

Even-odd Harmonious Labeling of Some Graphs

Dhvanik Zala, Narendra Chotaliya, Michal Chaurasiya



Abstract: Let $G = (V, E)$ be a graph, with $n = |V(G)|$ and $m = |E(G)|$. An injective mapping $f: V(G) \rightarrow \{1, 2, 3, \dots, 2m-1\}$ is called an even-odd harmonious labeling of the graph G , if τ is an induced edge mapping $f^*: E(G) \rightarrow \{0, 2, 4, \dots, 2(m-1)\}$ such that (i) f^* is bijective mapping (ii) $f^*(e = pq) = (f(p) + f(q)) \pmod{2m}$. The graph acquired from this labeling is called even-odd harmonious graph. In this paper, we discovered some interesting results like H-graph, comb graph, bistar graph and $\langle K_{2n}^{(2)}, K_{2n}^{(2)}, K_{2n}^{(2)} \rangle$ graph for even-odd harmonious labeling.

Keywords: Comb graph, Even-odd harmonious labeling, H-graph, Injective mapping

I. INTRODUCTION

Graph labeling is an engrossing and shirable research in the arena of graph theory. It trades in how vertices and edges of a graph are labelled corresponding to certain mathematical condition[1]. From Gallian[5], the meiotic research development in the sphere of graph labeling is taken. The pioneer of graph labeling was A. Rosa[10]. Books of Harary[2] and D.B.West[8] are being used for the ideas and basic knowledge. The harmonious graph have investigated [3] in 1980. Z.Liang et al[8] set forth the odd harmonious graphs in 2009 and in 2011 P.B.sarasija et al [10] investigated the even harmonious graphs. Further Adalin Beatress and Sarasija in [2] set forth the even odd harmonious graphs. We have manifested distinct graphs, as we have collected distinct types of graphs in forms of even - odd harmonious labeling.

II. BASIC TERMINOLOGY

Definition[16] 2.1: A graph $G = (V(G), E(G))$ with n edges is called a harmonious, if there is an injective function $f: V(G) \rightarrow \mathbb{Z}_n$ such that when each edge uv is allotted the label $(f(u) + f(v)) \pmod{n}$, the resulting edge labels are different. When the graph G is tree, exactly one edge label may be used on two vertices.

Definition[7] 2.2: Let $G = (V, E)$ be a graph, with $n = |V(G)|$ and $m = |E(G)|$, $f: V(G) \rightarrow \{1, 2, 3, \dots, 2m-1\}$ is said to be an even-odd harmonious labeling of the graph G if

τ is an induced edge mapping $f^*: E(G) \rightarrow \{0, 2, 4, \dots, 2(m-1)\}$ such that (i) f^* is bijective mapping (ii) $f^*(e = pq) = (f(p) + f(q)) \pmod{2m}$. The graph acquired from this labeling is called even-odd harmonious graph.

Definition[8] 2.3: The H-graph of a path P_n is the graph secured from two copies of path P_n with vertices $v_1, v_2, v_3, \dots, v_n$ and $v_{n+1}, v_{n+2}, v_{n+3}, \dots, v_{2n}$ by attaching the vertices v_{n+1} and v_{n+2} if n is odd and the vertices $v_{\frac{n}{2}-1}$ and $v_{\frac{n}{2}}$ if n is even.

Definition[8] 2.4: A comb graph is a graph obtained by attaching a single pendant edge to each vertex of a path. The comb graph is defined as $P_n \odot K_1$. Where $P_n = \{v_1, \dots, v_n\}$ be the path with n vertices which contains n vertices and $n-1$ edges.

Definition[9] 2.5: The bistar graph $B_{n,p}$ is a graph acquired from a path P_n by attaching the root of stars S_n and S_m at the terminal vertices of P_n , the bistar graph is denoted by $B_{n,m}$.

Remark: In this paper, we use "EOHL" instead of "even-odd harmonious labeling", for the simplicity.

III. EVEN-ODD HARMONIOUS LABELING OF ACYCLIC GRAPH

Theorem 3.1: The H-graph of path P_n is an even-odd harmonious graph.

Proof: Let $G = H_n$ be the H-graph. Let $v_1, v_2, v_3, \dots, v_n, v_{n+1}, v_{n+2}, v_{n+3}, \dots, v_{2n}$ be the vertices of graph G and $E(G) = \{v_1v_2, v_2v_3, \dots, v_{n-1}v_n, v_1v_{n+1}, v_2v_{n+2}, \dots, v_nv_{n+n}\}$ $\langle v_{n+1}v_{n+2}, v_{n+2}v_{n+3}, \dots, v_{n+n-1}v_{n+n} \rangle$ $\langle v_{n+1}v_{n+2}, v_{n+2}v_{n+3}, \dots, v_{n+n-1}v_{n+n} \rangle$ $\langle v_{n+1}v_{n+2}, v_{n+2}v_{n+3}, \dots, v_{n+n-1}v_{n+n} \rangle$

Note that, $p = |V(G)| = 2n$ and $q = |E(G)| = 2n - 1$. Define an injective function $f: V(G) \rightarrow \{1, 2, 3, \dots, 4n-1\}$ such that

Case-1: - When $n \equiv 1 \pmod{2}$

$$f(v_i) = \begin{cases} i & i \equiv 1 \pmod{2} \\ 2n+i-1 & i \equiv 0 \pmod{2} \end{cases} \quad \text{and}$$

$$f(v_i) = \begin{cases} 3n+i-1 & i \equiv 1 \pmod{2} \\ n+i & i \equiv 0 \pmod{2} \end{cases}$$

Case-2: - When $n \equiv 0 \pmod{2}$

$$f(v_i) = \begin{cases} i & i \equiv 1 \pmod{2} \\ 2n+i-1 & i \equiv 0 \pmod{2} \end{cases} \quad \text{and}$$

$$f(v_i) = \begin{cases} 2n-i & i \equiv 1 \pmod{2} \\ 4n-i+1 & i \equiv 0 \pmod{2} \end{cases}$$

and an induced edge function $f^*: E(G) \rightarrow \{0, 2, 4, \dots, 4n-4\}$ such that

Case-1: - When $n \equiv 1 \pmod{2}$

$$f^*(v_i) = f^*(v_{i+1}v_i) = (2n+2i) \pmod{2n}, 1 \leq i \leq n-1$$

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