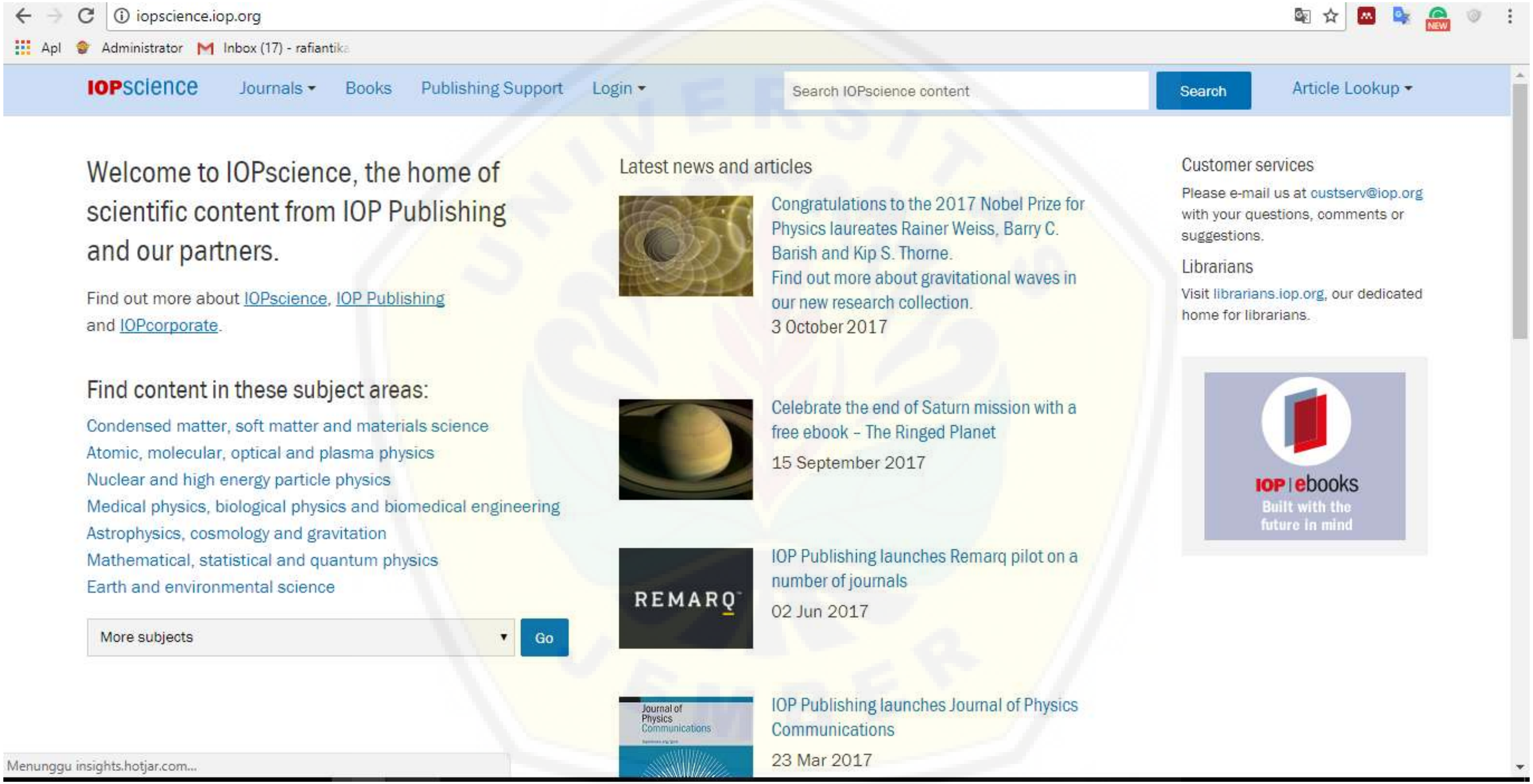
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Super local edge antimagic total coloring of $P_n \triangleright H$

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Abstract. In this paper, we consider that all graphs are finite, simple and connected. Let $G(V, E)$ be a graph of vertex set V and edge set E. A bijection $f : V(G) \longrightarrow \{1, 2, 3, ..., |V(G)|\}$ is called a local edge antimagic labeling if for any two adjacent edges e_1 and e_2, $w(e_1) \neq w(e_2)$, where for $e = uv \in G$, $w(e) = f(u) + f(v)$. Thus, any local edge antimagic labeling induces a proper edge coloring of G if each edge e is assigned the color $w(e)$. It is considered to be a super local edge antimagic total coloring, if the smallest labels appear in the vertices. The super local edge antimagic chromatic number, denoted by $\gamma_{leat}(G)$, is the minimum number of colors taken over all colorings induced by super local edge antimagic total labelings of G. In this paper we initiate to study the existence of super local edge antimagic total coloring of comb product of graphs. We also analyse the lower bound of its local edge antimagic chromatic number. It is proved that $\gamma_{leat}(P_n \triangleright G) \geq \gamma_{leat}(P_n) + \gamma_{leat}(G)$. Furthermore we have determine exact value local edge antimagic coloring of $P_n \triangleright P_m$, $P_n \triangleright C_m$ and $P_n \triangleright S_m$.

1. Introduction

We consider that all graphs in this paper are finite, simple and connected graph, for detail definition of graph see [1, 2].

A bijection mapping that assigns natural number to vertices of a graph is called a graph labeling. In this type of labeling, we consider all weights associated with each edge. The labelings will be said to be an antimagic if all edge weights value are all different. Hartsfield and Ringel [3] introduced the concept of antimagic labeling of a graph. There are a lot of results regarding to antimagic labeling, some of them can be found in Dafik *et. al* [5], [6]. They determined super edge-antimagic total labelings of $mK_{n,n}$ and super edge-antimagicness for a class of disconnected graphs, respectively.

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In this study, we will examine the relation between antimagic labeling and coloring of graph, namely a local edge antimagic coloring. We know that a proper edge coloring of a graph G is a coloring of all edges of G by natural number such that any two adjacent edges receive different colors. While, by a local edge antimagic total labeling, we mean a bijection $f : V(G) \cup E(G) \longrightarrow \{1, 2, 3, \ldots, |V(G)| + |E(G)|\}$ such that for any two adjacent edges e_1 and e_2, $w_t(e_1) \neq w_t(e_2)$, for $e = uv \in G$ and $w_t(e) = f(u) + f(v) + f(uv)$. Thus, any local edge antimagic total labeling induces a proper edge coloring of G if each edge e is assigned by the color $w_t(e)$. It is considered to be a super local edge antimagic total coloring, if the smallest labels appear in the vertices. The super local edge antimagic chromatic number $\gamma_{leat}(G)$ is the minimum number of colors taken over all colorings induced by super local edge antimagic total labelings of G. This paper just initiate to study the super local edge antimagic total colorings.

