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Gaussian Divisor Cordial Anti Magic Labeling in Some Classes of Graphs.

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Abstract: New labeling such as Gaussian Divisor Cordial labeling introduced in this paper. We investigate if the above mentioned labelings exist for the $D_2(K_{1,n})$ graph , The Spl$(K_{1,n})$ graph , Modified extended duplicate graph of star, Modified extended duplicate graph of path, corona graph $K_p \odot K_h$, corona graph $W_p \odot K_h$, corona graph $S_p \odot K_h$, corona graph $H_p \odot K_h$, Corona product of P_g o K_2 graph and Corona product of $P_n\ o\ C_g$ graph.

Keywords: Graph labelings, antimagic graphs, Gaussian antimagic graphs , Guassian divisor cordial antimagic graph.

I . Introduction

Rosa [3] first proposed the idea of graph labeling in 1967. An integer label is applied to a graph's edges, vertices, or both, depending on the circumstances. Recently, there has been a rapid growth of the graph labeling problem that arises in graph theory. This is because of its importance in mathematics as well as the variety of application it has, such as in X-rays, crystallography, coding theory, radar, astronomy, circuit design, and the creation of effective radar type codes, missile guidance codes, convolution codes, and communication codes with the best autocorrelation properties. In the last five decades, an enormous literature has been written about the topic. Families of graphs bearing lovely names like graceful, harmonic, felicitous, and elegant were both out of them.

The concept of Gaussian antimagic labeling was recently introduced in [5].The paper proves that graphs such as the $D_2(K_{1,n})$ graph , Spl$(K_{1,n})$ graph , Modified extended duplicate graph of star, Modified extended duplicate graph of path, corona graph $K_p \odot K_h$, corona graph $W_p \odot K_h$, corona graph $S_p \odot K_h$, corona graph $H_p \odot K_h$, Corona product of P_g o K_2 graph and Corona product of $P_n\ o\ C_g$ graph can have Gaussian antimagic labeling.

II Preliminaries

In this section, we give basic notions relevant to this paper.

Definition 2.1 : The shadow graph D_2(H) of a connected graph H is constructed by taking two copies of H, denoted as H_1 and H_2. Join each vertex u in H_1 to the neighbors of the corresponding vertex v in H_2.

Definition 2. 2 : The spilt graph Spl(H) is obtained by adding a new vertex s′ to each vertex s in the graph G. In Spl(H), the vertex s′ is connected to every vertex that is adjacent to s in H. The resultant graph is denoted as Spl(H).

Definition 2.3. The extended duplicate graph of star is denoted byEDG(S_m), is obtained from the duplicate graph of star by v_1 joining and v_1'.

Definition 2.4. The extended duplicate graph of path graph is denoted by EDG(P_m)has 2m+2 vertices and 2m+1 edges .

Definition 2.5 : The graph obtained with one copy of G and n copies of H and connecting the jth vertex of G with each and every vertex in the jth copy of H is referred as corona graph of G with order n. It is mentioned as $G \odot H$.

Definition2.6 : Corona graph $K_p \Theta K_h$ is the complete graph on *p* vertices with *h* pendent vertices connected to each vertex of the complex graph.

Definition 2.7 : Corona graph $W_p \Theta K_t$ is the wheel graph on *p*+1 vertices with *h* pendent vertices connected by *p* vertices on the boundary of the wheel graph. It is also denoted by $W_p \Theta nK_1$

Definition 2.8 : Corona graph $S_p \Theta K_h$ is the star graph on *p*+1 vertices with *h* pendent vertices connected by *p* vertices on the boundary of the star graph. It is also denoted by $S_p \Theta nK_1$.

Definition 2.9 : Corona graph $H_p \Theta K_h$ is the helm graph on 2*p*+1 vertices with *h* pendent vertices connected by *p* vertices vertices on the boundary of the helm graph. It is also denoted by $H_p \Theta nK_1$.

Definition 2.10: When graph G has edge labels, the weight of vertex v is equal to the sum of the edge labels for all edges intersecting with it. Total labeling defines the vertex weight of v as the sum of the label of v and the edge labels for all edges incident v. If k is identical among all vertices in G, the labeling is known as vertex-magic edge labeling or vertex-magic total labeling, and k is mentioned as magic constant. The labeling process is called vertex-antimagic edge labeling or vertex-antimagic total labeling if all of G's vertices have different weights.

Definition 2.11:

Let Ø be a function from the vertices of G to {1,0} and for each xy assigns the label $|\text{Ø}(x) - \text{Ø}(y)|$. The function Ø is said to be a cordial labeling of G if the number of vertices labeled 1 and the number of vertices labeled 0 differ by at most one, the number of edges labeled 1, and the number of edges labeled 0 differ by at most one.

Definition 2.12. A Graph G is called a divisor cordial labeling if for a function from a set of all vertices V to {1,2,3,. . .,p} such that each edge uv∈G assign the label 1 if either φ(u) / φ(v) or φ(v) / φ(u) and label 0 if φ(u) ∤ φ(v) or φ(v) ∤ φ(u) such that it satisfies $|e_{\text{Ø}}(1) - e_{\text{Ø}}(0)| \leq 1$ and called as divisor cordial graph.

Definition 2.13: Gaussian antimagic labeling in a G(q,r) graph is a function f: V → {c+id/c,d∈ N} 1 ≤c≤d≤ r such that the induced function $f^*: E \to N$ defined by $f^*(vw) = |f(v)|^2 + |f(w)|^2$ results all the edge labels are distinct. A graph that admits Gaussian antimagic labeling is called a Gaussian antimagic graph.

Definition 2.14: Let G=(V(G),E(G)) be a Simple graph and

$f:V(G) \to \{\alpha+i\beta/\alpha,\beta \in Z^+\}$be a bijection function is said to be a Guassian divisor Cordial Labeling if for each edge vw, the induced map

$$\varphi(vw) = \begin{cases} 1, & \text{if } |f(v)|^2/|f(w)|^2 \text{ or } |f(w)|^2/|f(v)|^2 \text{ is an integer} \\ 0, & \text{otherwise} \end{cases}$$

satisfies the condition $|e_f(1) - e_f(0)| \leq 1$ where $e_f(1)$ is the number of edges having label '1' and $e_f(0)$ is the number of '0' – labeled edges.

III.Main Results

Gaussian Divisor Cordial Antimagic Labeling in Shadow and Splitting graph of $K_{1,n}$ Graphs

Theorem 3. 1: The $D_2(K_{1,n})$ admits Gaussian divisor cordial antimagic labeling.

Proof: Let V = { $u_1, u_2, u_3, \ldots, u_m, v_1, v_2, v_3, \ldots, v_m$,s, t } be the vertices and E ={{ $s u_h$ / $1 \leq h \leq m$, m∈ N }∪{ $t u_h$ / $1 \leq h \leq m$, $h \neq \frac{m+1}{2}$ m∈ N } ∪

{ $t v_h$ / $1 \leq h \leq m$, m∈ N }∪ { $s v_h$ / $1 \leq h \leq m$, $h \neq \frac{m+1}{2}$ m∈ N }} be the edges of the $D_2(K_{1,n})$ graph. |V |=2m+2, |E |=4m-2.where 'm' is odd

Define a function $f : V \rightarrow \{a+ib \,/\, a, b \in N\}$ such that

$f(u_k) = 2^{k+1}+i2^{(k+2)}$, $1 \le k \le m$.

$f(v_k) = 2^k+i(2^{(k+1)}+1)$, $1 \le k \le m$

$f(s) = 2+i2$

$f(t) = 1+i$

Define the induced function $\varphi : E \rightarrow \{0,1\}$ is given by

$$\varphi(v_i v_{i+1}) = \begin{cases} 1, \text{ if } \mathbf{|f(x)|^2/|f(y)|^2 \text{ or } |f(y)|^2/|f(x)|^2 \text{ is integer}} \\ 0, \text{ otherwise} \end{cases}$$

This implies that $|e_f(0) - e_f(1)| \le 1$

$D_2(K_{1,n})$ graph						
Edge	**Limit**	**Edge Labeled**	**No. of 0's**	**No. of 1's**	**Total No. of Edges**	**Total No. of vertices**
s u_h	$1 \le h \le m$	One	0	m		
t u_h	$1 \le h \le m$, $h \ne \frac{m+1}{2}$	One	0	m-1		
t v_h	$1 \le h \le m$	Zero	m	0		
s v_h	$1 \le h \le m$, $h \ne \frac{m+1}{2}$	Zero	m-1	0		
Total			2m-1	2m-1	4m-2	2m+2

Example 3.1: The Gaussian divisor cordial antimagic labeling for $D_2(K_{1,n})$ graph with $2m + 2$ vertices is shown in figure –3.1

