graphs are investigated. We rule out the possibility of a QSD with block graph that has the same parameters as that of the Symplectic graph  $Sp(2r, q)$ , where  $q$  is an odd prime power or its complement. We obtain support for Bagchi's recent conjecture, which states that "For the existence of a quasi-symmetric 2-design with block graph  $K_{m \times n}$ , we must have  $m \equiv n + 1 \pmod{n^2}$ ". Under certain conditions, we rule out the possibility of a QSD having a pseudo-Latin square or negative Latin square block graph.

**Keywords** Strongly regular graphs · Quasi-symmetric designs · Block graph

**Mathematics Subject Classification** 05B05

## 1 Introduction

Let  $X$  be a finite set of  $v$  elements called points, and  $\beta$  be a set of  $k$ -element subsets of  $X$  called blocks, such that each pair of points occur in  $\lambda$  blocks, then the pair  $\mathbf{D} = (X, \beta)$  is 2- $(v, k, \lambda)$  design. For a 2- $(v, k, \lambda)$  design  $\mathbf{D}$ , the number of blocks containing  $\alpha$  in  $X$  is  $r$ , which is independent of  $\alpha$ . The number of blocks in  $\mathbf{D}$  is denoted by  $b$ .

An integer  $\lambda_1$ ,  $0 \leq \lambda_1 < k$ , is an *intersection number* of  $\mathbf{D}$  if there exist  $B, B' \in \beta$  such that  $|B \cap B'| = \lambda_1$ . Symmetric designs have exactly one intersection number.

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# Quasi Symmetric Designs

**Mohan S. Shrikhande, Sharad S. Sane**



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