Arumugam *et al.* [4] firstly introduced a local vertex antimagic coloring of a graph G. They gave a lower bound and an upper bound of local vertex antimagic coloring of joint graph and also exact value of local vertex antimagic coloring for path, cycle, complete graph, friendship, wheel, bipartite and complete bipartite. Ika, *et. al.* [7] has determined the lower bound of the local edge antimagic coloring, denoted by $\gamma_{lea}(G) \geq \Delta(G)$. If $\Delta(G)$ is maximum degrees of G.

Ika, *et. al.* [8] study super local edge antimagic total coloring of any graph using EAVL technique and has found the lower bound of super local edge antimagic chromatic number, denoted by $\gamma_{leat}(G) \geq \Delta(G)$, and determined exact value of ladder graph L_n, caterpillar graph $C_{n,m}$, and graph coronations $P_n \odot P_2$ and $C_n \odot P_2$. Ika, *et. al.* [9] has determined exact value of path graph $\gamma_{leat}(P_n) = 2$ if n is odd and $\gamma_{leat}(P_n) = 3$ if n is even, cycle graph $\gamma_{leat}(C_n) = 3$. Alfarisi, *et. al.* [10] also study the existence of local edge antimagic total coloring of some wheel related graphs, they found exact value of $\gamma_{leat}(F_n) = n + 2$ if n is odd and $\gamma_{leat}(F_n) = n + 3$ if n is even, wheel graph $\gamma_{leat}(W_n) = n + 4$ if $n = 4$ and $\gamma_{leat}(W_n) = n + 3$ if $n \geq 3$ and $n \neq 4$.

To show our results, we use following definition

Definition 1.1. *Let $G(V, E)$ be a graph of vertex set V and edge set E. A bijection $f : V(G) \cup E(G) \to \{1, 2, 3, \ldots, |V(G)| + |E(G)|\}$ is called a local edge antimagic total labeling if for any two adjacent edges e_1 and e_2, $w(e_1) \neq w(e_2)$, where for $e = uv \in G$, $w(e) = f(u) + f(uv) + f(v)$. It is considered to be a super local edge antimagic total labeling, if the smallest labels appear in the vertices.*

Noted that, any super local edge antimagic total labeling induces a proper edge coloring of G if each edge e is assigned by the color $w(e)$.

Furthermore, the following observation in Arumugam paper, see [4], is very important for our study.

Observation 1.1. [4] *For any graph G, the local vertex antimagic chromatic number $\chi_{la}(G) \geq \chi(G)$, where $\chi(G)$ is a chromatic number of vertex coloring of G.*

Let G and H be two connected graphs. Let o be a vertex of H. Comb product between G and H is a graph obtained by taking one copy of G and $|V(G)|$ copies of H and grafting the i-th copy of H at the vertex o to the i-th vertex of G, and denoted by $G \triangleright H$. By the definition of comb product, we can say that $V(G \triangleright H) = \{(a,u)|a \in V(G), u \in V(H)\}$ and $(a,u)(b,v) \in E(G \triangleright H)$ whenever $a = b$ and $uv \in E(H)$, or $ab \in E(G)$ and $u = v = o$.

In this paper we will determine super local edge antimagic total coloring of comb product of graphs and also analyse the lower bound of its local edge antimagic chromatic number. It is proved that $\gamma_{leat}(P_n \triangleright H) \geq \gamma_{leat}(P_n) + \gamma_{leat}(H)$. Furthermore we have determine chromatic number of local edge antimagic coloring of $P_n \triangleright H$

2. Main Result

Firstly, we present our result by showing the lower bound of super local edge antimagic total chromatic number of comb product graph.

Lemma 2.1. *Let P_n be path and H be any special graph. The super local edge antimagic total chromatic number of of comb product graph is $\gamma_{leat}(P_n \triangleright H) \geq \gamma_{leat}(P_n) + \gamma_{leat}(H)$.*

Proof. The comb product between P_n and H is a graph obtained by one copy of P_n and $\mid V(P_n) \mid$ copies of H, and grafting the i vertex of P_n to the u_i in i-th copy of G. Suppose P_n admits a local edge antimagic coloring with $\gamma_{leat}(P_n)$. Furthermore, the subgraph H_i admits a local edge antimagic total coloring with $\gamma_{leat}(H_i)$.The total edge weights of local edge antimagic total coloring from subgraph P_n and H_i are different.

To show that the total edge weights of local edge antimagic total coloring from subgraph P_n and H_i are different. If subgraph H_i; $1 \leq i \leq n$ are labeled by the function $f : V(H_i) \cup E(H_i) \longrightarrow \{1, 2, 3, ..., k\}$ with $k = |V(H_i)| + |E(H_i)|$. The largest total edge weight is $k + (k-1) + (k-2)$, thus we have $w_t(H_i) = 3k - 3$. Next, the label element of P_n by function $f : V(P_n) \cup E(P_n) \longrightarrow \{k+1, k+2, k+3, ..., |V(P_n)| + |E(P_n)|\}$, the smallest total edge weight is $(k+1) + (k+2) + (k+3)$ thus $w_t(P_n) = 3k + 6$. Since $w_t(H_i) < w_t(P_n)$, the total edge weight of *local edge antimagic total* coloring from subgraph P_n and H_i are different. The total edge weights in each subgraph H_i induce the local edge antimagic total coloring of the same weight, thus $\gamma_{leat}(H_1) = \gamma_{leat}(H_2) = \cdots = \gamma_{leat}(H_n) = \gamma_{leat}(H)$. We obtain that a local antimagic labeling of $P_n \triangleright H$.

$$\begin{aligned} \gamma_{leat}(P_n \triangleright H) &\geq |\{w_{P_n}(e), e \in V(P_n)\}| + |\{w_{H_i}(e), e \in V(H_i)\}| \\ &= \gamma_{leat}(P_n) + \gamma_{leat}(H_i) \\ &= \gamma_{lea}(P_n) + \gamma_{leat}(H) \end{aligned}$$

Hence, from the above edge weight it is easy to see that the lower bound of local antimagic total coloring of $P_n \triangleright H$ is $\gamma_{leat}(P_n \triangleright H) \geq \gamma_{leat}(P_n) + \gamma_{leat}(H)$. $\square$

