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K-Super Mean Labeling of Cycle Related Graphs

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Abstract : ***Let G be a*** (p,q) ***graph and*** $f : V(G) \to \{1,2,3 \ldots\ldots p+q+k-1\}$ ***be an injection. For each edge*** $e = uv$, ***let*** $f^*(e) = \frac{f(u)+f(v)}{2}$ ***if*** $f(u)+f(v)$ ***is even and*** $f^*(e) = \frac{f(u)+f(v)+1}{2}$ ***if*** $f(u)+f(v)$ ***is odd ,then*** f ***is called k- Super mean labeling if*** $f(V) \cup \{f^*(e): e \in E(G)\} = \{1,2,3,\ldots\ldots p+q+k-1\}$. ***A graph that admits a k-Super mean labeling is called k-Super mean graph.***

In this paper we investigate k – super mean labeling of $< C_m, K_{1,n} >$ ***and*** $< C_m * K_{1,n} >$.

Keywords: k–Super mean labeling, k–Super mean graph, $< C_m, K_{1,n} >, < C_m * K_{1,n} >$ ***AMS Subject Classification--- 05C78***

I. INTRODUCTION

All graphs in this paper are finite, simple and undirected. The symbols V(G) and E(G) will denote the vertex set and edge set of a graph G. Terms not defined here are used in the sense of Harary [7]. Graph labeling was first introduced in the late 1960's. Many studies in graph labeling refer to Rosa's research in 1967 [11]. Labeled graphs serve as useful models for a broad range of applications such as X-ray, crystallography, radar, coding theory, astronomy, circuit design and communication network addressing. The concept of mean labeling was introduced and studied by S. Somasundaram and R.Ponraj [12]. The concept of super mean labeling was introduced and studied by D. Ramya et al. [11]. Futher some results on super mean graphs are discussed in [8, 9, 10, 14, 15]. B. Gayathri and M. Tamilselvi [13] extended super mean labeling to k-super mean labeling. In this paper we investigate k – Super mean labeling of $< C_m, K_{1,n} >$ *and* $< C_m * K_{1,n} >$. For brevity, we use k-SML for k-super mean labeling. Here k denoted as any positive integer greater than or equal to 1.

II. MAIN RESULTS

A. Definition 2.1

Let G be a (p, q) graph and $f: V(G) \to \{1,2,3,\ldots,p+q\}$ be an injection. For each edge e = uv, let $f^*(e) = \frac{f(u)+f(v)}{2}$ if $f(u)+f(v)$ is even and $f^*(e) = \frac{f(u)+f(v)+1}{2}$ if $f(u)+f(v)$is odd, then f is called Super mean labeling if $f(V) \cup \{f^*(e): e \in E(G)\} = \{1,2,3,\ldots,p+q\}$. A graph that admits a super mean labeling is called Super mean graph.

B. Definition 2.2

Let G be a (p, q) graph and $f: V(G) \to \{k, k+1, k+2, \ldots, p+q+k-1\}$be an injection. For each edge e = uv, let $f^*(e) = \frac{f(u)+f(v)}{2}$ if $f(u)+f(v)$ is even and $f^*(e) = \frac{f(u)+f(v)+1}{2}$ if $f(u)+f(v)$is odd, then f is called k-Super mean labeling if $f(V) \cup \{f^*(e): e \in E(G)\} = \{k, k+1, \ldots, p+q+k-1\}$. A graph that admits a k-super mean labeling is called k-Super mean graph.

C. Definition 2.3

$< C_m, K_{1,n} >$ is the graph obtained from C_m and $K_{1,n}$ by identifying the vertex u_1 of C_m with the central vertex v of $K_{1,n}$.

D. Theorem 2.4

The graph $< C_m, K_{1,n} >$ is a k-Super Mean Labeling for $n \le 2$ and $m \ge 3$.

1) *Proof:* Let G denotes the graph $< C_m, K_{1,n} >$. Let $V(G) = \{u_i ; 1 \le i \le m\} \cup \{v_i; 1 \le i \le n\}$ and $E(G) = \{e_i = (u_1 v_i); 1 \le i \le n\} \cup \{e_i' = (u_i u_{i+1}); 1 \le i \le m-1\} \cup \{e_m' = (u_m u_1)\}$ be the vertices and edges of G respectively. For m=4, the super mean labeling of the graphs $< C_1, K_{1,1} >, < C_2, K_{1,2} >, < C_3, K_{1,3} >$ *and* $< C_1, K_{1,4} >$

