

## Combinatorial Parameters for Cobipartite Graphs

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The minimum rank problem for zero-nonzero matrix patterns is to determine the smallest rank of a matrix whose zero entries occur in specified positions. Similarly, the minimum rank problem for a simple graph is to find the smallest rank of a symmetric matrix whose off-diagonal nonzero entries occur according to the edges of a given graph. In each case, a fundamental combinatorial lower bound exists; for the former, it is the triangle number of the pattern, while for the latter it is the zero forcing number of the graph. For a given zero-nonzero pattern, there exists an associated cobipartite graph. In previous work, the minimum rank of the pattern and the maximum nullity of its associated cobipartite graph were shown to obey a simple relationship; each is equal to the number of vertices in the graph minus the other. We show that the corresponding bounds (that of the triangle number and the zero forcing number) obey this same relationship. This forms a connection between the goal of understanding when the triangle number is equal to the minimum rank of a pattern and that of determining when the zero forcing number of a graph is equal to its maximum nullity. Having established this connection for cobipartite graphs, we explore, for these graphs, other combinatorial parameters related to their maximum nullity.

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