Theorem 2.1. *For $n, m \geq 3$, the super local edge antimagic total chromatic number of $P_n \triangleright P_m$ is*

$$\gamma_{leat}(P_n \triangleright P_m) = \begin{cases} 4, & \text{if } n \text{ is odd, } m \text{ is odd} \\ 5, & \text{if } n \text{ is odd, } m \text{ is even} \end{cases}$$

Proof. The graph $P_n \triangleright P_m$ is a connected graph with vertex set $V(P_n \triangleright P_m) = \{x_{i,j} : 1 \leq i \leq n, 1 \leq j \leq m\}$ and edge set $E(P_n \triangleright P_m) = \{x_{i,1}x_{i+1,1} : 1 \leq i \leq n-1\} \cup \{x_{i,j}x_{i,j+1}; 1 \leq i \leq n, 1 \leq j \leq m-1\}$. Hence $|V(P_n \triangleright P_m)| = mn$ and $|E(P_n \triangleright P_m)| = mn - 1$. We will

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describe the proof into two cases.

Case 1: For n is odd and m is odd, we will show that the lower bound of the local edge antimagic total coloring of $P_n \triangleright P_m$ is $\gamma_{leat}(P_n \triangleright P_m) \geq 4$. Based on Lemma 2.1, the lower bound is $\gamma_{leat}(P_n \triangleright P_m) \geq \gamma_{leat}(P_n) + \gamma_{leat}(P_m) = 2 + 2 = 4$. It concludes that the lower bound of the local edge antimagic total coloring of $P_n \triangleright P_m$ is $\gamma_{leat}(P_n \triangleright P_m) \geq 4$. Furthermore, we will show that the upper bound of the local edge antimagic total coloring of $P_n \triangleright P_m$ is $\gamma_{leat}(P_n \triangleright P_m) \leq 4$.

Define a bijection $f : V(P_n \triangleright P_m) \cup E(P_n \triangleright P_m) \longrightarrow \{1, 2, 3, ..., |V(P_n \triangleright P_m)| + |E(P_n \triangleright P_m)|\}$ by the following.

$$f(v) = \begin{cases} \frac{i+(j-1)n+1}{2}, & \text{if } v = x_{i,j}, \text{ when } i \text{ is odd and } j \text{ is odd} \\ \frac{i+jn+1}{2}, & \text{if } v = x_{i,j}, \text{ when } i \text{ is even and } j \text{ is odd} \\ \frac{nm+i+nj}{2}, & \text{if } v = x_{i,j}, \text{ when } i \text{ is odd and } j \text{ is even} \\ \frac{i+(m+j-1)n}{2}, & \text{if } v = x_{i,j}, \text{ when } i \text{ is even and } j \text{ is even} \end{cases}$$

$$f(e) = \begin{cases} 2nm - n(1+j) - i + 1, & \text{if } e = x_{i,j}x_{i,j+1}, \text{ when } 1 \leq i \leq n \text{ and } j \text{ is odd} \\ 2nm + n(1+j) - i + 1, & \text{if } e = x_{i,j}x_{i,j+1}, \text{ when } 1 \leq i \leq n \text{ and } j \text{ is even} \\ 2nm - i - 1, & \text{if } e = x_{i,j}x_{i+1,j}, \text{ when } i \text{ is odd and } j = 1 \\ 2nm - i + 1, & \text{if } e = x_{i,j}x_{i+1,j}, \text{ when } i \text{ is even and } j = 1 \end{cases}$$

And the super total edge weight are as follows

$$w(e) = \begin{cases} \frac{5nm-2n+3}{2}, & \text{if } e = x_{i,j}x_{i,j+1}, \text{ when } 1 \leq i \leq n \text{ and } j \text{ is odd} \\ \frac{5nm+2n+3}{2}, & \text{if } e = x_{i,j}x_{i,j+1}, \text{ when } 1 \leq i \leq n \text{ and } j \text{ is even} \\ \frac{4nm+n+1}{2}, & \text{if } e = x_{i,j}x_{i+1,j}, \text{ when } i \text{ is odd and } j = 1 \\ \frac{4nm+n+5}{2}, & \text{if } e = x_{i,j}x_{i+1,j}, \text{ when } i \text{ is even and } j = 1 \end{cases}$$

Hence, from the above super total edge weights, it easy to see that f induces a proper edge coloring of $P_n \triangleright P_m$ and it gives $\gamma_{leat}(P_n \triangleright P_m) \leq 4$. Based on Lemma 2.1, the lower bound is $\gamma_{leat}(P_n \triangleright P_m) \geq \gamma_{leat}(P_n) + \gamma_{leat}(P_m) = 4$. It concludes that $\gamma_{leat}(P_n \triangleright P_m) = 4$ when n and m is odd.

Case 2: For n is odd and m is even, we will show that the lower bound of the local edge antimagic total coloring of $P_n \triangleright P_m$ is $\gamma_{leat}(P_n \triangleright P_m) \geq 5$. Based on Lemma 2.1, the lower bound is $\gamma_{leat}(P_n \triangleright P_m) \geq \gamma_{leat}(P_n) + \gamma_{leat}(P_m) = 2 + 3 = 5$. It concludes that the lower bound of the local edge antimagic total coloring of $P_n \triangleright P_m$ is $\gamma_{leat}(P_n \triangleright P_m) \geq 5$. Furthermore, we will show that the upper bound of the local edge antimagic total coloring of $P_n \triangleright P_m$ is $\gamma_{leat}(P_n \triangleright P_m) \leq 5$.

Define a bijection $f : V(P_n \triangleright P_m) \cup E(P_n \triangleright P_m) \longrightarrow \{1, 2, 3, ..., |V(P_n \triangleright P_m)| + |E(P_n \triangleright P_m)|\}$ by the following.

$$f(v) = \begin{cases} \frac{i+(j-1)n+1}{2}, & \text{if } v = x_{i,j}, \text{ when } i \text{ is odd and } j \text{ is odd} \\ \frac{i+jn+1}{2}, & \text{if } v = x_{i,j}, \text{ when } i \text{ is even and } j \text{ is odd} \\ \frac{n(m+j-1)+i}{2}, & \text{if } v = x_{i,j}, \text{ when } i \text{ is odd and } j \text{ is even} \\ \frac{n(m+j-2)+i}{2}, & \text{if } v = x_{i,j}, \text{ when } i \text{ is even and } j \text{ is even} \end{cases}$$