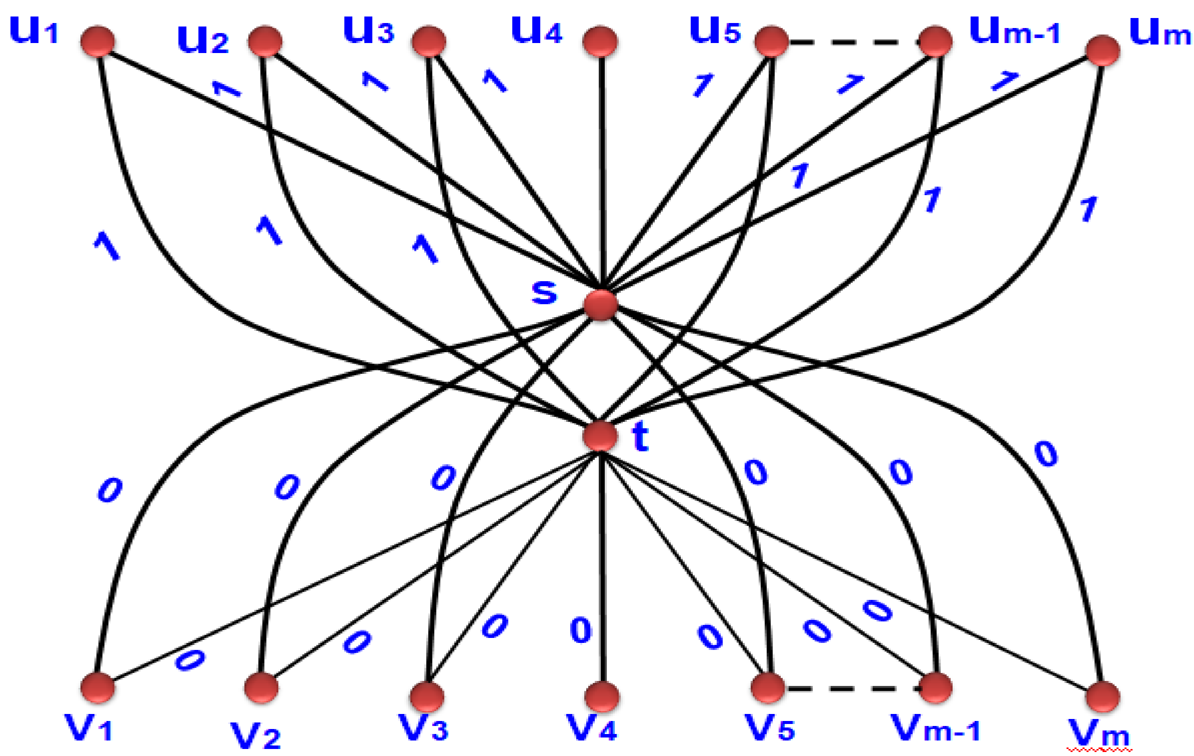

Figure 3.1.: The Gaussian divisor cordial antimagic labeling for $D_2(K_{1,n})$ graph with $2m + 2$

Theorem 2: The Spl$(K_{1,n})$ admits Gaussian divisor cordial antimagic labeling.

Proof: Let V = { $u_1, u_2, u_3, \ldots, u_m$, s , $v_1, v_2, v_3, \ldots, v_{m-1}$, t } be the vertices and E ={{ s u_h / $1 \le h \le m$, $m \in N$ }∪{ s v_{2h-1} / $1 \le h \le \frac{m-1}{2}$, $m \in N$ } ∪

{ s v_{2h} / $1 \le h \le \frac{m-1}{2}$, $m \in N$ }∪ { t v_h / $1 \le h \le m-1$, $m \in N$ } ∪{ s t}} be the edges of the Spl$(K_{1,n})$ graph. |V |=2m+1, |E |=3m-1.where ‘m’ is odd

Define a function f : V → {a+ib / a, b ∈ N } such that

$f(u_k) = (k+1)+i\,(k+2)$, $1 \le k \le m$.

$f(v_k) = (k+2)+i\,(2k+4)$,$1 \le k \le m-1$

$f(s) = 2+i4$

$f(t) = 1+i2$

Define the induced function $\varphi : E \to \{0,1\}$ is given by

$$\varphi(v_i v_{i+1}) = \begin{cases} 1, & \text{if } |f(x)|^2/|f(y)|^2 \text{ or } |f(y)|^2/|f(x)|^2 \text{ is integer} \\ 0, & \text{otherwise} \end{cases}$$

This implies that $|e_f(0) - e_f(1)| \leq 1$

Spl($K_{1,n}$) graph						
Edge	**Limit**	**Edge Labeled**	**No. of 0's**	**No. of 1's**	**Total No. of Edges**	**Total No. of vertices**
s u_h	$1 \leq h \leq m$	Zero	m	0		
s v_{2h-1}	$1 \leq h \leq \frac{m-1}{2}$	Zero	$\frac{m-1}{2}$	0		
s v_{2h}	$1 \leq h \leq \frac{m-1}{2}$	One	0	$\frac{m-1}{2}$		
t v_h	$1 \leq h \leq m-1$,	One	0	m-1		
S t	-	One	0	1		
Total			$\frac{3m-1}{2}$	$\frac{3m-1}{2}$	3m-1	2m+1

Example.3. 2: The Gaussian divisor cordial antimagic labeling for Spl($K1,n$) graph with $2m + 1$ vertices is shown in figure –3.2

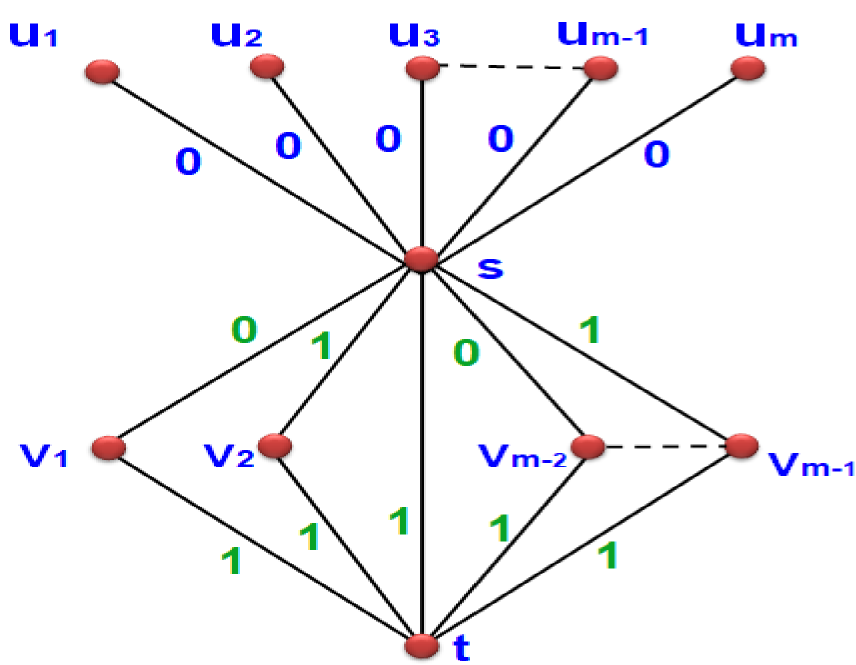

Figure 3.2.: The Gaussian divisor cordial antimagic labeling for Spl($K1,n$) graph with $2m + 1$ vertices.

Gaussian Anti Magic Labeling for Modified Extended Duplicate Graph of Star and Path

Theorem 3.3: The Modified extended duplicate graph of star admits Gaussian divisor cordial antimagic labeling

Proof: Let V = { s, t, u, $v_1, v_2, v_3, \ldots, v_m$ $w_1, w_2, w_3, \ldots, w_m$ } be the vertices and E ={{ s w_h / $1 \le h \le m$, m∈ N }∪{ t v_h / $1 \le h \le m$, m∈ N } ∪ { s u }∪ { u t }

} be the edges of the Modified extended duplicate graph of star.

|V |=2m+3, |E |=2m+2.

Define a function f : V → {a+ib / a, b ∈ N } such that

$f(w_k) = 2^{k+1}+i2^{(k+2)}$, $1\le k \le m$.

$f(v_k) = k+i(k+1)$,$1\le k \le m$

f(s) = 2+i2

f(t) = 1+i , f(u) = 1+i3

Define the induced function $\varphi : E \to \{0,1\}$ is given by

$$\varphi(v_i v_{i+1}) = \begin{cases} 1, & \text{if } \mathbf{|f(x)|^2/|f(y)|^2 \text{ or } |f(y)|^2/|f(x)|^2 \text{ is integer}} \\ 0, & \text{otherwise} \end{cases}$$

This implies that $|e_f(0) - e_f(1)| \le 1$

Modified extended duplicate graph of star						
Edge	**Limit**	**Edge Labeled**	**No. of 0's**	**No. of 1's**	**Total No. of Edges**	**Total No. of vertices**
s w_h	$1 \le h \le m$	One	0	m		
t v_h	$1 \le h \le m$	Zero	m	0		
s u	-	Zero	1	0		
u t	-	One	0	1		
Total			m+1	m+1	2m+2	2m+3

Example 3.3: The Gaussian divisor cordial antimagic labeling for Modified extended duplicate graph of star with $2m + 3$ vertices is shown in figure – 3.3

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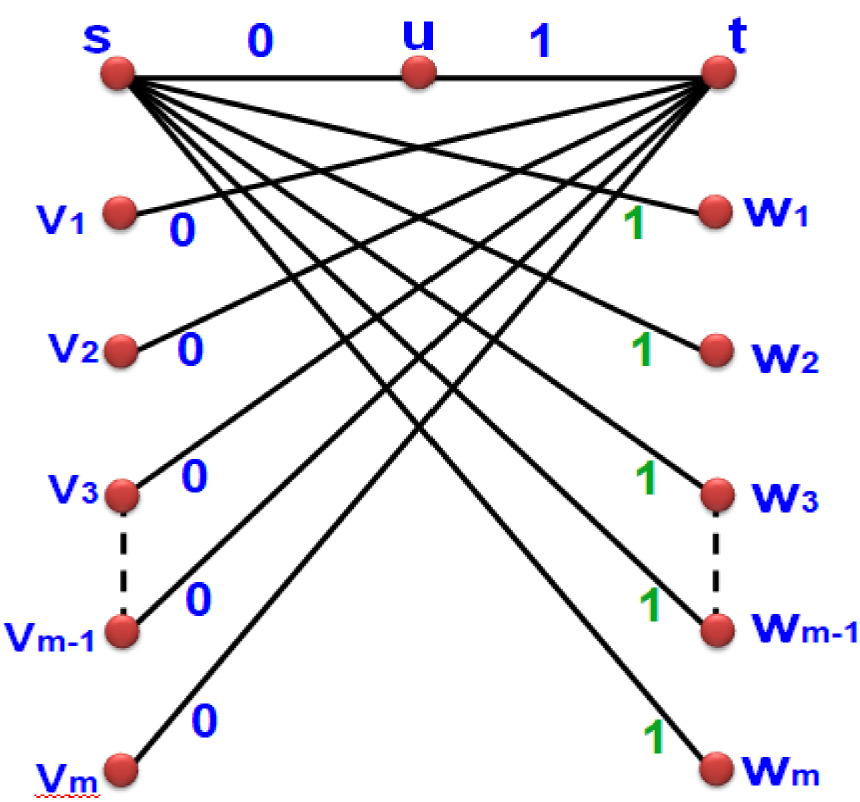

Figure 3.3.: The Gaussian divisor cordial antimagic labeling for Modified extended duplicate graph of star with $2m + 3$ vertices.

