The Boolean rank of the uniform intersection matrix and a family of its submatrices.
(English) Zbl 1411.05173
Linear Algebra Appl. 574, 67-83 (2019).

Summary: We study the Boolean rank of two families of binary matrices. The first is the binary matrix $A_{k,t}$ that represents the adjacency matrix of the intersection bipartite graph of all subsets of size $t$ of $\{1,2,\ldots,k\}$. We prove that its Boolean rank is $k$ for every $k \geq 2t$.

The second family is the family $U_{s,m}$ of submatrices of $A_{k,t}$ that is defined as $U_{s,m} = (J_m \otimes I_s) + (I_m \otimes J_s)$, where $I_s$ is the identity matrix, $J_s$ is the all-ones matrix, $s = k - 2t + 2$ and $m = \binom{2t-2}{t-1}$. We prove that the Boolean rank of $U_{s,m}$ is also $k$ for the following values of $t$ and $s$: for $s = 2$ and any $t \geq 2$; for $t = 3$ and any $s \geq 2$; and for any $t \geq 2$ and $s > 2t - 2$, that is $k > 4t - 4$.

MSC:

- 05C50 Graphs and linear algebra (matrices, eigenvalues, etc.)
- 15B34 Boolean and Hadamard matrices
- 15B99 Special matrices
- 68Q99 Theory of computing

Keywords:

- Boolean rank
- cover size
- intersection matrix

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References:


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