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$$f(e)=\begin{cases} n(2m-1)-i+1, & \text{if } e=x_{i,j}x_{i,j+1}, \text{ when } 1\le i\le n \text{ and } j=1\\ n(2m-1-j)-i+1, & \text{if } e=x_{i,j}x_{i,j+1}, \text{ when } 1\le i\le n \text{ and } j \text{ is even}\\ n(2m+1-j)-i+1, & \text{if } e=x_{i,j}x_{i,j+1}, \text{ when } 1\le i\le n \text{ and } j \text{ is odd}\\ 2nm-i-1, & \text{if } e=x_{i,j}x_{i+1,j}, \text{ when } i \text{ is odd and } j=1\\ 2nm-i+1, & \text{if } e=x_{i,j}x_{i+1,j}, \text{ when } i \text{ is even and } j=1 \end{cases}$$

And the super total edge weight are as follows

$$w(e)=\begin{cases} \frac{5nm-n+3}{2}, & \text{if } e=x_{i,j}x_{i,j+1}, \text{ when } 1\le i\le n \text{ and } j=1\\ \frac{5nm+n+3}{2}, & \text{if } e=x_{i,j}x_{i,j+1}, \text{ when } 1\le i\le n \text{ and } j \text{ is odd}\\ \frac{5nm-3n+3}{2}, & \text{if } e=x_{i,j}x_{i,j+1}, \text{ when } 1\le i\le n \text{ and } j \text{ is even}\\ 2nm+\frac{n+1}{2}, & \text{if } e=x_{i,j}x_{i+1,j}, \text{ when } i \text{ is odd and } j=1\\ 2nm+\frac{n+5}{2}, & \text{if } e=x_{i,j}x_{i+1,j}, \text{ when } i \text{ is even and } j=1 \end{cases}$$

Hence, from the above super total edge weights, it easy to see that f induces a proper edge coloring of $P_n \triangleright P_m$ and it gives $\gamma_{leat}(P_n \triangleright P_m) \le 5$. Based on Lemma 2.1, the lower bound is $\gamma_{leat}(P_n \triangleright P_m) \ge \gamma_{leat}(P_n) + \gamma_{leat}(P_m) = 5$. It concludes that $\gamma_{leat}(P_n \triangleright P_m) = 5$ when n is odd and m is even. □

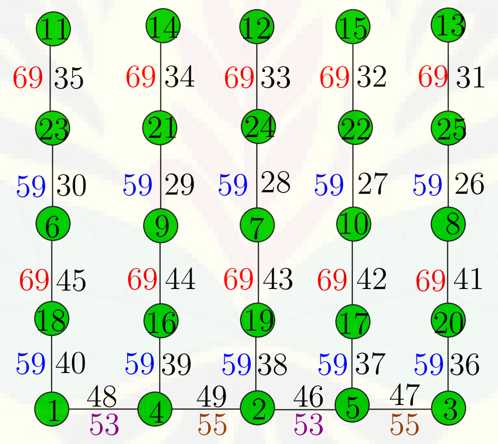

Figure 1. Illustration of local edge antimagic total coloring of $P_5 \triangleright P_5$

Theorem 2.2. *For $n, m \ge 3$, n is even and m is odd, the super local edge antimagic total chromatic number of $P_n \triangleright P_m$ is*

$$5 \le \gamma_{leat}(P_n \triangleright P_m) \le 7$$

Proof. For n is even and m is odd, we will show that the lower bound of the local edge antimagic total coloring of $P_n \triangleright P_m$. Based on Lemma 2.1, the lower bound is $\gamma_{leat}(P_n \triangleright P_m) \ge \gamma_{leat}(P_n) + \gamma_{leat}(P_m) = 3+2 = 5$. Furthermore, we will show the upper bound of the local edge antimagic total coloring of $P_n \triangleright P_m$ as follows.

Define a bijection $f : V(P_n \triangleright P_m) \cup E(P_n \triangleright P_m) \longrightarrow \{1, 2, 3, ..., |V(P_n \triangleright P_m)| + |E(P_n \triangleright P_m)|\}$ by the following.

$$f(v) = \begin{cases} \frac{i+(j-1)n+1}{2}, & \text{if } v = x_{i,j}, \text{ when } i \text{ is odd and } j \text{ is odd} \\ \frac{i+jn}{2}, & \text{if } v = x_{i,j}, \text{ when } i \text{ is even and } j \text{ is odd} \\ \frac{nm+i+nj+1}{2}, & \text{if } v = x_{i,j}, \text{ when } i \text{ is odd and } j \text{ is even} \\ \frac{n(m+j-1)+i}{2}, & \text{if } v = x_{i,j}, \text{ when } i \text{ is even and } j \text{ is even} \end{cases}$$

$$f(e) = \begin{cases} n(2m-1-j)-i+1, & \text{if } e = x_{i,j}x_{i,j+1}, \text{ when } 1 \le i \le n \text{ and } j \text{ is odd} \\ n(2m+1-j)-i+1, & \text{if } e = x_{i,j}x_{i,j+1}, \text{ when } 1 \le i \le n \text{ and } j \text{ is even} \\ 2nm-1, & \text{if } e = x_{i,j}x_{i+1,j}, \text{ when } i = 1 \text{ and } j = 1 \\ 2nm-i+1, & \text{if } e = x_{i,j}x_{i+1,j}, \text{ when } i \text{ is odd and } j = 1 \\ 2nm-i-1, & \text{if } e = x_{i,j}x_{i+1,j}, \text{ when } i \text{ is even and } j = 1 \end{cases}$$

And the super total edge weight are as follows

$$w(e) = \begin{cases} \frac{5nm-2n+4}{2}, & \text{if } e = x_{i,j}x_{i,j+1}, \text{ when } i \text{ is odd and } j \text{ is odd} \\ \frac{5nm-2n+2}{2}, & \text{if } e = x_{i,j}x_{i,j+1}, \text{ when } i \text{ is even and } j \text{ is odd} \\ \frac{5nm+2n+4}{2}, & \text{if } e = x_{i,j}x_{i,j+1}, \text{ when } i \text{ is odd and } j \text{ is even} \\ \frac{5nm+2n+2}{2}, & \text{if } e = x_{i,j}x_{i,j+1}, \text{ when } i \text{ is even and } j \text{ is even} \\ \frac{4nm+n+2}{2}, & \text{if } e = x_{i,j}x_{i+1,j}, \text{ when } i = 1 \text{ and } j = 1 \\ \frac{4nm+n+4}{2}, & \text{if } e = x_{i,j}x_{i+1,j}, \text{ when } i \text{ is odd and } j = 1 \\ \frac{4nm+n}{2}, & \text{if } e = x_{i,j}x_{i+1,j}, \text{ when } i \text{ is even and } j = 1 \end{cases}$$

