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Path and cycle related families of E-Cordial graph

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Abstract
The two copies of graph G(p, q) are joined by t paths on n-points each We represent the family by $G(tP_n)$. The paths are attached at the same fixed point on G. We discuss E-cordiality of C_3(Pn), $K_4(P_n)$, $S_4(P_n)$ (shel graph S4) We show that under certain conditions these graphs are E-cordial.

Keywords: graph, E-cordial, shel graph, C3, C4

Introduction
In 1997 Yilmaz and Cahit introduced weaker version of edge graceful labeling E-cordial labeling. Let G be a (p, q) graph. f:E→{0, 1} Define f on V by f(v) $=\sum\{f(vu)(vu)\in E(G)\}(mod\ 2)$. The function f is called as E-cordial labeling if |vf(0)-vf(1)|≤1 and |ef(0)-ef(1)|≤1 where $v_f(i)$ is the number of vertices labeled with i =0, 1. And $e_f(i)$ is the number of edges labeled with i= 0, 1, We follow the convention that $v_f(0, 1)$ =(a, b) for $v_f(0)$=a and vf(1)=b further $e_f(0,1)$=(x, y) for $e_f(0)$=x and $e_f(1)$=y. A graph that admits E-cordial labeling is called as E-cordial graph. Yilmaz and Cahit prove that trees Tn are E-cordial iff for n not congruent to 2(mod 4), Kn are E-cordial iff n not congruent to 2(mod 4), Fans Fn are E-cordial iff for n not congruent to 1(mod 4).
Yilmaz and Cahit observe that A graph on n vertices can not be E-cordial if n is congruent to 2 (mod 4). One should refer Dynamic survey of graph labeling by Joe Gallian [2] for more results on E-cordial graphs.
The graphs we consider are finite, undirected, simple and connected. For terminology and definitions we refer Harary [3] and Dynamic survey of graph labeling by Joe Gallian [2]. The families we discuss are obtained by taking two copies of graph G and join them by t paths of equal length. The paths are attached at the same fixed point on G. we represent these families by G(tPn). We take t = 1 and G = C_3, S_4, K_4.

Theorems proved
G=$C_3(1P_n)$ is E-cordial iff n' is not congruent to 2 (mod 4).where n'=|V(G)|
Proof: We define Gas V(G)={u1, u2, u3, u4}U{v1, v2,.vn} E(G)={ei=(vivi+1), i=1, 2, n-1, c_1=(u1u2) c_2=(u2v1),c_3=(u1v1), c_4=(vnu3), c_5=(u3u4), c_6=($u_4$vn)} |V(G)| =n+4 and |E(G)| = n+3.

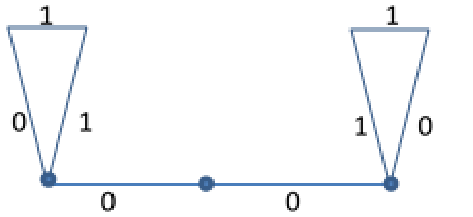

Fig 4.1 : E-cordial labeling of C3(P3). Thenumbers are edge labels.

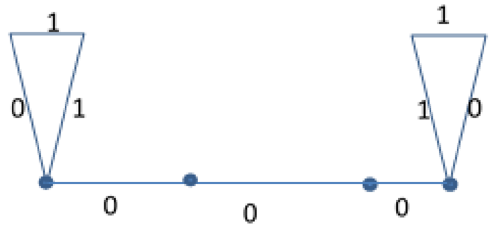

Fig 4.2 : E-cordial labeling of C3(P4). Thenumbers are edge labels.

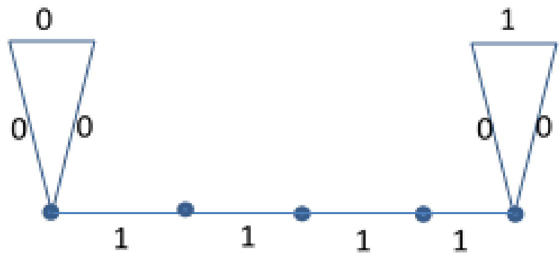

Fig 4.3: E-cordial labeling of C3(P5). Thenumbers are edge labels.

For n>5 define a function f:V(G)→{0, 1} as $f(u_1)=f(u_2)=0$
$f(c_4)=f(c_5)=f(c_6)=0, f(c_1)=f(c_3)=0, f(c_2)=1$
for i ≤2t;
f(ei) =1 for I is odd number
f(ei)=0 I is even number
Where t =min$\{\frac{n-i}{4}$/i=0,1,2,3}

