

# Further Results on Odd Harmonious Labeling of Graphs

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**Abstract:** Liang and Bai proposed the notion of odd harmonious labeling of a graph in 2009. Since then, numerous papers have explored this topic. This study adds some new results to the existing literature. First, we provide a sufficient condition for an Eulerian graph to be an odd harmonious graph, which enhances the result from 2014. Furthermore, we identify several new classes of graphs that exhibit odd harmonious properties.

**Keywords:** disjoint union of graphs; odd harmonious labeling; path union of graphs; splitting graph; subdivided shell flower graph; vertex union of graphs.

**2010 Mathematics Subject Classification.** 26A25; 26A35.

## 1 Introduction

The concept of odd harmonious labeling of a graph was defined in 2009 by Liang and Bai [18] as follows: A graph  $G$  is said to be odd harmonious if there exists an injection  $f : V(G) \rightarrow \{0, 1, 2, \dots, 2q - 1\}$  such that the induced function  $f^* : E(G) \rightarrow \{1, 3, \dots, 2q - 1\}$  defined by  $f^*(uv) = f(u) + f(v)$  is a bijection. If  $f(V(G)) = \{0, 1, 2, \dots, q\}$  then  $f$  is called as strongly odd harmonious labeling and  $G$  is called as strongly odd harmonious graph. Motivated by this concept, several researchers have studied this topic and relevant results have been published in many journals and proceedings, among others. Our published results on odd harmonious labeling of graphs [5]-[17], [19] might definitely be useful to the interested researchers.

In this paper, we add further results on this labeling. Throughout the paper, we refer to the vertices and edges of the graph  $G$  by points and links respectively. We also introduce a new graph namely  $D_2 \& Spl(G)$ . To construct the graph, first find shadow graph  $D_2(G)$  and then for the original graph  $G$ , find splitting graph  $Spl(G)$ . The combination of  $D_2(G)$  and  $Spl(G)$  gives a new graph  $D_2 \& Spl(G)$ . An example for the graph  $D_2 \& Spl(P_5)$  is shown in Figure 1.

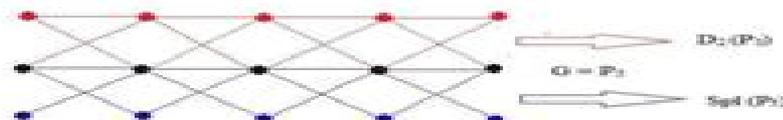


Fig. 1:  $D_2 \& Spl(P_5)$

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# Odd Harmonious Labeling Of Some Graphs Core

**Martin Baca, Mirka Miller**



## Odd Harmonious Labeling Of Some Graphs Core:

Mathematical Reviews ,2004     Graceful, Harmonious and Magic Type Labelings Susana C. López,Francesc A. Muntaner-Batle,2017-02-26 Aimed toward upper undergraduate and graduate students in mathematics this book examines the foremost forms of graph labelings including magic harmonious and graceful labelings An overview of basic graph theory concepts and notation is provided along with the origins of graph labeling Common methods and techniques are presented introducing readers to links between graph labels A variety of useful techniques are presented to analyze and understand properties of graph labelings The classical results integrated with new techniques complete proofs numerous exercises and a variety of open problems will provide readers with a solid understanding of graph labelings     **How to Label a Graph** Gary Chartrand,Cooroo Egan,Ping Zhang,2019-06-15 This book depicts graph labelings that have led to thought provoking problems and conjectures Problems and conjectures in graceful labelings harmonious labelings prime labelings additive labelings and zonal labelings are introduced with fundamentals examples and illustrations A new labeling with a connection to the four color theorem is described to aid mathematicians to initiate new methods and techniques to study classical coloring problems from a new perspective Researchers and graduate students interested in graph labelings will find the concepts and problems featured in this book valuable for finding new areas of research     **Design Annual** ,2011     *Super Edge-Antimagic Graphs* Martin Baca,Mirka Miller,2008 Graph theory and graph labeling in particular are fast growing research areas in mathematics New results are constantly being discovered and published at a rapidly increasing rate due to the enormous number of open problems and conjectures in the field This book deals mainly with the super edge antimagic branch of graph labeling It is written for specialists but could be read also by postgraduate or undergraduate students with high school knowledge of mathematics and a vibrant interest in problem solving     *A Study on Graph Labeling Problems* J. Lisy Bennet ,S. Chandra Kumar, Graph theory has applications in many areas of the computing social and natural science The theory is also intimately related to many branches of mathematics including matrix theory numerical analysis probability topology and combinatory The fact is that graph theory serves as a mathematical for any system involving a binary relation