Hence, from the above super total edge weights, it gives $\gamma_{leat}(P_n \triangleright P_m) \le 7$. Based on Lemma 2.1, the lower bound is $\gamma_{leat}(P_n \triangleright P_m) \ge \gamma_{leat}(P_n) + \gamma_{leat}(P_m) = 5$. It concludes that $5 \le \gamma_{leat}(P_n \triangleright P_m) \le 7$ when n is even and m is odd. □

Theorem 2.3. *For $n, m > 3$, n and m is even, the super local edge antimagic total chromatic number of $P_n \triangleright P_m$ is*

$$6 \le \gamma_{leat}(P_n \triangleright P_m) \le 9$$

Proof. For n is even and m is odd, we will show that the lower bound of the local edge antimagic total coloring of $P_n \triangleright P_m$. Based on Lemma 2.1, the lower bound is $\gamma_{leat}(P_n \triangleright P_m) \ge \gamma_{leat}(P_n) + \gamma_{leat}(P_m) = 3 + 3 = 6$. Furthermore, we will show the upper bound of the local edge antimagic total coloring of $P_n \triangleright P_m$ as follows.

Define a bijection $f : V(P_n \triangleright P_m) \cup E(P_n \triangleright P_m) \longrightarrow \{1, 2, 3, ..., |V(P_n \triangleright P_m)| + |E(P_n \triangleright P_m)|\}$ by the following.

$$f(v) = \begin{cases} \frac{i+(j-1)n+1}{2}, & \text{if } v = x_{i,j}, \text{ when } i \text{ is odd and } j \text{ is odd} \\ \frac{i+jn}{2}, & \text{if } v = x_{i,j}, \text{ when } i \text{ is even and } j \text{ is odd} \\ \frac{n(m+j-1)+i+1}{2}, & \text{if } v = x_{i,j}, \text{ when } i \text{ is odd and } j \text{ is even} \\ \frac{n(m+j-2)+i}{2}, & \text{if } v = x_{i,j}, \text{ when } i \text{ is even and } j \text{ is even} \end{cases}$$

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$$f(e) = \begin{cases} n(2m-1)-i+1, & \text{if } e = x_{i,j}x_{i,j+1}, \text{ when } 1 \le i \le n \text{ and } j=1 \\ n(2m+1-j)-i+1, & \text{if } e = x_{i,j}x_{i,j+1}, \text{ when } 1 \le i \le n \text{ and } j \text{ is odd}, j \ne 1 \\ n(2m-1-j)-i+1, & \text{if } e = x_{i,j}x_{i,j+1}, \text{ when } 1 \le i \le n \text{ and } j \text{ is even} \\ 2nm-1, & \text{if } e = x_{i,j}x_{i+1,j}, \text{ when } i=1 \text{ and } j=1 \\ 2nm-i+1, & \text{if } e = x_{i,j}x_{i+1,j}, \text{ when } i \text{ is odd}, i \ne 1 \text{ and } j=1 \\ 2nm-i-1, & \text{if } e = x_{i,j}x_{i+1,j}, \text{ when } i \text{ is even and } j=1 \end{cases}$$

And the super total edge weight are as follows

$$w(e) = \begin{cases} \frac{5nm-n+4}{2}, & \text{if } e = x_{i,j}x_{i,j+1}, \text{ when } i \text{ is odd and } j=1 \\ \frac{5nm-n+2}{2}, & \text{if } e = x_{i,j}x_{i,j+1}, \text{ when } i \text{ is even and } j=1 \\ \frac{5nm+n+4}{2}, & \text{if } e = x_{i,j}x_{i,j+1}, \text{ when } i \text{ is odd and } j \text{ is odd}, j \ne 1 \\ \frac{5nm+n+2}{2}, & \text{if } e = x_{i,j}x_{i,j+1}, \text{ when } i \text{ is even and } j \text{ is odd}, j \ne 1 \\ \frac{5nm-3n+4}{2}, & \text{if } e = x_{i,j}x_{i,j+1}, \text{ when } i \text{ is odd and } j \text{ is even} \\ \frac{5nm-3n+2}{2}, & \text{if } e = x_{i,j}x_{i,j+1}, \text{ when } i \text{ is even and } j \text{ is even} \\ \frac{4nm+n+2}{2}, & \text{if } e = x_{i,j}x_{i+1,j}, \text{ when } i=1 \text{ and } j=1 \\ \frac{4nm+n+4}{2}, & \text{if } e = x_{i,j}x_{i+1,j}, \text{ when } i \text{ is odd and } j=1 \\ \frac{4nm+n}{2}, & \text{if } e = x_{i,j}x_{i+1,j}, \text{ when } i \text{ is even and } j=1 \end{cases}$$

Hence, from the above super total edge weights, it gives $\gamma_{leat}(P_n \triangleright P_m) \le 9$. Based on Lemma 2.1, the lower bound is $\gamma_{leat}(P_n \triangleright P_m) \ge \gamma_{leat}(P_n) + \gamma_{leat}(P_m) = 6$. It concludes that $6 \le \gamma_{leat}(P_n \triangleright P_m) \le 9$ when n and m is even. □

Theorem 2.4. *For $n, m \ge 3$ and n is odd, the local edge antimagic chromatic number of $P_n \triangleright C_m$ is*

$$\gamma_{leat}(P_n \triangleright C_m) = 5$$

Proof. The graph $P_n \triangleright C_m$ is a connected graph with vertex set $V(P_n \triangleright C_m) = \{x_{i,j} : 1 \le i \le n, 1 \le j \le m\}$ and edge set $E(P_n \triangleright C_m) = \{x_{i,1}x_{i+1,1} : 1 \le i \le n-1\} \cup \{x_{i,j}x_{i,j+1}; 1 \le i \le n, 1 \le j \le m-1\} \cup \{x_{i,1}x_{i,m} : 1 \le i \le n\}$. Hence $|V(P_n \triangleright C_m)| = mn$ and $|E(P_n \triangleright C_m)| = mn + n - 1$. We will describe the proof into two cases.

