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Binary consecutive covering arrays

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Abstract A $k \times n$ array with entries from a q-letter alphabet is called a t-covering array if each $t \times n$ submatrix contains amongst its columns each one of the q^t different words of length t that can be produced by the q letters. In the present article we use a probabilistic approach based on an appropriate Markov chain embedding technique, to study a t-covering problem where, instead of looking at all possible $t \times n$ submatrices, we consider only submatrices of dimension $t \times n$ with its rows being consecutive rows of the original $k \times n$ array. Moreover, an exact formula is established for the probability distribution function of the random variable, which enumerates the number of deficient submatrices (i.e., submatrices with at least one missing word, amongst their columns), in the case of a $k \times n$ binary matrix ($q = 2$) obtained by realizing kn Bernoulli variables.

Keywords t-Covering arrays · Orthogonal arrays · Consecutive covering arrays · Markov chains · Random matrices · Complete factorial designs