Normalized Laplacian spectra of central vertex join and central edge join of two regular graphs

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Abstract

Normalized Laplacian spectrum of a graph is the collection of all normalized Laplacian eigenvalues of the matrix associated with the graph. Let G be a simple (p,q) graph with vertex set $V(G) = \{v_1, v_2, \dots, v_p\}$. The normalized Laplacian matrix $\mathcal{L}(G) = (\mathcal{L}_{ij})$ of G is defined as

$$\mathcal{L}_{ij} = \begin{cases} 1, & if\ i = j\ and\ deg(v_i) \neq 0 \\ -\dfrac{1}{\sqrt{deg(v_i)deg(v_j)}}, & if\ i \neq j\ and\ v_i\ is\ adjacent\ to\ v_j \\ 0, & otherwise. \end{cases}$$

For a graph without isolated vertices, the normalized Laplacian matrix of G can be written as

$$\mathcal{L}(G) = I_p - D^{-1/2}(G)A(G)D^{-1/2}(G)$$

where $D^{-1/2}(G)$ is the diagonal matrix with diagonal entries $\frac{1}{\sqrt{deg(v_i)}}$ and A(G) is the adjacency matrix of G. The central graph C(G) of G is obtained by subdividing each edge of G exactly once and joining all the nonadjacent vertices in G. In this talk, we shall discuss normalized Laplacian spectra of central vertex join and central edge join of two regular graphs. Also, we obtain some non-regular $\mathcal{L}$ − cospectral graphs.