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The largest eigenvalue of the normalized distance Laplacian matrix

We discuss two conjectures of Reinhart which seek to minimize or maximize the largest eigenvalue of the normalized distance Laplacian matrix over all connected n vertex graphs. We prove one of these conjectures and make significant progress towards the second. If λ is the largest eigenvalue over all normalized distance Laplacians of n vertex connected graphs, then $\lambda = 2 - \Theta\left(\frac{1}{\sqrt{n}}\right)$. We show that under any one of several natural conditions, the extremal graph must have diameter $\Theta\left(\sqrt{n}\right)$.