Theorem $S_4(P_n)$ is E-cordial iff n is not congruent to 2 (mod 4)
Proof: S4(pn)is defined as V(G) = {u1, u2, u3, u4, u5, u6}U{v1, v2, v3.vn} and the edge set is given by E(G) = {c1=(v1u1), (u1u2), c3=(u2u3), c4=(u3u4), c4=(u4v1), c5=(v1u2)} U {ei = (vivi+1), i= 1, 2,…,n-1}
For n>5 define a function f:V(G)→{0,1} as f(u1)=f(u2)=0
$f(c_4)=f(c_5)=f(c_6)=0, f(c_1)=f(c_3)=0, f(c_2)=1$
for i ≤2t;
f(ei) =1 for I is odd number
f(ei)=0 I is even number
Where t =min$\{\frac{n-i}{4}$/i=0, 1, 2, 3}

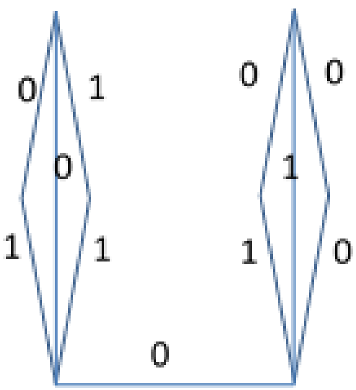

Fig 4.4: $S_4(p_2)$ The edge label numbers are shown

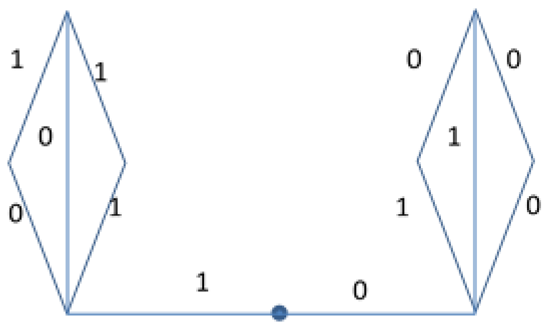

Fig 4.5: $S_4(p_3)$ The edge label numbers are shown

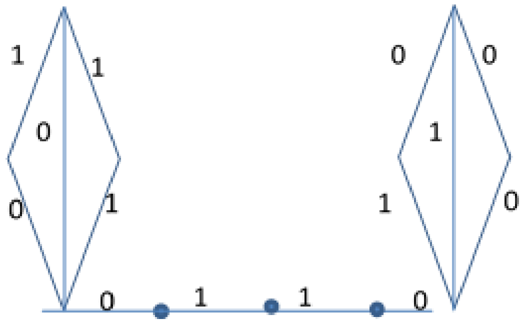

Fig 4.6: $S_4(p_5)$ The edge label numbers are shown

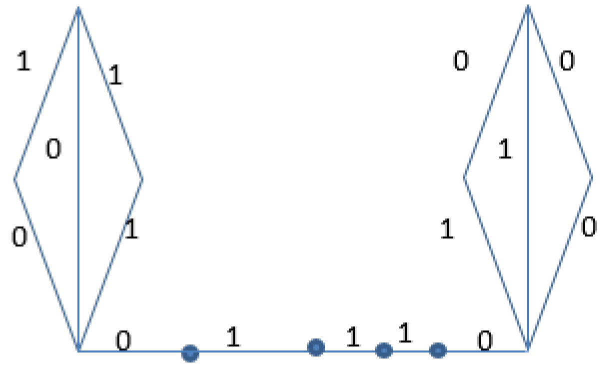

Fig 4.7: $S_4(p_5)$ The edge label numbers are shown

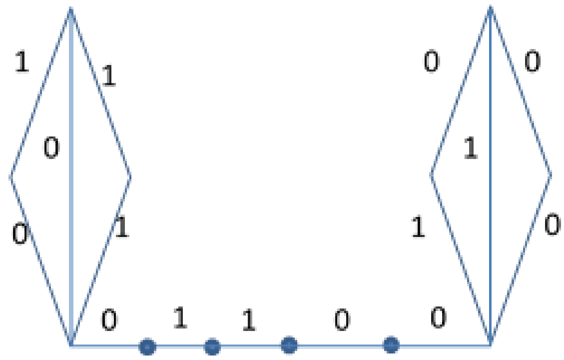

Fig 4.8: $S_4(p_6)$ The edge label numbers are shown

Define a function f : V(G)→{0, 1} as f(u1)=f(u2)=0
$f(c_4)=f(c_5)=f(c_6)=0$,
$f(c_1)=f(c_3)=0, f(c_2)=1$
take t = $\frac{n-j}{4}$/j=1, 2, 3. (n is divisible by 4 then graph is not E-cordial)
For i ≤2t
f(ei)=0 for i is odd number ≤2t
f(ei)=1 for i is even number <2t.
f(ei)=1 for i= 2t, 2t+1, 2t+k where k = p-t+1 where p = $\frac{n-1}{2}$ for n ≡1,3 (mod 4) and p = $\frac{n-2}{2}$when n ≡2(mod 4).
f(ei) = 0 for 2t+k<i ≤n
Note that The number distribution is
1) for n≡1(mod 4) $v_f(0,1)=(\frac{n}{2}+3,\frac{n}{2}+4)$, $e_f(0,1)=(\frac{n}{2}+4,\frac{n}{2}+4)$
2) for n≡2(mod 4) $v_f(0,1)=(\frac{n}{2}+4,\frac{n}{2}+4)$, $e_f(0,1)=(\frac{n}{2}+5,\frac{n}{2}+4)$
3) for n≡3(mod 4) $v_f(0,1)=(\frac{n}{2}+5,\frac{n}{2}+4)$, $e_f(0,1)=(\frac{n}{2}+5,\frac{n}{2}+5)$

Theorem $K_4(P_n)$ is E-cordial.