Theorem 3.4: The Modified extended duplicate graph of path admits Gaussian divisor cordial antimagic labeling.

Proof: Let V = { $u_1, u_2, u_3, \ldots, u_m, v_1, v_2, v_3, \ldots, v_m$ } be the vertices and E ={{ $u_h v_{h+1}$ / $1 \le h \le (m-1)$, $m \in N$ }∪{ $v_h u_{h+1}$ / $1 \le h \le (m-1)$, $m \in N$ } ∪

{ $u_2 v_2$ }} be the edges of the Modified extended duplicate graph of path. $|V| = 2m$, $|E| = 2m-1$. Define a function $f : V \to \{a+ib \mid a, b \in N\}$ such that

$f(u_k) = (k+1)+i(k+2), \quad 1 \le k \le m.$

$f(v_k) = (2k+4)+i(2k+6), \quad 1 \le k \le m$

Define the induced function $\varphi : E \to \{0,1\}$ is given by

$$\varphi(v_i v_{i+1}) = \begin{cases} 1, \text{ if } \mathbf{|f(x)|^2/|f(y)|^2 \text{ or } |f(y)|^2/|f(x)|^2 \text{ is integer}} \\ 0, \text{ otherwise} \end{cases}$$

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This implies that $|e_f(0) - e_f(1)| \leq 1$

Modified extended duplicate graph of path						
Edge	**Limit**	**Edge Labeled**	**No. of 0's**	**No. of 1's**	**Total No. of Edges**	**Total No. of vertices**
$u_h v_{h+1}$	$1 \leq h \leq (m-1)$	Zero	(m-1)	0		
$u_{h+1} v_h$	$1 \leq h \leq (m-1)$	One	0	(m-1)		
$u_2 v_2$	-	Zero	1	0		
Total			m	m-1	2m-1	2m

Example 3. 4: The Gaussian divisor cordial antimagic labeling for Modified extended duplicate graph of path with $2m$ vertices is shown in figure – 3.4

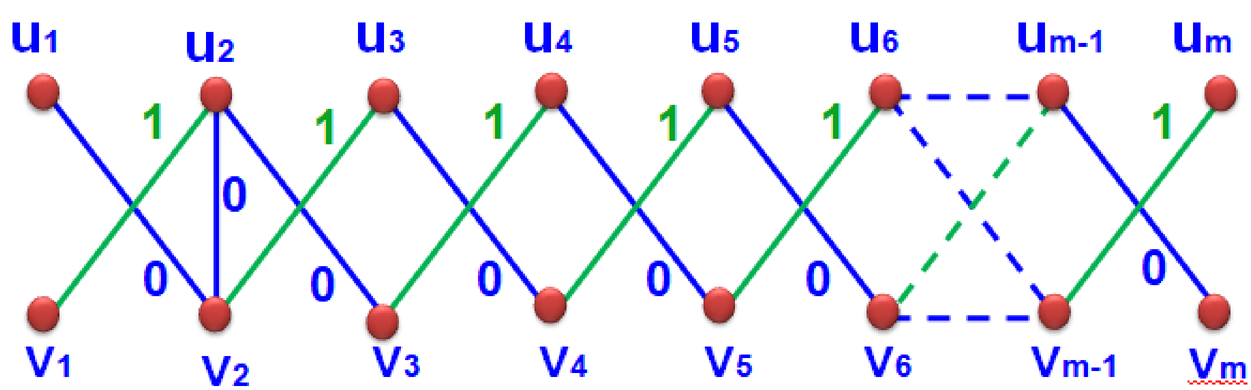

Figure 3.4.: The Gaussian divisor cordial antimagic labeling for Modified extended duplicate graph of path with $2m$ vertices

Gaussian antimagic labeling on the Families of Corona graphs Theorem 3.5: The corona graph $K_p \Theta K_h$ admits Gaussian divisor cordial antimagic labeling.

Proof: Let V = $\{r, s, t_1, t_2, t_3, \ldots, t_m, u_1, u_2, u_3, \ldots, u_{m+1}, v_1, v_2, v_3, \ldots, v_{m+1}, w_1, w_2, w_3, \ldots, w_m\}$ be the vertices and E $=\{\{u_1 u_{h+1} / 1 \leq h \leq m, m \in N\} \cup \{v_1 v_{h+1} / 1 \leq h \leq m, m \in N\} \cup \{r t_h / 1 \leq h \leq m, m \in N\} \cup \{s w_h / 1 \leq h \leq m, m \in N\} \cup$

$\{u_1 v_1\} \cup \{v_1 s\} \cup \{s r\} \cup \{r u_1\}\}$ be the edges of the corona graph $K_p \Theta K_h$. $|V|=4m+4$, $|E|=4m+4$.

Define a function $f : V \rightarrow \{a+ib / a, b \in N\}$ such that

$f(u_k) = 2^k + i\, 2^{(k+1)}$, $1 \leq k \leq (m+1)$.

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$f(v_k) = 3^k+i\,3^{(k+1)}$, $1 \le k \le (m+1)$

$f(r) = 1+i$, $f(s) = 2+i2$

$f(t_k) = k+i\,(k+1)$, $1 \le k \le m$.

$f(w_k) = 2^k+i\,(2^{(k+1)}+1)$, $1 \le k \le m$.

Define the induced function $\varphi : E \rightarrow \{0,1\}$ is given by

$$\varphi(v_i v_{i+1}) = \begin{cases} 1, & \text{if } |f(x)|^2/|f(y)|^2 \text{ or } |f(y)|^2/|f(x)|^2 \text{ is integer} \\ 0, & \text{otherwise} \end{cases}$$

This implies that $|e_f(0) - e_f(1)| \le 1$

Modified extended duplicate graph of star						
Edge	**Limit**	**Edge Labeled**	**No. of 0's**	**No. of 1's**	**Total No. of Edges**	**Total No. of vertices**
$u_1\, u_{h+1}$	$1 \le h \le m$	One	0	m		
$v_1\, v_{h+1}$	$1 \le h \le m$	One	0	m		
$r\, t_h$	$1 \le h \le m$	Zero	m	0		
$s\, w_h$	$1 \le h \le m$	Zero	m			
$u_1\, v_1$	-	Zero	1	0		
$v_1\, s$	-	Zero	1	0		
$s\, r$	-	One	0	1		
$r\, u_1$	-	One	0	1		
Total			2m+2	2m+2	4m+4	4m+4

Example 3.5: The Gaussian divisor cordial antimagic labeling for corona graph $K_p \odot K_h$ with $4m+4$ vertices is shown in figure – 3.5

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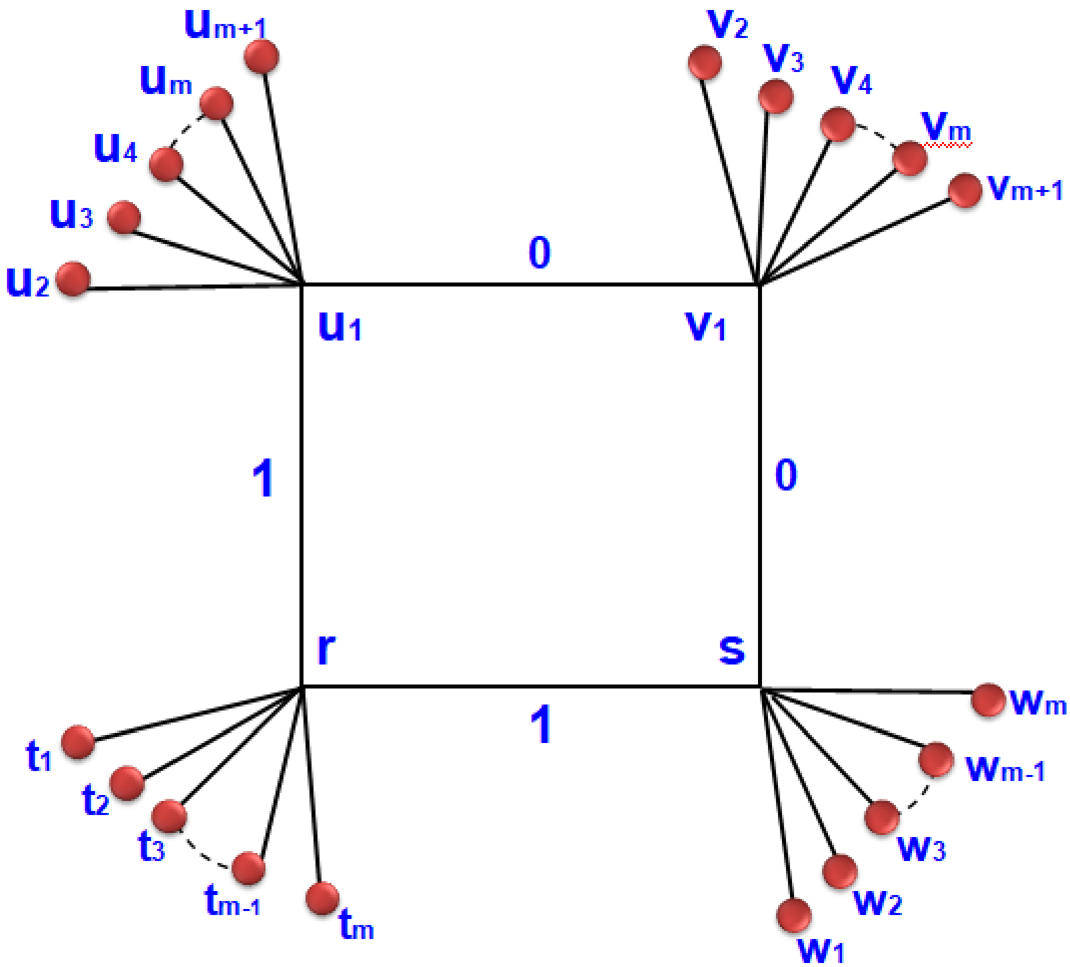