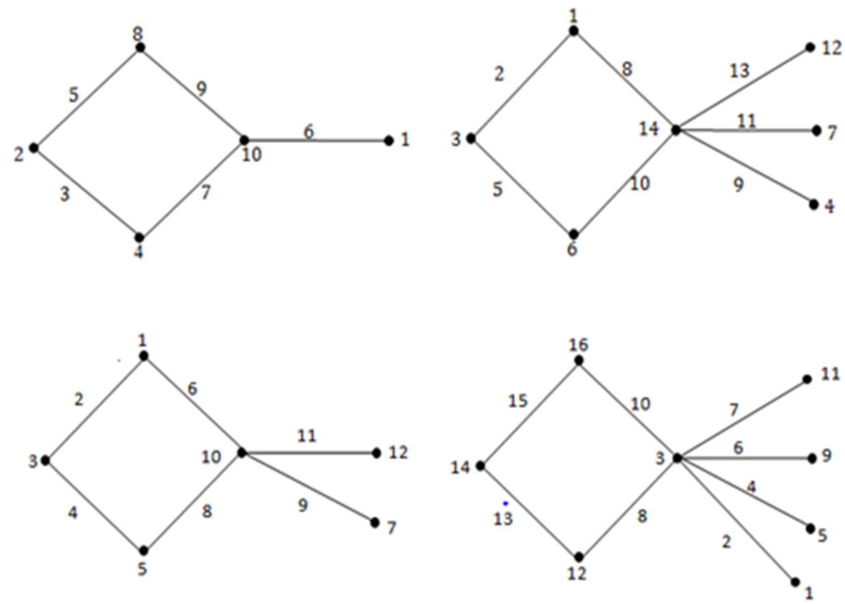

Figure 1

Define $f : V(G) \rightarrow \{k, k+1, \ldots \ldots \ldots . k+2(m+n)-1\}$

2) *Case (1):* m is odd

Let $m = 2l + 1$ for all $l \in Z^+$

For n=1, 2

$f(v_i) \quad = k + i - 1 \qquad ,1 \leq i \leq n$

$f(u_1) \quad = k + 2n$

$f(u_j) \quad = k + 2n + 4j - 6 \qquad ,2 \leq j \leq l + 1$

$f(u_{l+1+j}) = k + 2n + 4l - 4j + 5 \qquad ,1 \leq j \leq l$

For n=3, 4

$f(u_1) \quad = \quad k + 4$

$f(u_j) \quad = \quad k + 2n + 4j - 2 \qquad ,2 \leq j \leq l$

$f(u_{l+j}) \quad = \quad k + 2n + 4l - 4j + 5 \qquad ,1 \leq j \leq l$

$f(u_{2l+1}) \quad = \quad k + 2n + 3$

3) *Case (2):* m is even

Let $m = 2l$ for all $l \in Z^+$

For n=1, 2

$f(v_i) \quad = k + i \qquad ,1 \leq i \leq n$

$f(u_1) \quad = k + 2n$

$f(u_j) \quad = k + 2n + 4j - 5 \qquad ,2 \leq j \leq l$

$f(u_{l+j}) \quad = k + 2n + 4l - 3(j-1) \qquad ,1 \leq j \leq 2$

$f(u_{l+2+j}) = k + 2n + 4l - 4j - 2 \qquad ,1 \leq j \leq l - 2$

For n=3, 4

$f(u_1) \quad = k + 4$

$f(u_j) \quad = k + 2n + 4j - 2 \qquad ,2 \leq j \leq l - 1$

$f(u_{l-1+j}) \quad = k + 2n + 4l - 3(j-1) - 1 \qquad ,1 \leq j \leq 2$

$f(u_{l+1+j}) \quad = k + 2n + 4l - 4j - 3 \qquad ,1 \leq j \leq l - 2$

$f(u_{2l}) \quad = 2n + 4$

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Clearly, $\boldsymbol{f}$ induces distinct edge labels and it is easy to check that $\boldsymbol{f}$ generates a k −super mean labeling and Hence $< C_m, K_{1,n} >$ is a k −Super Mean Labeling, for all $m \geq 3$ and $n \leq 4$.

