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Small Spectra are Spectrally Arbitrary for Threshold Graphs

Given a simple, undirected graph G on n vertices, let $S(G)$ be the collection of $n \times n$ real symmetric matrices $A = [a_{ij}]$ associated to G satisfying $a_{ij} \neq 0$ if and only if ij (when $i \neq j$) is an edge in G and the main diagonal is free to be chosen. For any square matrix A, let $q(A)$ equal the minimum number of distinct eigenvalues of A. The minimum number of distinct eigenvalues of G is defined as $q(G) = \min\{q(G) : A \in S(G)\}$. For the class of graphs known as *threshold graphs*, it is known that $q(G) \leq 4$. We present an alternative proof of this result and show that, for any four distinct numbers, there exists a matrix in $S(G)$ whose eigenvalues realize that sequence.