

# Sign Patterns that Allow a Positive Left Inverse

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## Abstract

An  $m \times n$  sign pattern  $\mathcal{S}$  is an  $m \times n$  matrix with entries in  $\{+, -, 0\}$ . Such a sign pattern allows a positive left inverse provided that there exist an  $m \times n$  matrix  $A$  with the sign pattern  $\mathcal{S}$  and an  $n \times m$  matrix  $B$  with only positive entries satisfying  $BA = I$  where  $I$  is the  $n \times n$  identity matrix. For  $m > n \geq 2$ , a characterization of nonsquare sign patterns with no rows of zeros that allow a positive left inverse is given. This leads to a characterization of all sign patterns with  $m \geq n \geq 2$  that allow a positive left inverse, giving a generalization of the known result for the square case, which involves the related bipartite digraph. Sign patterns that allow a nonnegative left inverse are also discussed.

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