

Minimizing the number of gap-zeros in binary matrices

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We study a problem of minimising the total number of zeros in the gaps between blocks of consecutive ones in the columns of a binary matrix by permuting its rows. The problem is known to be NP-hard. An analysis of the structure of an optimal solution, allows us to focus on a restricted solution space, and to use an implicit representation for searching the space. We develop an exact solution algorithm, which is polynomial if the number of columns is fixed, and two constructive heuristics to tackle instances with an arbitrary number of columns. The heuristics use a novel solution representation based upon column sequencing. In our computational study, all heuristic solutions are either optimal or close to an optimum. One of the heuristics is particularly effective, especially for problems with a large number of rows.