E. Example 2.5

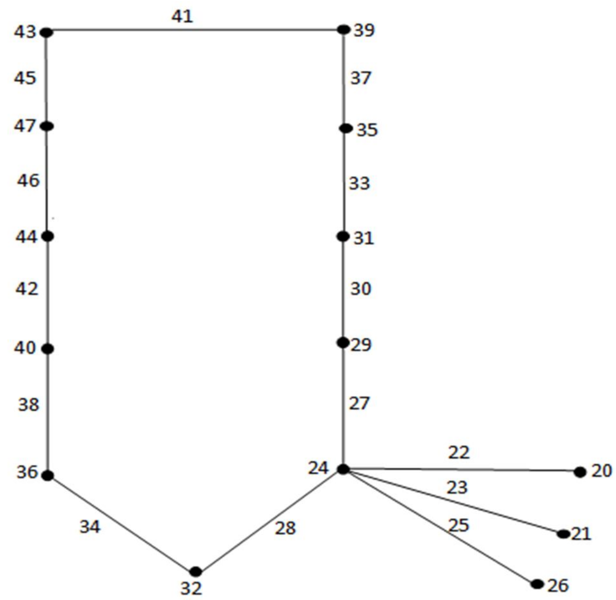


Figure 2: 20-Super mean labeling of $<C_{11}, K_{1,3}>$

F. Definition 2.6

$< C_m * K_{1,n} >$ is the graph obtained from C_m and $K_{1,n}$ by identifying any one of the vertices of C_m with a pendant vertex of $K_{1,n}$ (i.e. a non-central vertex of $K_{1,n}$).

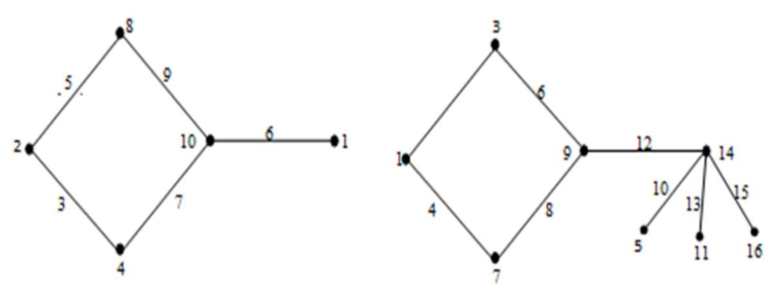
G. Theorem 2.7

The graph $< C_m * K_{1,n} >$ is a k-Super Mean Labeling for $n \leq 6$ and $m \geq 3$.

1) Proof:

Let G denotes the graph $< C_m * K_{1,n} >$. Let $V(G) = \{u_i ; 1 \leq i \leq m\} \cup \{v_i; 1 \leq i \leq n\}$ and $E(G) = \{e_i = (u_1 v_{i+1}); 1 \leq i \leq n-1\} \cup \{e_i' = (u_i u_{i+1}); 1 \leq i \leq m-1\} \cup \{e_m' = (u_m u_1)\} \cup \{e = (v v_1)\}$ be the vertices and edges of G respectively.

For m=4, the super mean labeling of the graphs $< C_m * K_{1,n} >$, n=1, 2, 3,4,5,6 are shown in Figure 3.



$<C_4 * K_{1,1}>$ $<C_4 * K_{1,4}>$

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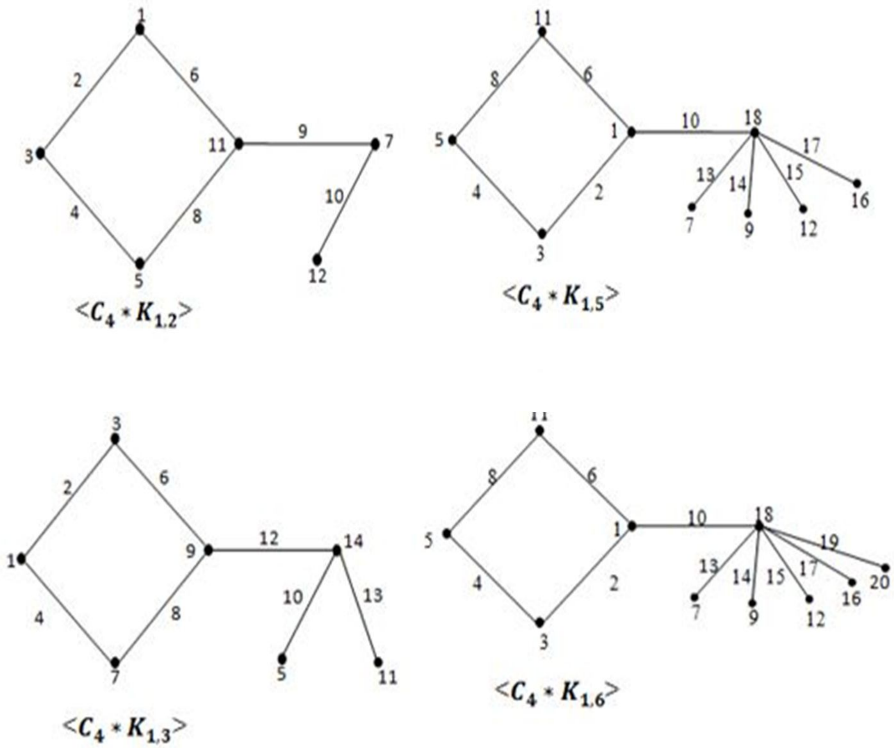