4-Remainder Cordial Labeling of Some Graphs R.Ponraj,K.Annathurai,R.Kala, In this paper we investigate the 4 remainder cordial behavior of grid subdivision of crown Subdivision of bistar book Jelly fish subdivision of Jelly fish Mongolian tent graphs     *Handbook to Harmonious Labelings of Graphs* Dushyant Tanna,2014-08-07 Graph theory as a part of Discrete Mathematics has lots of application in the real world This Book as an good introduction to graph theory will be a handy manual for all those who need a background of graph theory with all relevant definitions and examples Basic results and theorems related to labeling are given with proof and examples Some of the open problems are also posed In Short this will be a good starter pack for the graceful and harmonious labeling of graphs     **Some Labeling Theorems for Planar Linear Graphs** Horace Maynard Trent,1969     Even Modular Edge Irregularity Strength of Graphs

K.Muthugurupackiam,S.Ramya, A new graph characteristic even modular edge irregularity strength of graphs is introduced Estimation on this parameter is obtained and the precise values of this parameter are obtained for some families of graphs

*Magic and Antimagic Graphs* Martin Bača,Mirka Miller,Joe Ryan,Andrea Semaničová-Feňovčíková,2019-09-14 Magic and antimagic labelings are among the oldest labeling schemes in graph theory This book takes readers on a journey through these labelings from early beginnings with magic squares up to the latest results and beyond Starting from the very basics the book offers a detailed account of all magic and antimagic type labelings of undirected graphs Long standing problems are surveyed and presented along with recent results in classical labelings In addition the book covers an assortment of variations on the labeling theme all in one self contained monograph Assuming only basic familiarity with graphs this book complete with carefully written proofs of most results is an ideal introduction to graph labeling for students learning the subject More than 150 open problems and conjectures make it an invaluable guide for postgraduate and early career researchers as well as an excellent reference for established graph theorists

**Distance-two Constrained Labeling and List-labeling of Some Graphs** Haiying Zhou,2013

**Some Results on 4-Total Difference Cordial Graphs** R. Ponraj, A graph with admits a  $k$  total difference cordial labeling is called  $k$  total difference cordial graphs

From Multi-prime to Subset Labelings of Graphs Bethel I. McGrew,2021 A graph labeling is an assignment of labels elements of some set to the vertices or edges or both of a graph  $G$  If only the vertices of  $G$  are labeled then the resulting graph is a vertex labeled graph If only the edges are labeled the resulting graph is an edge labeled graph The concept was first introduced in the 19th century when Arthur Cayley established Cayley's Tree Formula which proved that there are  $n^{n-2}$  distinct labeled trees of order  $n$  Since then it has grown into a popular research area In this study we first review several types of labelings then turn to the particular problem of multi prime labelings where products of distinct primes are assigned as labels that are disjoint for adjacent vertices and intersecting for non adjacent vertices We express the problem in the equivalent language of subset labelings denoting elements in a label by their indices  $1, 2, \dots, k$  A graph's subset index is the smallest number of elements  $k$  from which we can assign a subset labeling  $f$  considered as a function with domain  $V(G)$  and range  $P_k$  i.e the power set of  $k$  with the empty set omitted It turns out that the problem of determining the subset index for graph classes such as paths and cycles is nontrivial For paths of order  $n$  we determine the index up to  $n-4$  and for cycles of order  $n$  we determine it up to  $n-18$  We also describe the connection between the problem of determining the subset index of a graph and a combinatorics problem related to the so called Erdős-Ko-Rado Theorem namely the problem of determining the largest possible family of sets such that every set is disjoint from at most some fixed number of sets in the collection Our work on subset labelings of cycles in particular has resulted in the correction of a significant research result in this area reopening the problem for further research We also consider the problem of determining the subset index for other graph classes including prisms and grids for which we present upper bounds in terms of the subset indices of paths and cycles We conclude by studying the

problem for select graph unions      **Distance Two Labeling of Some Products of Graphs** Qiong Wu, Hong Kong Baptist University. Department of Mathematics, 2013      *Cordial Labeling of Some New and Existing Classes of Graphs* Alice Lacaze-Masmonteil, 2016

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