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CONSTRUCTION OF DIVISIBLE DESIGNS FROM NORMALIZED HADAMARD MATRICES

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Construction of block designs is an important part of design theory. Literature shows that there are several ways of constructing block designs with parameters(v, k, λ). Further, the correspondence between Hadamard matrices and block designs is well known. One can obtain a (v, k, λ) −design from Hadamard matrices and vice versa. These designs have the property that any two points occur in exactly λ blocks. Also, the graph drawn for these designs are k −regular graphs such that any two vertices have exactly λ neighbours.

In this study, we present a method to construct a generalized (v, k, λ) −design with a large point set using the normalized Hadamard matrices. First, a regular Hadamard matrix with row/column sum is constructed and then, this regular Hadamard matrix is used to obtain the incidence matrix M of the generalized design. This construction splits the design into two (v, k, λ) −designs with a new set of parameters $(v, k, \lambda_1, \lambda_2)$ where $v = 6m^2, k = 2m^2 + m,\ \lambda_1 = m^2 + m$ and $\lambda_2 = \frac{m^2+m}{2}$.

By taking the matrix M as the adjacency matrix, one can draw a graph. Since this design has a constant block size k, the resulting graph is a k −regular graph. But any pair of vertices have either λ_1 or λ_2 common neighbours. This construction results two different (v, k, λ) −designs that can be obtained with the same point set and equal block size which can be used in coding theory, cryptography and image analysis.