Figure 3.5.: The Gaussian divisor cordial antimagic labeling for corona graph $K_p \odot K_h$ with $4m+4$ vertices.

Theorem 3.6: The corona graph $W_p \odot K_h$ admits Gaussian divisor cordial antimagic labeling.

Proof: Let V = Let V = { $u_1, u_2, u_3, \ldots, u_{(n/2)}, v_1, v_2, v_3, \ldots, v_{(n/2)}$ $u_{1\,1}, u_{1\,2}, u_{1\,3}, \ldots,$ $u_{1\,m}, u_{2\,1}, u_{2\,2}, u_{2\,3}, \ldots, u_{2\,m}, u_{31}, u_{32}, u_{33}, \ldots, u_{3\,m}, \ldots, u_{((n/2-1)\,1}, u_{((n/2-1)\,2}, u_{((n/2-1)\,3}, \ldots$ $, u_{((n/2-1)\,m}, u_{(n/2)\,1}, u_{(n/2)\,2}, u_{(n/2)\,3}, \ldots, u_{(n/2)\,m}, v_{11}, v_{1\,2}, v_{1\,3}, \ldots, v_{1\,m}, v_{2\,1}, v_{2\,2}, v_{2\,3}, \ldots$ $, v_{2\,m}, v_{3\,1}, v_{3\,2}, v_{3\,3}, \ldots, v_{3\,m}, \ldots, v_{((n/2-1)\,1}, v_{((n/2-1)\,2}, v_{((n/2-1)\,3}, \ldots, v_{((n/2-1)\,m},$ $v_{(n/2)\,1}, v_{(n/2)\,2}, v_{(n/2)\,3}, \ldots, v_{(n/2)\,m}$ } be the vertices and E ={{ $u_1 u_{1\,h} / 1 \le h \le m$ } ∪ { $u_2 u_{2\,h} / 1 \le h \le m$ }∪{ $u_3 u_{3h} / 1 \le h \le m$ } ∪ , . . . , ∪ { $u_{((n/2)-1)} u_{((n/2)-1)\,h} / 1 \le h \le m$ } ∪{ $u_{(n/2)} u_{(n/2)\,h} / 1 \le h \le m$ } ∪ { $v_1 v_{1\,h} / 1 \le h \le m$ } ∪ { $v_2 v_{2\,h} / 1 \le h \le m$ } ∪ { $v_3 v_{3\,h} / 1 \le h \le m$ }∪ , . . . , ∪ { $v_{((n/2)-1)} v_{((n/2)-1)\,h} / 1 \le h \le m$ } ∪ { $v_{(n/2)} v_{(n/2)\,h} / 1 \le h \le m$ } ∪ { $u_h u_{(h+1)} / 1 \le h \le (\frac{n}{2}-1)$ } ∪ { $v_h v_{(h+1)} / 1 \le h \le (\frac{n}{2}-1)$ }

∪ { v_1 u_1 } ∪ { $v_{(n/2)}$ $u_{(n/2)}$ } ∪ { $w u_h / 1 \le h \le \frac{n}{2}$ } ∪ { $w v_h / 1 \le h \le \frac{n}{2}$ }} be the edges

of the corona graph $W_p \Theta K_h$. |V |=n(m+1)+1, |E |= n(m+2).

Define a function f : V → {a+ib / a∈ W, b ∈ N } such that

$f(u_k) = (k+1)+i\,(k+1)^2,\ 1 \le k \le (\frac{n}{2})$

$f(v_k) = (k+1)+i((k+1),\ 1 \le k \le (\frac{n}{2}),$

$f(w)= 0+i$

$f(u_{1\,k}) = 2^{(k+1)}+i2^{(k+2)},\ 1 \le k \le m$

$f(u_{2\,k}) = 3^{(k+1)}+i3^{(k+2)},\ 1 \le k \le m$

$f(u_{3\,k}) = 4^{(k+1)}+i4^{(k+2)},\ 1 \le k \le m$

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$f(u_{((n/2)-1)\ k}) = (\frac{n}{2})^{(k+1)}+i(\frac{n}{2})^{(k+2)},\ 1 \le k \le m$

$f(u_{((n/2)\ k}) = (\frac{n}{2}+1)^{(k+1)}+i(\frac{n}{2}+1)^{(k+2)},\ 1 \le k \le m$

$f(v_{1\,k}) = 2^{(k+1)}+i(2^{(k+2)}+1),\ 1 \le k \le m$

$f(v_{2\,k}) = 3^{(k+1)}+i(3^{(k+2)}+1),\ 1 \le k \le m$

$f(v_{3\,k}) = 4^{(k+1)}+i(4^{(k+2)}+1),\ 1 \le k \le m$

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$f(v_{((n/2)-1)\ k}) = (\frac{n}{2})^{(k+1)}+i\,((\frac{n}{2})^{(k+2)}+1),\ 1 \le k \le m$

$f(v_{((n/2)\ k}) = (\frac{n}{2}+1)^{(k+1)}+i((\frac{n}{2}+1)^{(k+2)}+1),\ 1 \le k \le m$

Define the induced function $\varphi : E \to \{0,1\}$ is given by

$$\varphi\,(v_i v_{i+1}) = \begin{cases} 1, \text{ if } |f(x)|^2/|f(y)|^2 \text{ or } |f(y)|^2/|f(x)|^2 \text{ is integer} \\ 0, \text{ otherwisem} \end{cases}$$

This implies that $|e_f(0) - e_f(1)| \le 1$

Corona graph $W_p \Theta K_h$						
Edge	**Limit**	**Edge Labeled**	**No. of 0's**	**No. of 1's**	**Total No. of Edges**	**Total No. of vertices**
$u_1 u_{1h}$	_$1 \le h \le m$	One	0	m		
$u_2 u_{2h}$	_$1 \le h \le m$	One	0	m		
$u_3 u_{3h}$	_$1 \le h \le m$	One	0	m		
-	-	-	-	-		
-	-	-	-	-		
-	-	-	-	-		
$u_{((n/2)-1)}\ u_{((n/2)-1)h}$	_$1 \le h \le m$	One	0	m		
$u_{(n/2)} u_{(n/2)h}$	_$1 \le h \le m$	One	0	m		
$v_1 v_{1h}$	_$1 \le h \le m$	Zero	m	0		
$v_2 v_{2h}$	_$1 \le h \le m$	Zero	m	0		
$v_3 v_{3h}$	_$1 \le h \le m$	Zero	m	0		
-	-	-	-	-		
-	-	-	-	-		
-	-	-	-	-		
$v_{((n/2)-1)}\ v_{((n/2)-1)h}$	_$1 \le h \le m$	Zero	m	0		
$v_{(n/2)} v_{(n/2)h}$	_$1 \le h \le m$	Zero	m	0		
$u_h\ u_{h+1}$	$1 \le h \le (\frac{n}{2}-1)$	Zero	$(\frac{n}{2}-1)$	0		
$v_h\ v_{h+1}$	$1 \le h \le (\frac{n}{2}-1)$	Zero	$(\frac{n}{2}-1)$	0		
$u_{(n/2)}\ v_{(n/2)}$	-	Zero	1			
$u_1\ v_1$	-	Zero	1	0		
$w\ u_h$	$1 \le h \le \frac{n}{2}$	One	0	$\frac{n}{2}$		
$w\ v_h$	$1 \le h \le \frac{n}{2}$	One	0	$\frac{n}{2}$		
Total			$(m+2)(\frac{n}{2})$	$(m+2)(\frac{n}{2})$	$n(m+2)$	$n(m+1)+1$

Example 3.6: The Gaussian divisor cordial antimagic labeling for corona graph with $n(m + 1) + 1$ vertices is shown in figure –3.6