Case 1: For n is odd and m is odd, we will show that the lower bound of the local edge antimagic total coloring of $P_n \triangleright C_m$ is $\gamma_{leat}(P_n \triangleright C_m) \ge 5$. Based on Lemma 2.1, the lower bound is $\gamma_{leat}(P_n \triangleright C_m) \ge \gamma_{leat}(P_n) + \gamma_{leat}(C_m) = 2 + 3 = 5$. It concludes that the lower bound of the local edge antimagic total coloring of $P_n \triangleright C_m$ is $\gamma_{leat}(P_n \triangleright C_m) \ge 5$. Furthermore, we will show that the upper bound of the local edge antimagic total coloring of $P_n \triangleright C_m$ is $\gamma_{leat}(P_n \triangleright C_m) \le 5$.

Define a bijection $f : V(P_n \triangleright C_m) \cup E(P_n \triangleright C_m) \longrightarrow \{1, 2, 3, ..., |V(P_n \triangleright C_m)| + |E(P_n \triangleright C_m)|\}$ by the following.

$$f(v) = \begin{cases} \frac{i+1}{2}, & \text{if } v = x_{i,j}, \text{ when } i \text{ is odd and } j=1 \\ \frac{n+i+1}{2}, & \text{if } v = x_{i,j}, \text{ when } i \text{ is even and } j=1 \\ \frac{i+jn}{2}, & \text{if } v = x_{i,j}, \text{ when } i \text{ is odd and } j \text{ is odd}, j \ne 1 \\ \frac{i+(j-1)n}{2}, & \text{if } v = x_{i,j}, \text{ when } i \text{ is even and } j \text{ is odd}, j \ne 1 \\ 1-i+\frac{(m+j+1)n}{2}, & \text{if } v = x_{i,j}, \text{ when } 1 \le i \le n \text{ and } j \text{ is even} \end{cases}$$

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$$f(e)=\begin{cases}\frac{i}{2}+n(2m-3), & \text{if } e=x_{i,j}x_{i,j+1}, \text{ when } i \text{ is even and } j=1\\ \frac{n+i}{2}+n(2m-3), & \text{if } e=x_{i,j}x_{i,j+1}, \text{ when } i \text{ is odd and } j=1\\ \frac{i+1}{2}+n(2m-2), & \text{if } e=x_{i,j}x_{i,j+1}, \text{ when } i \text{ is odd and } j=2\\ \frac{i+1+n}{2}+n(2m-2), & \text{if } e=x_{i,j}x_{i,j+1}, \text{ when } i \text{ is even and } j=2\\ \frac{i+1}{2}+n(2m-2-j), & \text{if } e=x_{i,j}x_{i,j+1}, \text{ when } i \text{ is odd and } j \text{ is odd}\\ \frac{i+1+n}{2}+n(2m-2-j), & \text{if } e=x_{i,j}x_{i,j+1}, \text{ when } i \text{ is even and } j \text{ is odd}\\ \frac{i+1}{2}+2nm-nj, & \text{if } e=x_{i,j}x_{i,j+1}, \text{ when } i \text{ is odd and } j \text{ is even}\\ \frac{i+1+n}{2}+2nm-nj, & \text{if } e=x_{i,j}x_{i,j+1}, \text{ when } i \text{ is even and } j \text{ is even}\\ 2nm-i+1, & \text{if } e=x_{i,1}x_{i,m}, \text{ when } 1\le i\le n\\ 2nm+n-i-1, & \text{if } e=x_{i,j}x_{i+1,j}, \text{ when } i \text{ is odd, } j=1\\ 2nm+n-i+1, & \text{if } e=x_{i,j}x_{i+1,j}, \text{ when } i \text{ is even, } j=1\end{cases}$$

And the super total edge weight are as follows

$$w(e)=\begin{cases}\frac{5nm-2n+3}{2}, & \text{if } e=x_{i,j}x_{i,j+1}, \text{ when } 1\le i\le n \text{ and } j \text{ is odd}\\ \frac{5nm+2n+3}{2}, & \text{if } e=x_{i,j}x_{i,j+1}, \text{ when } 1\le i\le n \text{ and } j \text{ is even}\\ \frac{5nm+3}{2}, & \text{if } e=x_{i,1}x_{i,m}, \text{ when } 1\le i\le n\\ \frac{4nm+3n+1}{2}, & \text{if } e=x_{i,j}x_{i+1,j}, \text{ when } i \text{ is odd and } j=1\\ \frac{4nm+3n+5}{2}, & \text{if } e=x_{i,j}x_{i+1,j}, \text{ when } i \text{ is even and } j=1\end{cases}$$

Hence, from the super total above edge weights, it easy to see that f induces a proper edge coloring of $P_n \triangleright C_m$ and it gives $\gamma_{leat}(P_n \triangleright C_m) \le 5$. Based on Lemma 2.1, the lower bound is $\gamma_{leat}(P_n \triangleright C_m) \ge \gamma_{leat}(P_n) + \gamma_{leat}(C_m) = 5$. It concludes that $\gamma_{leat}(P_n \triangleright C_m) = 5$.

Case 2: For n is odd and m is even, we will show that the lower bound of the local edge antimagic total coloring of $P_n \triangleright C_m$ is $\gamma_{leat}(P_n \triangleright C_m) \ge 5$. Based on Lemma 2.1, the lower bound is $\gamma_{leat}(P_n \triangleright C_m) \ge \gamma_{leat}(P_n) + \gamma_{leat}(C_m) = 2+3 = 5$. It concludes that the lower bound of the local edge antimagic total coloring of $P_n \triangleright C_m$ is $\gamma_{leat}(P_n \triangleright C_m) \ge 5$. Furthermore, we will show that the upper bound of the local edge antimagic total coloring of $P_n \triangleright C_m$ is $\gamma_{leat}(P_n \triangleright C_m) \le 5$.

Define a bijection $f : V(P_n \triangleright S_m) \cup E(P_n \triangleright S_m) \longrightarrow \{1, 2, 3, ..., |V(P_n \triangleright P_m)| + |E(P_n \triangleright P_m)|\}$ by the following.

