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On the Δ-interval and the Δ-convexity numbers of graphs and graph products ☆

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Abstract

Given a graph G and a set $S \subseteq V(G)$, the Δ-interval of S, $[S]_\Delta$, is the set formed by the vertices of S and every $w \in V(G)$ forming a triangle with two vertices of S. If $[S]_\Delta = S$, then S is Δ-convex of G; if $[S]_\Delta = V(G)$, then S is a Δ-interval set of G. The Δ-interval

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Boundary-type sets of strong product of directed graphs*

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Abstract

Let $D = (V, E)$ be a strongly connected digraph and let u and v be two vertices in D. The maximum distance $md(u, v)$ is defined as $md(u, v) = \max\{\overrightarrow{d}(u, v), \overrightarrow{d}(v, u)\}$, where $\overrightarrow{d}(u, v)$ denotes the length of a shortest directed $u - v$ path in D. This is a metric. The boundary, contour, eccentricity and periphery sets of a strongly connected digraph D with respect to this metric have been defined. The boundary-type sets of the strong product of two digraphs is investigated in this article.

Keywords: Maximum distance, boundary-type sets, strongly connected digraph, strong product.

Math. Subj. Class. (2020): 05C12, 05C20, 05C76

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Center of Cartesian and strong product of digraphs

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Summary: Let D=(V,E) be a digraph and u, v ∈ V(D). The metric maximum distance is defined by md(u,v) = max {{d}(u,v), {d}(v,u)} where {d}(u,v) denote the length of a shortest directed u-v path in D. The eccentricity of a vertex v in D is defined by ecc(v) = max {md(v,u): u ∈ V(D)}. The center C(D) of a strongly connected digraph consist of all the vertices with minimum eccentricity. The relationship between the center of the Cartesian and strong product of two or more digraphs and its factor graphs have been studied in this article.

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COMMON MULTIPLES OF PATHS AND STARS WITH COMPLETE GRAPHS

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ABSTRACT. A graph G is a common multiple of two graphs H_1 and H_2 if there exists a decomposition of G into edge-disjoint copies of H_1 and also a decomposition of G into edge-disjoint copies of H_2. If G is a common multiple of H_1 and H_2 and G has q edges, then we call G a (q, H_1, H_2) graph. Our paper deals with the following question: 'Given two graphs H_1 and H_2, for which values of q does there exist a (q, H_1, H_2) graph?' when H_1 is either a path or a star with 3 or 4 edges and H_2 is a complete graph.

1. Introduction and preliminaries

All graphs considered here are finite and undirected, unless otherwise noted. The size of a graph G, denoted by $e(G)$, is its number of edges.

K_n denotes the complete graph on n vertices, and $K_{m,n}$ denotes the complete bipartite graph with vertex partitions of sizes m and n.

A *k-path*, denoted by P_k, is a path with k vertices (is a path of length $k-1$); a *k-star*, denoted by S_k, is the complete bipartite graph $K_{1,k}$.

Let G and H be graphs. A *decomposition* of G is a set of edge-disjoint subgraphs of G whose union is G. An H- *decomposition* of G is a decomposition of G into copies of H. If G has an *H-decomposition*, we say that G is *H-decomposable* or H *divides* G and write $H|G$.

Given two graphs H_1 and H_2, one may ask for a graph G that is a *common multiple of* H_1 and H_2 in the sense that both H_1 and H_2 divide G. Several authors have investigated the problem of finding *least common multiples* of pairs of graphs; that is, graphs of minimum size which are both H_1- and H_2-decomposable. The problem was introduced by Chartrand et al in [6] and they showed that every two nonempty graphs have a least common multiple. It is clear that least common multiple of two graphs may not be unique. The size of a least common multiple of two graphs H_1 and H_2 is denoted by *lcm*(H_1,H_2). Also if q_1 and q_2 are two natural numbers, their number theoretic *lcm* is denoted by $lcm(q_1, q_2)$ as usual. Clearly, the least common multiple of two graphs H_1 and H_2 , *lcm*(H_1,H_2) $\geq$ *lcm*($e(H_1)$,$e(H_2)$). The problem of finding the size of least common multiples of graphs has been studied for several pairs of graphs: cycles and stars[6, 15],

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COMMON MULTIPLES OF PATH, STAR AND CYCLE WITH COMPLETE BIPARTITE GRAPHS

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Abstract: A graph G is a common multiple of two graphs H_1 and H_2 if there exists a decomposition of G into edge-disjoint copies of H_1 and also a decomposition of G into edge-disjoint copies of H_2. If G is a common multiple of H_1 and H_2, and G has q edges, then we call G a (q, H_1, H_2) graph. Our paper deals with the following question: Given two graphs H_1 and H_2, for which values of q does there exist a (q, H_1, H_2) graph? when H_1 is either a path or a star or a cycle and H_2 is a complete bipartite graph.

Keywords and Phrases: Graph Decomposition, Common Multiples of Graphs, Path, Star, Cycle, Complete Bipartite Graph.

2020 Mathematics Subject Classification: 05C38, 05C51, 05C70.

1. Introduction

All graphs considered here are finite and undirected unless otherwise noted. Let $|V(G)|$ and $e(G)$ denote, respectively, the order of a graph G and the size of G, that is, the number of edges in G.