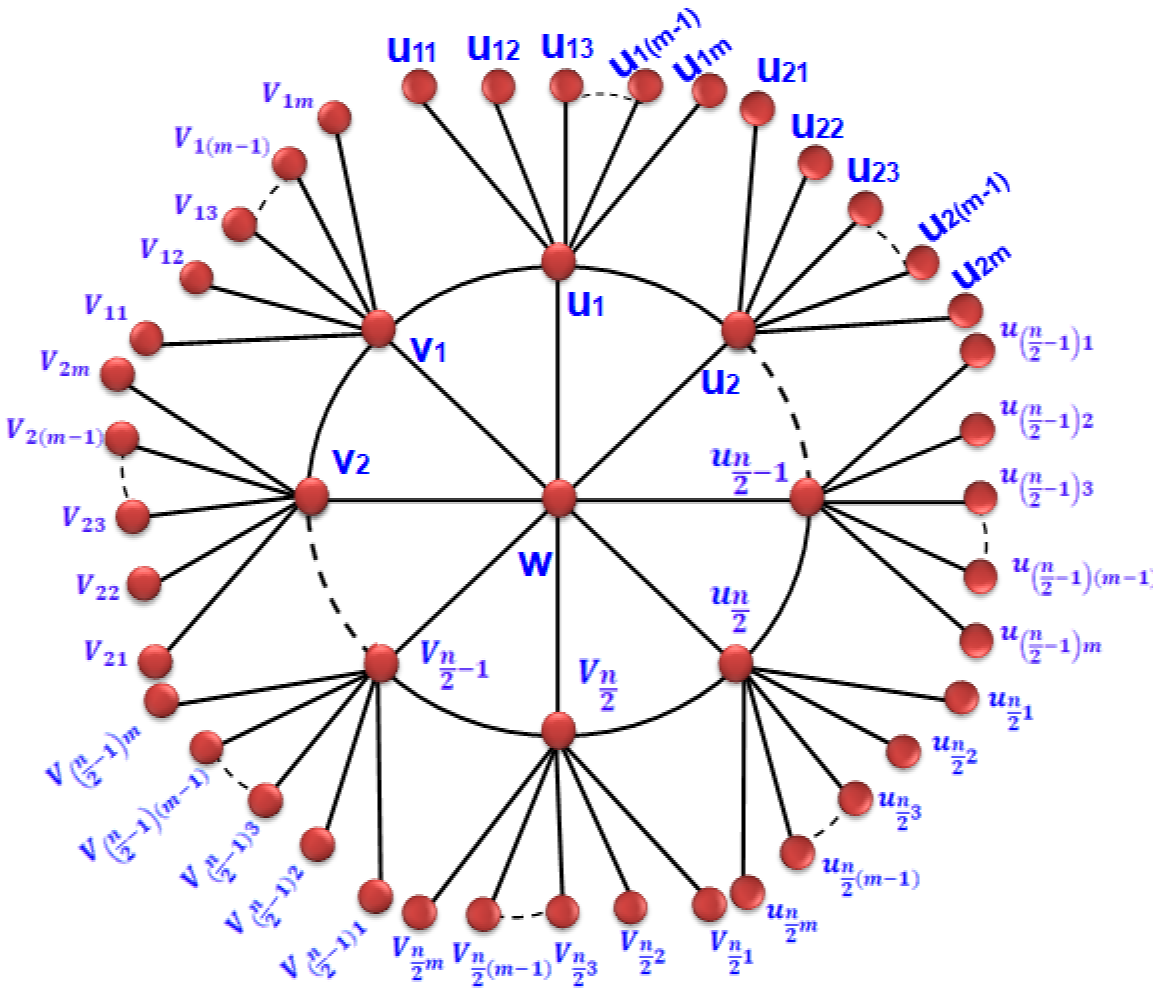

Figure 3.6.: The Gaussian divisor cordial antimagic labeling for corona graph with n(m + 1) + 1 vertices.

Theorem 3.7: The corona graph $S_p \odot K_h$ admits Gaussian divisor cordial antimagic labeling.

Proof: Let V = Let V = { s, $u_1, u_2, u_3, \ldots, u_{(n/2)(m+1)}$, $v_1, v_2, v_3, \ldots, v_{(n/2)}$, $w_{1\,1}, w_{1\,2}, w_{1\,3}, \ldots, w_{1\,m}, w_{2\,1}, w_{2\,2}, w_{2\,3}, \ldots, w_{2\,m}, w_{31}, w_{32}, w_{33}, \ldots, w_{3\,m}, \ldots, w_{((n/2-1)\,1}, w_{((n/2-1)\,2}, w_{((n/2-1)\,3}, \ldots, w_{((n/2-1)\,m}, w_{(n/2)\,1}, w_{(n/2)\,2}, w_{(n/2)\,3}, \ldots, w_{(n/2)\,m}$ } be the vertices and E ={{ $u_1 u_{(h+1)} / 1 \le h \le m$ } ∪ { $u_{m+2}\, u_{(m+2+h)} / 1 \le h \le m$ }∪{ $u_{2m+3}\, u_{(2m+3+h)} / 1 \le h \le m$ } ∪ , . . . , ∪ { $u_{((n/2)-2)m+((n/2)-1)}\, u_{((n/2)-2)m+((n/2)-1)+h} / 1 \le h \le m$ } ∪ {$u_{((n/2)-1)(m+1)+1}\, u_{((n/2)-1)(m+1)+1+h} / 1 \le h \le m$ } ∪ { $v_1 w_{1\,h} / 1 \le h \le m$ } ∪ { $v_2 w_{2\,h} / 1 \le h \le m$ } ∪ { $v_3 w_{3\,h} / 1 \le h \le m$ }∪ , . . . , ∪ { $v_{((n/2)-1)}\, w_{((n/2)-1)\,h} / 1 \le h \le m$ } ∪{ $v_{(n/2)}\, w_{(n/2)\,h} / 1 \le h \le m$ } ∪ { $s\, u_{(h-1)m+h} / 1 \le h \le (\frac{n}{2})$ } ∪ { $s\, v_h / 1 \le h \le \frac{n}{2}$ }} be the edges of the corona graph $S_p \odot K_h$. |V |=n(m+1)+1, |E |= n(m+1).

Define a function f : V → {a+ib / a, b ∈ N } such that

$$f(u_k) = 2^k + i\,2^{(k+1)},\ 1 \le k \le (\tfrac{n}{2})(m+1)$$

$$f(v_k) = 2^k + i\,2^k,\ 1 \le k \le (\tfrac{n}{2}),$$

$$f(w_{1\,k}) = 2^k + i(2^{(k+1)}+1),\ 1 \le k \le m$$

$$f(w_{2\,k}) = 4^k + i(4^{(k+1)}+1),\ 1 \le k \le m$$

$f(w_{3\,k}) = 8^k+i(8^{(k+1)}+1),\ 1 \leq k \leq m$

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$f(w_{(\,(n/2)-1)\ k}) = (\ 2^{(n/2)-1})^{\,k}+i\ ((\ 2^{(n/2)-1})^{\,k+1}+1),\ 1 \leq k \leq m$

$f(w_{(\,(n/2)\ k}) = (\ 2^{(n/2)})^{\,k}+i\ ((\ 2^{(n/2)})^{\,k+1}+1),\ 1 \leq k \leq m$

$f(s) = 1+i2$

Define the induced function $\varphi : E \to \{0,1\}$ is given by

$$\varphi\,(v_i v_{i+1}) = \begin{cases} 1, \text{ if } |f(x)|^2/|f(y)|^2 \text{ or } |f(y)|^2/|f(x)|^2 \text{ is integer} \\ 0, \text{ otherwise} \end{cases}$$

This implies that $|e_f(0) - e_f(1)| \leq 1$

corona graph $S_p\ \Theta\ K_h$						
Edge	**Limit**	**Edge Labeled**	**No. of 0's**	**No. of 1's**	**Total No. of Edges**	**Total No. of vertices**
$u_1\, u_{(h+1)}$	$1 \leq h \leq m$	One	0	m		
$u_{(m+2)}\, u_{(m+2+h)}$	$1 \leq h \leq m$	One	0	m		
$u_{(2m+3)}\, u_{(2m+3+h)}$	$1 \leq h \leq m$	One	0	m		
-	-	-	-	-		
-	-	-	-	-		
-	-	-	-	-		
$u_{((n/2)-2)m+\ ((n/2)-1)}\ \ u_{((n/2)-2)m+((n/2)-1)\ +h}$	$1 \leq h \leq m$	One	0	m		
$u_{((n/2)-1)(m+1)+\ 1}\ u_{((n/2)-1)(m+1)+1+h}$	$1 \leq h \leq m$	One	0	m		
$v_1\, w_{1\ h}$	$1 \leq h \leq m$	Zero	m	0		
$v_2\, w_{2\ h}$	$1 \leq h \leq m$	Zero	m	0		
$v_3\, w_{3\ h}$	$1 \leq h \leq m$	Zero	m	0		
-	-	-	-	-		
-	-	-	-	-		
-	-	-	-	-		
$v_{((n/2)-1)}\, w_{((n/2)-1)\ h}$	$1 \leq h \leq m$	Zero	m	0	n(m+1)	n(m+1)+1

$v_{(n/2)}\, w_{(n/2)\ h}$	$1 \le h \le m$	Zero	m	0		
$s\ u_{(h-1)m+h}$	$1 \le h \le \frac{n}{2}$	One	0	$\frac{n}{2}$		
$s\, v_h$	$1 \le h \le \frac{n}{2}$	Zero	$\frac{n}{2}$	0		
Total			$(m+1)(\frac{n}{2})$	$(m+1)(\frac{n}{2})$		

Example 3.7: The Gaussian divisor cordial antimagic labeling for corona graph with n(m + 1) + 1 vertices is shown in figure –3.7

