On the eccentricity matrices of graphs

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Abstract

The eccentricity matrix $\varepsilon(G)$ of a graph G is obtained from the distance matrix of G by retaining the largest distances in each row and each column and leaving zeros in the remaining ones. The largest eigenvalue of $\varepsilon(G)$ is called the ε-spectral radius and is denoted by $\rho(\varepsilon(G))$. The eccentricity energy (or the ε-energy) of G is sum of the absolute values of the eigenvalues of $\varepsilon(G)$. Two graphs are said to be ε-equienergetic if they have the same ε-energy. Here we discuss a conjecture about the least eigenvalue of eccentricity matrices of trees, presented in the article [Jianfeng Wang, Mei Lu, Francesco Belardo, Milan Randic. The anti-adjacency matrix of a graph: Eccentricity matrix. Discrete Applied Mathematics, 251: 299-309, 2018.], which we solved affirmatively. Also we give a characterization of the star graph, among the trees, in terms of invertibility of the associated eccentricity matrix. We establish some bounds for the ε-spectral radius and characterize the extreme graphs. Furthermore, we construct a pair of ε-equienergetic graphs which are not ε-cospectral.