Figure 3

Define $f : V(G) \to \{k, k+1, \ldots\ldots\ldots. k+2(m+n)-1\}$

2) *Case (1):* m is odd

Let $m = 2l + 1$ for all $l \in Z^+$

For n=1,2,3

$f(v) = k + 2n - 2$

$f(u_1 = v_1) = k + 2n$

$f(v_{n+1-i}) = k + i - 1 \quad ,1 \le i \le n-1 \quad ,n = 2,3$

$f(u_j) = k + 2n + 4j - 6 \quad ,2 \le j \le l+1$

$f(u_{l+1+j}) = k + 2n + 4l - 4j + 5 \quad ,1 \le j \le l$

For n=4,5

$f(v) = k + 4$

$f(u_1 = v_1) = k + 2n + 2$

$$f(v_{n+1-i}) = \begin{cases} k + i - 1 & ,1 \le i \le 2 \\ k + 6 + 3(i-3) & ,3 \le i \le n-1 \end{cases}$$

For n=6

$f(v) = k + 4$

$f(u_1 = v_1) = k + 14$

$f(v_2) = k + 11$

$f(v_3) = k + 10$

$f(v_4) = k + 6$

$f(v_5) = k + 1$

$f(v_6) = k$

$f(u_1) = k + 2n + 2$

$f(u_2) = k + 2n$

$f(u_j) = k + 2n + 4j - 7 \quad ,3 \le j \le l+2$

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$f(u_{l+2+j}) = k + 2n + 4l - 4j + 2 \quad ,1 \le j \le l-1$

m is even

Let $m = 2l$ for all $l \in Z^+$

$f(v) = k + 2n - 2$

$f(u_1 = v_1) = k + 2n$

$f(v_{n+1-i}) = k + i - 1 \quad ,1 \le i \le n-1 \quad ,n = 2,3$

$f(u_j) = k + 2n + 4j - 6 \quad ,2 \le j \le l$

$f(u_{l+j}) = k + 2n + 4l - 3(j-1) - 1 \quad ,1 \le j \le 2$

$f(u_{l+2+j}) = k + 2n + 4l - 4j - 3 \quad ,1 \le j \le l-2$

For n=4,5

$f(v) = k + 4$

$f(u_1 = v_1) = k + 2n + 2$

$$f(v_{n+1-i}) = \begin{cases} k + i - 1 & ,1 \le i \le 2 \\ k + 6 + 3(i-3) & ,3 \le i \le n-1 \end{cases}$$

For n=6

$f(v) = k + 4$

$f(u_1 = v_1) = k + 14$

$f(v_2) = k + 11$

$f(v_3) = k + 10$

$f(v_4) = k + 6$

$f(v_5) = k + 1$ and

$f(v_6) = 1$

$f(u_1) = k + 2n + 2$

$f(u_2) = k + 2n$

$f(u_j) = k + 2n + 4j - 7 \quad ,3 \le j \le l$

$f(u_{l+j}) = k + 2n + 4l - 4 + 3(j-1) \quad ,1 \le j \le 2$

$f(u_{l+2+j}) = k + 2n + 4l - 4j - 2 \quad ,1 \le j \le l-2$

Clearly, the edge labels are distinct. It can be easily verified that f generates a k –super mean labeling and Hence $< C_m * K_{1,n} >$ is a k –Super Mean Labeling, for all $m \ge 3$ and $n \le 6$.