Proof: The K_4(Pn) is defined as V(G)={ u1, u2, u3, u4, u5, u6}U{v1, v2,.vn}and E(G) ={c1=(v_1u_1), c_2=(u_1u_2), c_3=(u_2u_3), c_4=(u_3u_4), c_5=(v_1u_2), c_6=(u_1u_3)} U{c_7=(v_nu_4), c_8=(u_4u_5), c_9=(u_5u_6), c_{10}=(u_6v_n), c_{11}=(v_nu_5), c_{12}=(u_5u_6)} U{e_i=(v_iv_{i+1}) / I =1, 2…, n-1}

We diagramatically show below the E-cordial labeling of K4(p2), K4(p3), K4(P5).

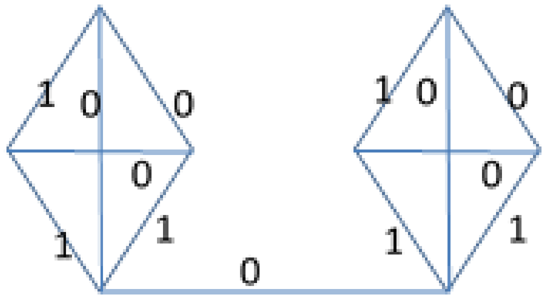

Fig 4.9: $k_4(P_2)$a labeled copy.

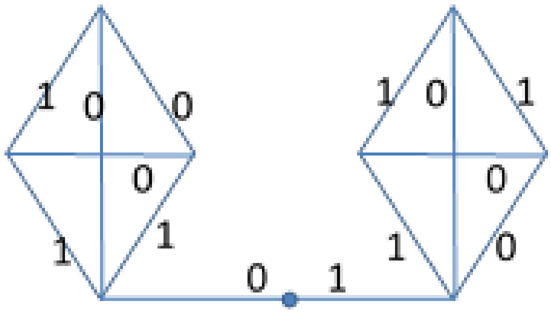

Fig 4.10: $k_4(P_3)$a labeled copy.

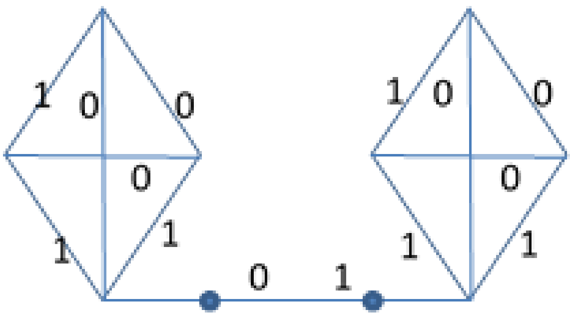

Fig 4.11: $k_4(P_3)$a labeled copy .

Define a function f :E(G)→{0,1} as

$f(c_1)=1$,

$f(c_2)=1$,

$f(c_4)=1$,

$f(c_7)=1$,

$f(c_8)=1$,

$f(c_{10})=1$. take t = $\frac{n-j}{4}$/j=1,2,3. (n is divisible by 4 then graph is not E-cordial)

For i ≤2t

f(ei)=0 for i is odd number ≤2t.

f(ei)=1 for i is even number <2t.

f(ei)=1 for i= 2t, 2t+1, 2t+k where k = p-t+1 where p = $\frac{n-1}{2}$ for n ≡1,3 (mod 4) and p = $\frac{n-2}{2}$when n ≡2(mod 4).

f(ei) = 0 for 2t+k<i ≤n

Note that The number distribution is

1) for n≡1(mod 4)$v_f(0, 1)=(\frac{n}{2}+3,\frac{n}{2}+4)$, $e_f(0,1)=(\frac{n}{2}+4,\frac{n}{2}+4)$

2) for n≡2(mod 4)$v_f(0, 1)=(\frac{n}{2}+4,\frac{n}{2}+4)$, $e_f(0,1)=(\frac{n}{2}+5,\frac{n}{2}+4)$

3) for n≡3(mod 4)$v_f(0, 1)=(\frac{n}{2}+5,\frac{n}{2}+4)$, $e_f(0,1)=(\frac{n}{2}+5,\frac{n}{2}+5)$

Conclusions

We have discussed only for single path between two copies of graphs. It is necessary to evaluate E-cordiality if there are 2 or more paths between twocopies of graphs.

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