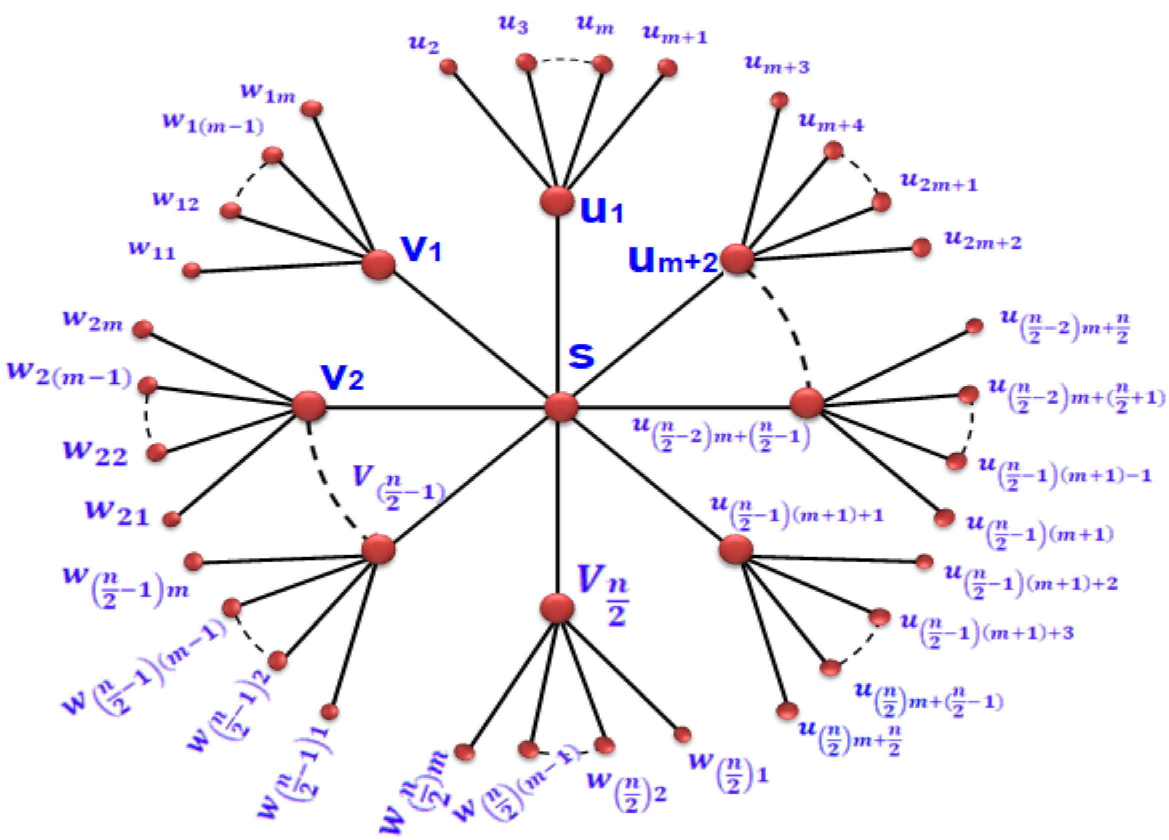

Figure 3.7.: The Gaussian divisor cordial antimagic labeling for corona graph with n(m + 1) + 1 vertices

Theorem 3.8: The corona graph $H_p \odot K_h$ admits Gaussian divisor cordial antimagic labeling.

Proof: Let V = { s, t_1, t_2, t_3, …, $t_{(n/2)}$ u_1, u_2, u_3, …, $u_{(n/2)}$, v_1, v_2, v_3, …, $v_{(n/2)}$, w_1, w_2, w_3, …, $w_{(n/2)}$ $u_{1\,1}$, $u_{1\,2}$, $u_{1\,3}$, . . . , $u_{1\,m}$, $u_{2\,1}$, $u_{2\,2}$, $u_{2\,3}$, . . . , $u_{2\,m}$, u_{31}, u_{32}, u_{33}, . . . ,$u_{3\,m}$, . . . ,$u_{((n/2-1)\,1}$, $u_{((n/2-1)\,2}$, $u_{((n/2-1)\,3}$, . . . , $u_{((n/2-1)\ m}$, $u_{(n/2)\,1}$, $u_{(n/2)\,2}$, $u_{(n/2)\,3}$, . . . ,$u_{(n/2)\,m}$, w_{11}, $w_{1\,2}$, $w_{1\,3}$, . . . ,$w_{1\,m}$, $w_{2\,1}$, $w_{2\,2}$, $w_{2\,3}$, . . . ,$w_{2\,m}$, $w_{3\,1}$, $w_{3\,2}$, $w_{3\,3}$, . . . , $w_{3\,m}$, . . . , $w_{((n/2-1)\,1}$, $w_{((n/2-1)\,2}$, $w_{((n/2-1)\,3}$, . . . ,$w_{((n/2-1)\,m}$, $w_{(n/2)\,1}$, $w_{(n/2)\,2}$, $w_{(n/2)\,3}$,…, $w_{(n/2)\,m}$ } be the vertices and E ={{ $u_1\, u_{1\,h}$ / $1 \le h \le m$ } ∪ { $u_2\, u_{2\,h}$ / $1 \le h \le m$ }∪{ $u_3\, u_{3h}$ / $1 \le h \le m$ } ∪ , . . . , ∪ { $u_{((n/2)-1)}\, u_{((n/2)-1)\,h}$ / $1 \le h \le m$ } ∪{ $u_{(n/2)}\, u_{(n/2)\ h}$ / $1 \le h \le m$ } ∪ { $w_1\, w_{1\,h}$ / $1 \le h \le m$ } ∪ { $w_2\, w_{2\,h}$ / $1 \le h \le m$ } ∪ { $w_3\, w_{3\ h}$ / $1 \le h \le m$ }∪ , . . . , ∪ { $w_{((n/2)-1)}\, w_{((n/2)-1)\,h}$ / $1 \le h \le m$ } ∪{ $w_{(n/2)}\, w_{(n/2)\ h}$ / $1 \le h \le m$ }∪ { $t_h\, u_h$ / $1 \le h \le \frac{n}{2}$ } ∪ { $v_h\, w_h$ / $1 \le h \le \frac{n}{2}$ } ∪ { $t_h\, t_{(h+1)}$ / $1 \le h \le (\frac{n}{2}-1)$ } ∪ { $v_h\, v_{(h+1)}$ / $1 \le h \le (\frac{n}{2}-1)$ } ∪ { v_1 t_1 } ∪ { $v_{(n/2)}$ $t_{(n/2)}$ } ∪ { s t_h / $1 \le h \le \frac{n}{2}$ } ∪ { s v_h / $1 \le h \le \frac{n}{2}$ }} be the edges of the corona graph $H_p \odot K_h$. |V |=n(m+2)+1, |E |= n(m+3).

Define a function f : V → {a+ib / a∈ W, b ∈ N } such that

$f(s) = 0+i$

$f(t_k) = (k+1)+i(k+1),\ 1 \le k \le (\frac{n}{2})$

$f(u_k) = (k+1)^2+i\,(k+1)^3,\ 1 \le k \le (\frac{n}{2})$

$f(v_k) = (k+1)+i\,(k+2),\ 1 \le k \le (\frac{n}{2})$,

$f(w_k) = (k+1) + i\,(k+1)^2,\ 1 \le k \le (\frac{n}{2})$

$f(u_{1\,k}) = 2^{(k+2)}+i2^{(k+3)},\ 1 \le k \le m$

$f(u_{2\,k}) = 3^{(k+2)}+i3^{(k+3)},\ 1 \le k \le m$

$f(u_{3\,k}) = 4^{(k+2)}+i4^{(k+3)},\ 1 \le k \le m$

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$f(u_{((n/2)-1)\ k}) = (\frac{n}{2})^{(k+2)}+i(\frac{n}{2})^{(k+3)},\ 1 \le k \le m$

$f(u_{((n/2)\ k}) = (\frac{n}{2}+1)^{(k+2)}+i(\frac{n}{2}+1)^{(k+3)},\ 1 \le k \le m$

$f(w_{1\,k}) = 2^k+i(2^{(k+1)}+1),\ 1 \le k \le m$

$f(w_{2\,k}) = 3^k+i(3^{(k+1)}+1),\ 1 \le k \le m$

$f(w_{3\,k}) = 4^k+i(4^{(k+1)}+1),\ 1 \le k \le m$

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$f(w_{((n/2)-1)\ k}) = (\frac{n}{2})^k+i\,((\frac{n}{2})^{(k+1)}+1),\ 1 \le k \le m$

$f(w_{((n/2)\ k}) = (\frac{n}{2}+1)^k+i((\frac{n}{2}+1)^{(k+1)}+1),\ 1 \le k \le m$

Define the induced function $\varphi : E \to \{0,1\}$ is given by

$$\varphi\,(v_i v_{i+1}) = \begin{cases} 1, \text{ if } |f(x)|^2/|f(y)|^2 \text{ or } |f(y)|^2/|f(x)|^2 \text{ is integer} \\ 0, \text{ otherwisem} \end{cases}$$

