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Sum of Squares of Degrees in a Graph

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Abstract:

Let $\mathcal{G}(v,e)$ be the set of all simple graphs with v vertices and e edges and let $P_2(G) = \sum d_i^2$ denote the sum of the squares of the degrees, $d_1, \ldots, d_v$, of the vertices of G.

It is known that the maximum value of $P_2(G)$ for $G \in \mathcal{G}(v,e)$ occurs at one or both of two special graphs in $\mathcal{G}(v,e)$--the quasi-star graph or the quasi-complete graph. For each pair (v,e), we determine which of these two graphs has the larger value of $P_2(G)$. We also determine all pairs (v,e) for which the values of $P_2(G)$ are the same for the quasi-star and the quasi-complete graph. In addition to the quasi-star and quasi-complete graphs, we find all other graphs in $\mathcal{G}(v,e)$ for which the maximum value of $P_2(G)$ is attained. Density questions posed by previous authors are examined.

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