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Summary: For an undirected graph $G = (V, E)$, a vertex $\tau \in V$ separates vertices $u$ and $v$ (where $u, v \in V$, $u \neq v$) if their distances to $\tau$ are not equal. Given an integer parameter $k \geq 1$, a set of vertices $L \subseteq V$ is a feasible solution, if for every pair of distinct vertices, $u, v$, there are at least $k$ distinct vertices $\tau_1, \tau_2, \ldots, \tau_k \in L$, each separating $u$ and $v$. Such a feasible solution is called a landmark set, and the $k$-metric dimension of a graph is the minimal cardinality of a landmark set for the parameter $k$. The case $k = 1$ is a classic problem, where in its weighted version, each vertex has a non-negative cost, and the goal is to find a landmark set with minimal total cost. We generalize the problem for $k \geq 2$, introducing two models, and we seek for solutions to both the weighted version and the unweighted version of this more general problem. In the model of all-pairs (AP), $k$ separations are needed for every pair of distinct vertices of $V$, while in the non-landmarks model (NL), such separations are required only for pairs of distinct vertices in $V \setminus L$. We study the weighted and unweighted versions for both models (AP and NL), for path graphs, complete graphs, complete bipartite graphs, and complete wheel graphs, for all values of $k \geq 2$. We present algorithms for these cases, thus demonstrating the difference between the two new models, and the differences between the cases $k = 1$ and $k \geq 2$.

MSC:

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resolving set; metric dimension; wheel graph

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References:


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