H. Example 2.8

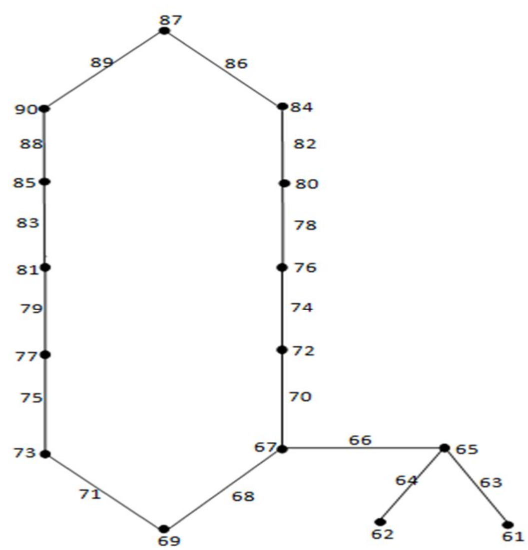

Figure 4: 60-Super mean labeling of $<C_{12} * K_{1,3}>$

III. CONCLUSIONS

Graph Labeling has its own applications in communication network and astronomy, so enormous types of labeling have grown. Towards this, k −Super Mean Labeling is also a kind of mean labeling. In this dissertation we discussed k −Super Mean Labeling of $< C_m, K_{1,n} >$ and $< C_m * K_{1,n} >$ graphs.

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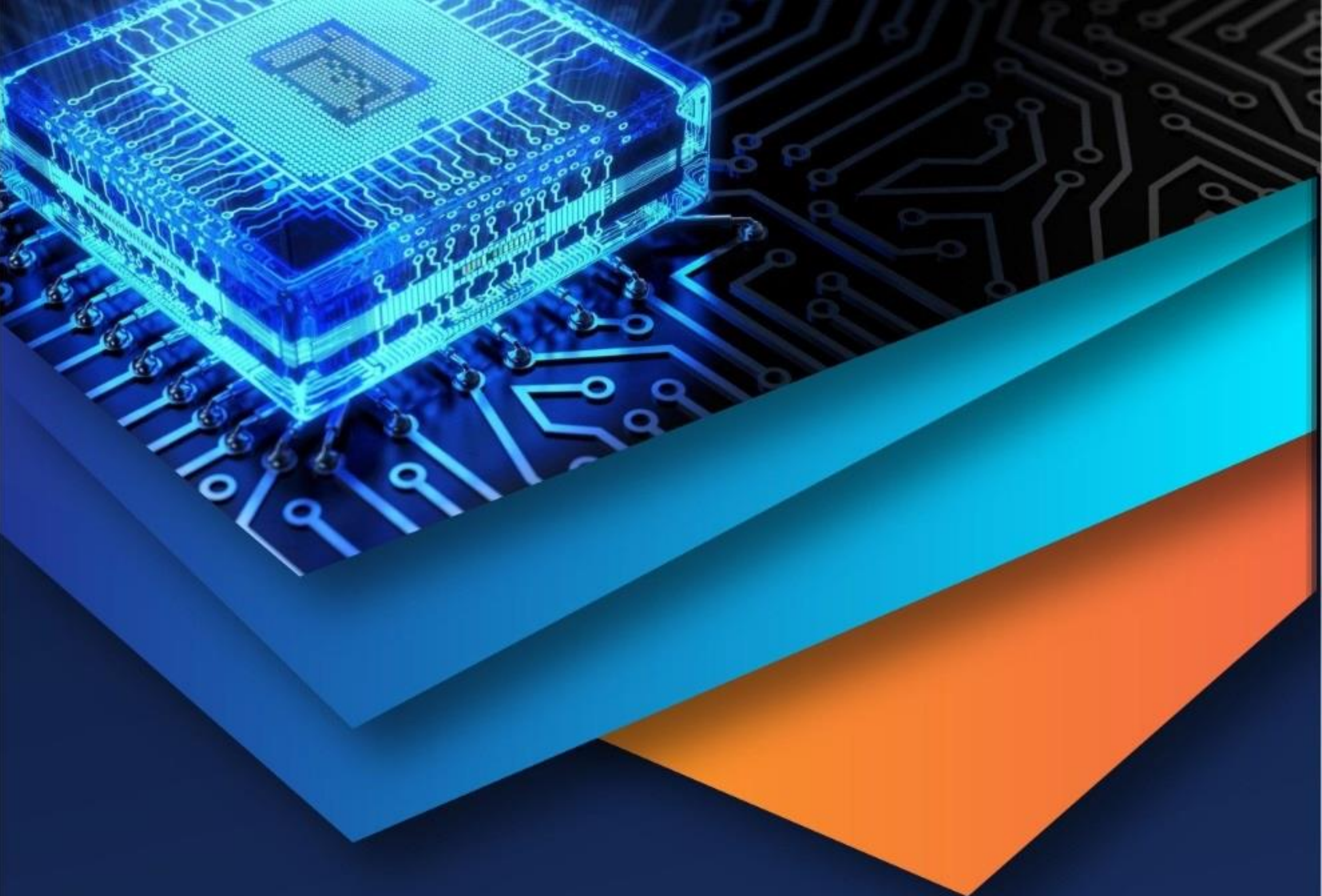

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