

## The K-Distance Neighborhood Polynomial of a Graph

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**Abstract :** In a graph  $G = (V, E)$ , the distance from a vertex  $v$  to a vertex  $u$  is the length of shortest  $v$  to  $u$  path. The eccentricity  $e(v)$  of  $v$  is the distance to a farthest vertex from  $v$ . The diameter  $\text{diam}(G)$  is the maximum eccentricity. The  $k$ -distance neighborhood of  $v$ , for  $0 \leq k \leq e(v)$ , is  $N_k(v) = \{u \in V(G) : d(v, u) = k\}$ . In this paper, we introduce a new distance degree based topological polynomial of a graph  $G$  is called a  $k$ - distance neighborhood polynomial, denoted  $N_k(G, x)$ . It is a polynomial with the coefficient of the term  $x^k$ , for  $0 \leq k \leq e(v)$ , is the sum of the cardinalities of  $N_k(v)$  for every  $v \in V(G)$ . Some properties of  $k$ - distance neighborhood polynomials are obtained. Exact formulas of the  $k$ - distance neighborhood polynomial for some well-known graphs, Cartesian product and join of graphs are presented.

**Keywords :** vertex degrees, distance in graphs, graph operation,  $N_k$ -polynomials

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