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Optimization, Graph Theory and Combinatorics

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Some results involving the A_α and B_α-matrices

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Let G be a simple graph with adjacency matrix $A(G)$, Laplacian matrix $L(G)$, signless Laplacian matrix $Q(G)$, and degree diagonal matrix $D(G)$. In 2024, Samanta et al. proposed a new convex linear combination of $A(G)$ and $D(G)$, denoted and defined as $B_\alpha(G) = (1-\alpha)D(G)+(2\alpha-1)A(G)$, where $\alpha \in [0,1]$. It is easy to see that $B_0(G) = L(G)$, $B_1(G) = A(G)$, $B_{\frac{1}{2}}(G) = \frac{1}{2}D(G)$ and $B_{\frac{2}{3}}(G) = \frac{1}{3}Q(G)$. The definition of the B_α–matrices was motivated by the convex linear combination $A_\alpha(G) = \alpha D(G) + (1-\alpha)A(G)$, for $\alpha \in [0,1]$, introduced by Nikiforov in 2017. In this paper, the author presented a novel version of the spectral Turán theorem, until then unknown for $\alpha > \frac{1}{2}$. Some notable differences between the A_α–matrices and the B_α–matrices are:

(i) unlike the A_α–matrices, the B_α–matrices are not always nonnegative, which poses challenges for their analysis; and

(ii) Nikiforov proved the monotonicity of the eigenvalues of $A_\alpha(G)$ in α, which does not occur for the eigenvalues of $B_\alpha(G)$.

In this talk, I present some results involving the A_α and B_α-matrices.

keywords: Graphs, A_α-matrices, B_α-matrices.

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