This implies that $|e_f(0) - e_f(1)| \le 1$

corona graph $H_p \odot K_h$						
Edge	**Limit**	**Edge Labeled**	**No. of 0's**	**No. of 1's**	**Total No. of Edges**	**Total No. of vertices**
$u_1 u_{1h}$	$1 \le h \le m$	One	0	m		
$u_2 u_{2h}$	$1 \le h \le m$	One	0	m		
$u_3 u_{3h}$	$1 \le h \le m$	One	0	m		
-	-	-	-	-		
-	-	-	-	-		
-	-	-	-	-		
$u_{((n/2)-1)}\ u_{((n/2)-1)h}$	$1 \le h \le m$	One	0	m		
$u_{(n/2)}\ u_{(n/2)h}$	$1 \le h \le m$	One	0	m		
$w_1 w_{1h}$	$1 \le h \le m$	Zero	m	0		
$w_2 w_{2h}$	$1 \le h \le m$	Zero	m	0		
$w_3 w_{3h}$	$1 \le h \le m$	Zero	m	0		
-	-	-	-	-		
-	-	-	-	-		
-	-	-	-	-		
$w_{((n/2)-1)}\ w_{((n/2)-1)h}$	$1 \le h \le m$	Zero	m	0		
$w_{(n/2)}\ w_{(n/2)h}$	$1 \le h \le m$	Zero	m	0		
$t_h\ u_h$	$1 \le h \le \frac{n}{2}$	One	0	$\frac{n}{2}$		
$w_h\ v_h$	$1 \le h \le \frac{n}{2}$	Zero	$\frac{n}{2}$	0		
$t_h\ t_{h+1}$	$1 \le h \le \frac{n}{2}-1$	Zero	$\frac{n}{2}-1$			
$v_h\ v_{h+1}$	$1 \le h \le \frac{n}{2}-1$	Zero	$\frac{n}{2}-1$			
$t_{(n/2)}\ v_{(n/2)}$	-	Zero	1			
$t_1\ v_1$	-	Zero	1	0		
$s\ t_h$	$1 \le h \le \frac{n}{2}$	One	0	$\frac{n}{2}$		
$s\ v_h$	$1 \le h \le \frac{n}{2}$	One	0	$\frac{n}{2}$		
Total			$(m+1)(\frac{n}{2})+n$	$(m+1)(\frac{n}{2})+n$	$n(m+3)$	$n(m+2)+1$

Example 3.8: The Gaussian divisor cordial antimagic labeling for corona graph with $(m + 2)n + 1$ vertices is shown in figure –3.8

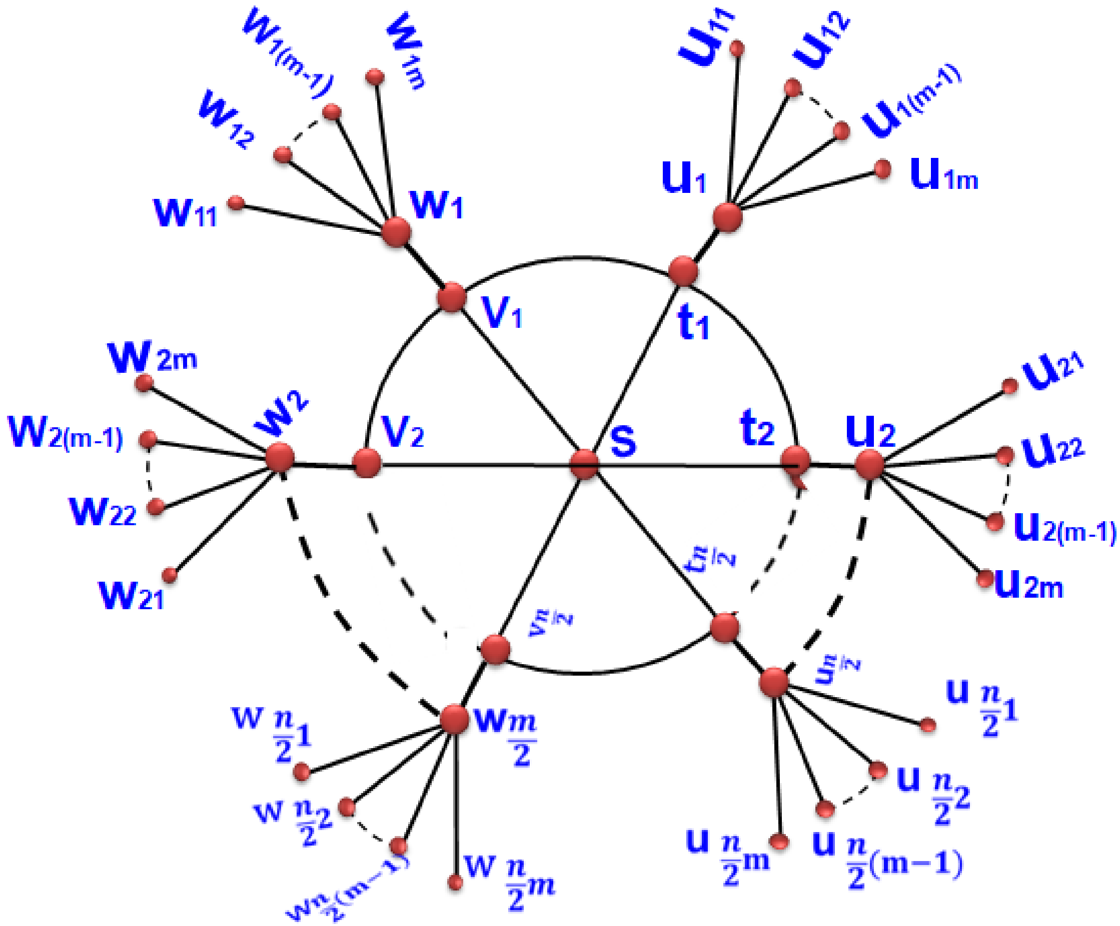

Figure 3.8.: The Gaussian divisor cordial antimagic labeling for corona graph with (m + 2)n + 1 vertices.

Theorem 3.9: The Corona product of P_g o K_2 graph admits Gaussian divisor cordial antimagic labeling

Proof: Let V = { $u_1, u_2, u_3, \ldots, u_m$, $v_1, v_2, v_3, \ldots, v_{2m}$ } be the vertices and E ={{ $u_h u_{h+1}$ / $1 \leq h \leq (m-1)$, m∈ N }∪{ $v_{2h-1} v_{2h}$ / $1 \leq h \leq m$, m∈ N } ∪{ $u_h v_{(2h-1)}$ / $1 \leq h \leq m$, m∈ N } ∪{ $u_h v_{2h}$ / $1 \leq h \leq m$, m∈ N } } be the edges of the Corona product of P_g o K_2 graph. |V |=3m, |E |=4m-1.

Define a function f : V → {a+ib / a, b ∈ N } such that

$$f(u_k) = 3^k + i\, 3^{(k+1)},\ 1 \leq k \leq m,\ f(v_k) = 2^k + i\, 2^{(k+1)},\ 1 \leq k \leq 2m$$

Define the induced function $\varphi : E \rightarrow \{0,1\}$ is given by

$\varphi(v_i v_{i+1})$ = 1, if $|f(x)|^2/|f(y)|^2$ or $|f(y)|^2/|f(x)|^2$ is integer

0, otherwise

This implies that $|e_f(0) - e_f(1)| \leq 1$

Corona product of P_g o K_2 graph						
Edge	**Limit**	**Edge Labeled**	**No. of 0's**	**No. of 1's**	**Total No. of Edges**	**Total No. of vertices**
$u_h\, u_{h+1}$	$1 \le h \le (m-1)$	One	0	(m-1)		
$v_{2h-1}\, v_{2h}$	$1 \le h \le m$	One	0	m		
$u_h\, v_{2h-1}$	$1 \le h \le m$	Zero	m	0		
$u_h\, v_{2h}$	$1 \le h \le m$	Zero	m	0		
Total			2m	2m-1	4m-1	3m

Example 3. 9.: The Gaussian divisor cordial antimagic labeling for Corona product of P_g o K_2 graph with $3m$ vertices is shown in figure –3.8

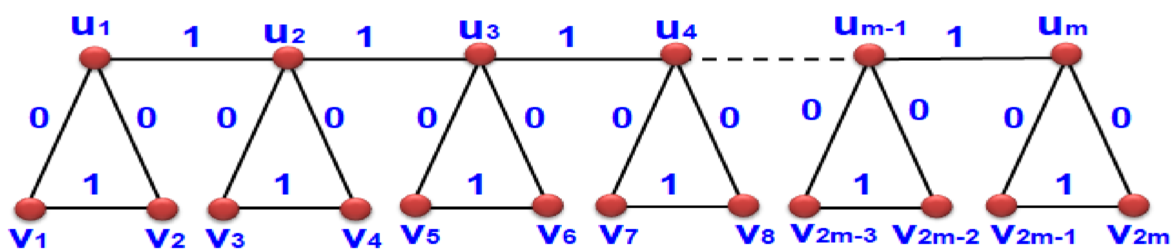

Figure 3.9.: The Gaussian divisor cordial antimagic labeling for Corona product of P_g o K_2 graph with $3m$ vertices

Theorem 3.10: The Corona product of $P_n\ o\ C_g$ graph admits Gaussian divisor cordial antimagic labeling.