$$f(v)=\begin{cases}\frac{i+1}{2}, & \text{if } v=x_{i,j}, \text{ when } i \text{ is odd and } j=1\\ \frac{n+i+1}{2}, & \text{if } v=x_{i,j}, \text{ when } i \text{ is even and } j=1\\ \frac{i+jn}{2}, & \text{if } v=x_{i,j}, \text{ when } i \text{ is odd and } j \text{ is odd, } j\ne 1\\ \frac{i+(j-1)n}{2}, & \text{if } v=x_{i,j}, \text{ when } i \text{ is even and } j \text{ is odd, } j\ne 1\\ 1-i+\frac{(m+j+1)n}{2}, & \text{if } v=x_{i,j}, \text{ when } 1\le i\le n \text{ and } j \text{ is even}\end{cases}$$

$$f(e)=\begin{cases}\frac{i}{2}+n(2m-1), & \text{if } e=x_{i,j}x_{i,j+1}, \text{ when } i \text{ is even and } j=1\\ \frac{n+i}{2}+n(2m-1), & \text{if } e=x_{i,j}x_{i,j+1}, \text{ when } i \text{ is odd and } j=1\\ \frac{i+1}{2}+n(2m-j-2), & \text{if } e=x_{i,j}x_{i,j+1}, \text{ when } i \text{ is odd and } j \text{ is even}\\ \frac{i+1+n}{2}+n(2m-j-2), & \text{if } e=x_{i,j}x_{i,j+1}, \text{ when } i \text{ is even and } j \text{ is even}\\ \frac{i+1}{2}+n(2m-j), & \text{if } e=x_{i,j}x_{i,j+1}, \text{ when } i \text{ is odd and } j \text{ is odd}, j\neq 1\\ \frac{i+1+n}{2}+n(2m-j), & \text{if } e=x_{i,j}x_{i,j+1}, \text{ when } i \text{ is even and } j \text{ is odd}, j\neq 1\\ \frac{i}{2}+n(2m-2), & \text{if } e=x_{i,1}x_{i,m}, \text{ when } i \text{ is even}\\ \frac{i+n}{2}+n(2m-2), & \text{if } e=x_{i,1}x_{i,m}, \text{ when } i \text{ is odd}\\ 2nm+n-i-1, & \text{if } e=x_{i,j}x_{i+1,j}, \text{ when } i \text{ is odd}, j=1\\ 2nm+n-i+1, & \text{if } e=x_{i,j}x_{i+1,j}, \text{ when } i \text{ is even}, j=1\end{cases}$$

And the super total edge weight are as follows

$$w(e)=\begin{cases}\frac{5nm+n+3}{2}, & \text{if } e=x_{i,j}x_{i,j+1}, \text{ when } 1\leq i\leq n \text{ and } j \text{ is odd}\\ \frac{5nm-3n+3}{2}, & \text{if } e=x_{i,j}x_{i,j+1}, \text{ when } 1\leq i\leq n \text{ and } j \text{ is even}\\ \frac{6nm-3n+3}{2}, & \text{if } e=x_{i,1}x_{i,m}, \text{ when } 1\leq i\leq n\\ \frac{4nm+3n+1}{2}, & \text{if } e=x_{i,j}x_{i+1,j}, \text{ when } i \text{ is odd and } j=1\\ \frac{4nm+3n+5}{2}, & \text{if } e=x_{i,j}x_{i+1,j}, \text{ when } i \text{ is even and } j=1\end{cases}$$

Hence, from the above super total edge weights, it easy to see that f induces a proper edge coloring of $P_n \triangleright C_m$ and it gives $\gamma_{leat}(P_n \triangleright C_m) \leq 5$. Based on Lemma 2.1, the lower bound is $\gamma_{leat}(P_n \triangleright C_m) \geq \gamma_{leat}(P_n) + \gamma_{leat}(C_m) = 5$. It concludes that $\gamma_{leat}(P_n \triangleright C_m) = 5$. Based on case 1 and case 2, so the super local edge antimagic total chromatic number of $P_n \triangleright C_m$, with n odd is $\gamma_{leat}(P_n \triangleright C_m) = 5$. □

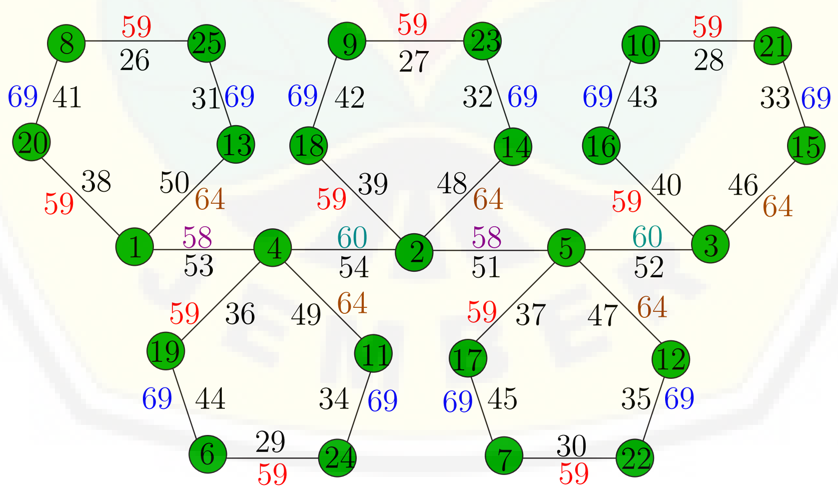

Figure 2. Illustration of local edge antimagic total coloring of $P_5 \triangleright C_5$

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Theorem 2.5. *For $n, m \geq 3$ and n is odd, the local edge antimagic chromatic number of $P_n \triangleright S_m$ is*

$$\gamma_{leat}(P_n \triangleright S_m) = 2 + m$$

Proof. The graph $P_n \triangleright S_m$ is a connected graph with vertex set $V(P_n \triangleright S_m) = \{a_i, x_i; 1 \leq i \leq n\} \cup \{x_{i,j}; 1 \leq i \leq n, 1 \leq j \leq m-1\}$ and edge set $E(P_n \triangleright S_m) = \{a_i x_i; 1 \leq i \leq n\} \cup \{x_i x_{i+1}; 1 \leq i \leq n-1\} \cup \{a_i x_{i,j}; 1 \leq i \leq n, 1 \leq j \leq m-1\}$. Hence $|V(P_n \triangleright S_m)| = mn + n$ and $|E(P_n \triangleright S_m)| = mn + n - 1$.

We will show that the lower bound of the local edge antimagic total coloring of $P_n \triangleright S_m$ is $\gamma_{leat}(P_n \triangleright S_m) \geq m + 2$. Based on Lemma 2.1, the lower bound is $\gamma_{leat}(P_n \triangleright S_m) \geq \gamma_{leat}(P_n) + \gamma_{leat}(S_m) = 2 + m$. It concludes that the lower bound of the local edge antimagic total coloring of $P_n \triangleright S_m$ is $\gamma_{leat}(P_n \triangleright S_m) \geq m + 2$. Furthermore, we will show that the upper bound of the local edge antimagic total coloring of $P_n \triangleright S_m$ is $\gamma_{leat}(P_n \triangleright S_m) \leq m + 2$.