K_n denotes the complete graph on n vertices, and $K_{m,n}$ denotes the complete bipartite graph with vertex partitions of cardinality m and n. A *k-path*, denoted

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Fold thickness of graphs

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Abstract. The graph G' obtained from a graph G by identifying two nonadjacent vertices in G having at least one common neighbor and reducing the resulting multiple edges to simple edges is called a 1-fold of G. A uniform k-folding of a graph G is a sequence of graphs $G = G_0, G_1, G_2, \ldots, G_k$, where G_{i+1} is a 1-fold of G_i for $i = 0, 1, 2, \ldots, k-1$ such that all graphs in the sequence are singular or all of them are nonsingular. The largest k for which there exists a uniform k-folding of G is called fold thickness of G and this concept was first introduced in [1]. In this paper, we determine fold thickness of lollipop graph, web graph, helm graph and rooted product of complete graphs and paths.

2020 AMS Subject Classification: 05C50, 05C76.

1. Introduction

The motivation for graph folding as defined by Gervacio *et al.* [5] is from the situation of folding a meter stick. Let a finite number of unit bars be joined together at ends in such a way that they are free to turn. There are some meter sticks with this structure as in Figure 1. This meter stick is a physical model of the path P_n on n vertices and can be folded to become a physical model of the complete graph K_2.

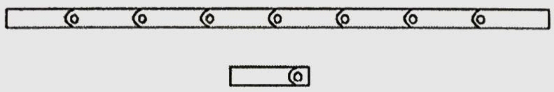

Figure 1. Meter stick – Folded and unfolded

Let G be a graph that is not isomorphic to a complete graph. If x and y are nonadjacent vertices of G that have atleast one common neighbor, then identify x and y and reduce any resulting multiple edges to simple edges to form a new graph, G'. We call G', a 1-*fold of* G. Consider a sequence of graphs $G = G_0, G_1, G_2, \ldots, G_k$ where G_{i+1} is a 1-fold of G_i for $i = 0, 1, 2, \ldots, k-1$. This sequence is called a k-folding of $G = G_0$. Let $\mathcal{A}(G_i)$ be the adjacency matrix of the graph G_i. A graph G_i is singular if $\mathcal{A}(G_i)$ is singular and nonsingular if $\mathcal{A}(G_i)$ is nonsingular. A graph G is said to have a uniform k-folding if there is a k-folding in which all graphs in the sequence are singular or all of them are nonsingular. The largest integer k for which there exists a uniform k-folding of G is called *fold thickness* of G, and is denoted by **fold** (G). If $G = G_0, G_1, G_2, \ldots, G_k$ is a k-folding of G, the graph G_k is referred as a k-*fold* of G. The *fold thickness* of a graph was first defined by F. J. H. Campeña and S.V. Gervacio in [1] and evaluated fold thickness of some special classes of graphs such as wheel graph, cycle graph, bipartite graphs etc.

2. Preliminaries

In this paper P_n, C_n and K_n denotes the path, cycle and complete graph on n vertices respectively. For vertex disjoint graphs G and H, the graph join, $G + H$ is the graph with vertex set $V(G + H) = V(G) \cup V(H)$ and edge set

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On graphs that have a unique least common multiple

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ABSTRACT

A graph G without isolated vertices is a least common multiple of two graphs H_1 and H_2 if G is a smallest graph, in terms of number of edges, such that there exists a decomposition of G into edge disjoint copies of H_1 and there exists a decomposition of G into edge disjoint copies of H_2. The concept was introduced by G. Chartrand *et al.* and they proved that every two nonempty graphs have a least common multiple. Least common multiple of two graphs need not be unique. In fact two graphs can have an arbitrary large number of least common multiples. In this paper graphs that have a unique least common multiple with $P_3 \cup K_2$ are characterized.

RESUMEN

Un grafo G sin vértices aislados es un mínimo común múltiplo de dos grafos H_1 y H_2 si G es uno de los grafos más pequeños, en términos del número de ejes, tal que existe una descomposición de G en copias de H_1 disjuntas por ejes y existe una descomposición de G en copias de H_2 disjuntas por ejes. El concepto fue introducido por G. Chartrand *et al.* donde ellos demostraron que cualquera dos grafos no vaciós tienen un mínimo común múltiplo. El mínimo común múltiplo de dos grafos no es necesariamente único. De hecho, dos grafos pueden tener un número arbitrariamente grande de mínimos comunes múltiplos. En este artículo caracterizamos los grafos que tienen un único mínimo común múltiplo con $P_3 \cup K_2$.

Keywords and Phrases: Graph decomposition, common multiple of graphs.

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On decomposition of multistars into multistars

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Abstract

The multistar $S^{w_1,\dots,w_n}$ is the multigraph whose underlying graph is an n-star and the multiplicities of its n edges are $w_1, \dots, w_n$. Let G and H be two multigraphs. An H-decomposition of G is a set D of H-subgraphs of G, such that the sum of $\omega(e)$ over all graphs in D which include an edge e, equals the multiplicity of e in G, for all edges e in G. In this paper, we fully characterize $S^{1,2,3}$, $K_{1,m}$ and S^{m^l} decomposable multistars, where m^l is m repeated l times.

Keywords: decomposition; multigraph; multistar
2020 AMS subject classifications: 05C51; 05C70; 05C75 [1]

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