Proof: Let V = { $u_1, u_2, u_3, \ldots, u_n, u_{1\,1}, u_{1\,2}, u_{1\,3}, \ldots, u_{1\,m}, u_{2\,1}, u_{2\,2}, u_{2\,3}, \ldots, u_{2\,m}, u_{31}$,

$u_{32}, u_{33}, \ldots, u_{3\,m}, \ldots, u_{(n-1)\,1}, u_{(n-1)\,2}, u_{(n-1)\,3}, \ldots, u_{(n-1)\,(m-1)}\ u_{(n-1)\,m}, u_{n\,1}, u_{n\,2}, u_{n\,3}, \ldots$

$, u_{n\,(m-1)}, u_{n\,m}$ } be the vertices and E ={{ $u_1 u_{1\,h} / 1 \le h \le m$ }∪ { $u_2\, u_{2\,h} / 1 \le h \le m$

}∪{ $u_3\, u_{3\,h} / 1 \le h \le m$ } ∪ , . . . , ∪ { $u_{(n-1)} u_{(n-1)\,h} / 1 \le h \le m$ } ∪{ $u_n u_{n\,h} / 1 \le h \le m$

} ∪ { $u_{1\,h} u_{1\,(h+1)} / 1 \le h \le m-1$ } ∪ { $u_{1\,1} u_{1\,m}$ } ∪ { $u_{2\,h} u_{2\,(h+1)} / 1 \le h \le m-1$ } ∪{ $u_{2\,1} u_{2\,m}$

}∪ { $u_{3\,h} u_{3\,(h+1)} / 1 \le h \le m-1$ } ∪ { $u_{3\,1} u_{3\,m}$ } ∪ , . . . , ∪ { $u_{(n-1)\,h} u_{(n-1)\,(h+1)} / 1 \le h \le m-1$

} ∪ { $u_{(n-1)\,1} u_{(n-1)\,m}$ }∪ { $u_{n\,h} u_{n\,(h+1)} / 1 \le h \le m-1$ } ∪ { $u_{n\,1} u_{n\,m}$ } ∪

{ $u_h u_{(h+1)} / 1 \le h \le n$ } } be the edges of the Corona product of $P_g\ o\ C_g$ graph.

|V |=n(m+1), |E |= n(2m+1)-1. where n is even

Define a function $f : V \rightarrow \{a+ib / a, b \in N\}$ such that

$$f(u_k) = (k+1) + i\,(k+1),\ 1 \le k \le n$$

$f(u_{(2k-1)\ 1}) = (2k)^2+i(2k)^3$, $1 \le k \le \frac{n}{2}$

$f(u_{1\,(k+1)}) = 2^k+i(2^{(k+1)}+1)$, $1 \le k \le (m-1)$

$f(u_{3\,(k+1)}) = 4^k+i(4^{(k+1)}+1)$, $1 \le k \le (m-1)$

$f(u_{5\,(k+1)}) = 4^k+i(4^{(k+1)}+1)$, $1 \le k \le (m-1)$

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$f(u_{(n-3)\ (k+1)}) = (n-2)^k+i((n-2)^{(k+1)}+1)$, $1 \le k \le m$

$f(u_{(n-1)\ (k+1)}) = n^k+i\,(n^{(k+1)}+1)$, $1 \le k \le (m-1)$

$f(u_{2\ k}) = 3^k+i3^{(k+1)}$, $1 \le k \le m$

$f(u_{4\ k}) = 5^k+i5^{(k+1)}$, $1 \le k \le m$

$f(u_{6\ k}) = 7^k+i7^{(k+1)}$, $1 \le k \le m$

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$f(u_{(n-2)\ k}) = (n-1)^k+i\,((n-1)^{(k+1)}$, $1 \le k \le m$

$f(u_{n\ k}) = (n+1)^k+i((n+1)^{(k+1)}$, $1 \le k \le m$

Define the induced function $\varphi : E \rightarrow \{0,1\}$ is given by

$$\varphi\,(v_i v_{i+1}) = \begin{cases} 1, \text{ if } |f(x)|^2/|f(y)|^2 \text{ or } |f(y)|^2/|f(x)|^2 \text{ is integer} \\ 0, \text{ otherwisem} \end{cases}$$

This implies that $|e_f(0) - e_f(1)| \le 1$

Corona product of P_n o C_g						
Edge	**Limit**	**Edge Labeled**	**No. of 0's**	**No. of 1's**	**Total No. of Edges**	**Total No. of vertices**
$u_1 u_{1\,h+1}$	_$1 \le h \le m-1$	Zero	m-1	0		
$u_1 u_{11}$	-	One	0	1	n(2m+1)-1	n(m+1)

.

$u_2 u_{2\,h}$	_1 ≤ h ≤ m	One	0	m
$u_3 u_{3\,h+1}$	_1 ≤ h ≤ m-1	Zero	m-1	0
$u_3 u_{31}$	-	One	0	1
$u_4 u_{4\,h}$	_1 ≤ h ≤ m	One	0	m
$u_5 u_{5\,h+1}$	_1 ≤ h ≤ m-1	Zero	m-1	0
$u_5 u_{5\,1}$	-	One	0	1
-	-	-	-	-
-	-	-	-	-
-	-	-	-	-
$u_{(n-1)} u_{(n-1)\,h+1}$	_1 ≤ h ≤ m-1	Zero	m-1	0
$u_{(n-1)} u_{(n-1)\,1}$	-	One	0	1
$u_n u_{n\,h}$	_1 ≤ h ≤ m	One	0	m
$u_{1\,h} u_{1\,(h+1)}$	_1 ≤ h ≤ m-1	Zero	m-1	0
$u_{1\,1} u_{1\,m}$	_-	Zero	1	0
$u_{2\,h} u_{2\,(h+1)}$	_1 ≤ h ≤ m-1	One	0	m-1
$u_{2\,1} u_{2\,m}$	-	One	0	1
$u_{3\,h} u_{3\,(h+1)}$	_1 ≤ h ≤ m-1	Zero	m-1	0
$u_{3\,1} u_{3\,m}$	_-	Zero	1	0
-	-	-	-	-
-	-	-	-	-
-	-	-	-	-
$u_{(n-1)\,h} u_{(n-1)\,(h+1)}$	_1 ≤ h ≤ m-1	Zero	m-1	0
$u_{(n-1)\,1} u_{(n-1)\,m}$	_-	Zero	1	0
$u_{n\,h} u_{n\,(h+1)}$	1≤ h ≤ m-1	One	0	m-1
$u_{n\,1} u_{n\,m}$	-	one	0	1
$u_h u_{(h+1)}$	1≤ h ≤ (n-1)	Zero	n-1	
Total			(2m+1)($\frac{n}{2}$)-1	(2m+1)($\frac{n}{2}$)

Example 3.10: The Gaussian divisor cordial antimagic labeling for Corona product of $P_n \, o \, C_g$ graph with (m + 1)n vertices is shown in figure – 3.10

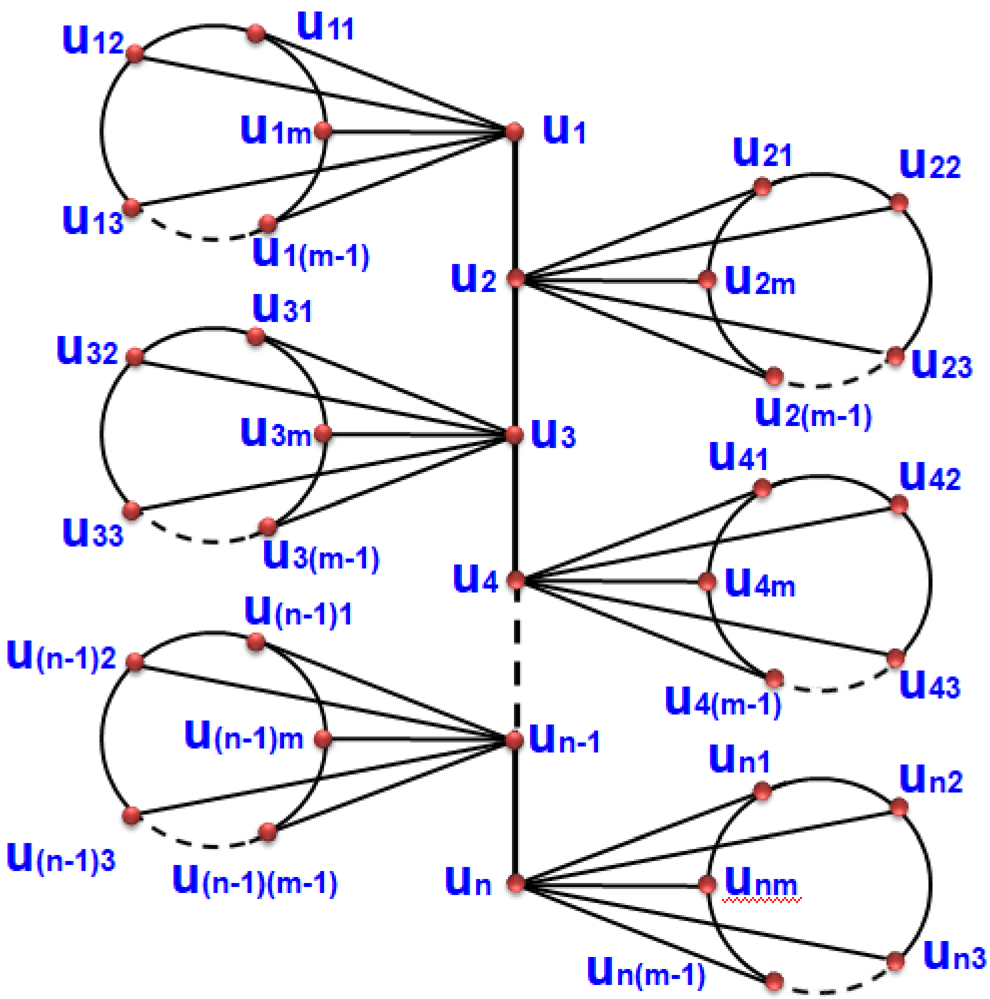

Figure 3.10.: The Gaussian divisor cordial antimagic labeling for Corona product of P_n *o* C_g graph with (m + 1)n vertices.

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