Define a bijection $f : V(P_n \triangleright S_m) \cup E(P_n \triangleright S_m) \longrightarrow \{1, 2, 3, ..., |V(P_n \triangleright S_m)| + |E(P_n \triangleright S_m)|\}$ by the following.

$$f(v) = \begin{cases} \frac{i+1}{2}, & \text{if } v = x_i,\ i \text{ odd},\ 1 \leq i \leq n \\ \frac{i+n+1}{2}, & \text{if } v = x_i,\ i \text{ even},\ 1 \leq i \leq n \\ \frac{i}{2} + n, & \text{if } v = a_i,\ i \text{ even},\ 1 \leq i \leq n \\ \frac{i+n}{2} + n, & \text{if } v = a_i,\ i \text{ odd},\ 1 \leq i \leq n \\ \frac{i+1}{2} + n(j+1), & \text{if } v = x_{i,j},\ i \text{ odd},\ 1 \leq i \leq n,\ 1 \leq j \leq m-1 \\ \frac{i+n+1}{2} + n(j+1), & \text{if } v = x_{i,j},\ i \text{ even},\ 1 \leq i \leq n,\ 1 \leq j \leq m-1 \end{cases}$$

$$f(e) = \begin{cases} nm + 2n - i + 1, & \text{if } e = a_i x_i,\ 1 \leq i \leq n \\ n(m + j + 2) - i + 1, & \text{if } e = a_i x_{i,j},\ 1 \leq i \leq n,\ 1 \leq j \leq m-1 \\ 2nm + 2n - i - 1, & \text{if } e = x_i x_{i+1},\ i \text{ odd},\ 1 \leq i \leq n-1 \\ 2nm + 2n - i + 1, & \text{if } e = x_i x_{i+1},\ i \text{ even},\ 2 \leq i \leq n-1 \end{cases}$$

And the super total edge weight are as follows

$$w_t(e) = \begin{cases} \frac{2nm+7n+3}{2}, & \text{if } e = a_i x_i,\ 1 \leq i \leq n \\ \frac{2nm+4nj+9n+3}{2}, & \text{if } e = a_i x_{i,j},\ 1 \leq i \leq n \text{ dan } 1 \leq j \leq m-1 \\ \frac{4nm+5n+1}{2}, & \text{if } e = x_i x_{i+1},\ i \text{ odd},\ 1 \leq i \leq n-1 \\ \frac{4nm+5n+5}{2}, & \text{if } e = x_i x_{i+1},\ i \text{ even},\ 1 \leq i \leq n-1 \end{cases}$$

Hence, from the above super total edge weights, it easy to see that f induces a proper edge coloring of $P_n \triangleright S_m$ and it gives $\gamma_{leat}(P_n \triangleright S_m) \leq 5$. Based on Lemma 2.1, the lower bound is $\gamma_{leat}(P_n \triangleright S_m) \geq \gamma_{leat}(P_n) + \gamma_{leat}(S_m) = 2 + m$. It concludes that $\gamma_{leat}(P_n \triangleright C_m) = 2 + m$. So the super local edge antimagic total chromatic number of $P_n \triangleright S_m$, with n odd is $\gamma_{leat}(P_n \triangleright S_m) = 2 + m$. □

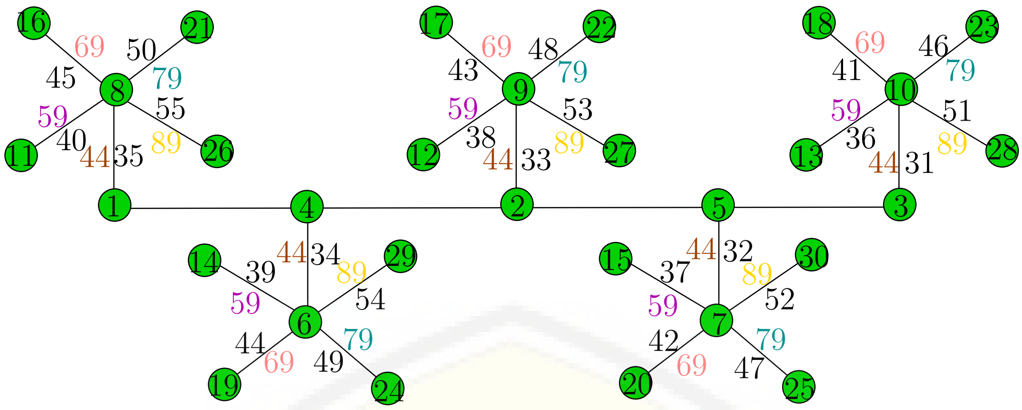

Figure 3. Illustration of local edge antimagic total coloring of $P_5 \triangleright S_5$

3. Conclusion

In this paper we have given an asymptotically tight result on super local edge antimagic total chromatic number of comb products of path and any graphs. Hence the following problem aries naturally.

Open Problem 3.1. *Determine the lower bound and upper local edge antimagic coloring of* $G \triangleright H$

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References

[1] Gross J L, Yellen J and Zhang P 2014 *Handbook of graph Theory* Second Edition CRC Press Taylor and Francis Group

[2] Chartrand G and Lesniak L 2000 *Graphs and digraphs 3rd* ed (London: Chapman and Hall)

[3] Hartsfield N dan Ringel G 1994 *Pearls in Graph Theory* Academic Press. United Kingdom

[4] Arumugam S, Premalatha K, Baca M and Semanicova-Fenovcikova A 2017 Local Antimagic Vertex Coloring of a Graph, *Graphs and Combinatorics* **33** 275-285

[5] Dafik, Miller M, Ryan J, and Baca M 2011 Super edge-antimagic total labelings of $mK_{n,n}$ *Ars Combinatoria* **101** 97-107

[6] Dafik, M Mirka, Joe Ryan, and Martin Baca 2006 Super edge-antimagicness for a class of disconnected graphs

[7] Agustin I H, Dafik, Moh. Hasan, Alfarisi R and Prihandini R M 2017 Local edge antimagic coloring of graphs *Far East Journal of Mathematical Sciences.*

[8] Agustin I H, Dafik, Slamin, Ridho Alfarisi and Kurniawati E Y 2017 The construction of super local edge antimagic total coloring by using an EAVL Technique *accepted*

[9] Agustin I H, Dafik, Slamin, Ermita E R and Alfarisi R 2017 On the total local edge super antimagicness of special graph and graph with pendant edge *accepted*

[10] Alfarisi R, Dafik, Agustin I H and Kristiana A I 2017 The local edge antimagic total coloring of some wheel related graphs *Far East Journal of Mathematical Sciences*