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# SOME CLASSES OF 4-TOTAL PRIME CORDIAL LABELING OF GRAPHS

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## ABSTRACT

Let G be a (p, q) graph. Let f : V (G) → {1, 2, . . . , k} be a map where k ∈N and k > 1. For each edge uv, assign the label gcd(f (u), f (v)). f is called k-Total prime cordial labeling of G if $|t_f(i) - t_f(j)| \leq 1$, i, j ∈{1, 2, · · · , k} where $t_f(x)$ denotes the total number of vertices and the edges labelled with x. A graph with a k-total prime cordial labeling is called k-total prime cordial graph. In this paper we investigate the 4-total prime cordial labeling of some graphs like flower graph, gear graph, $IT_n \odot K_1$

***Key words:*** *(Corona, gear graph, Flower graph).*

## I. INTRODUCTION

Graphs considered here are finite, simple and undirected. Ponraj et al. [4], have been introduced the concept of k-total prime cordial labeling and the k-total prime cordial labeling of certain graphs have been investigated. Also in [4, 5, 6, 7, 8, 9], the 4-total prime cordial labeling behaviour of path, cycle, star, bistar, some complete graphs, comb, double comb, triangular snake, double triangular snake, ladder, friendship graph, jelly fish, book, irregular triangular snake, triangular ladder, armed crown, shadow graph, Pn2, Tn⊙ K2 and subdivision of some graphs like comb, double comb, star, bistar, triangular snake, ladder, double triangular snake, jelly fish, triangular ladder, Tn⊙ K1 have been investigated. In this paper we investigate the 4-total prime cordial labeling of few graphs like flower graph, gear graph, ITn⊙ K1.

## II. PRELIMINARIES

Definition2.1. Let G be a (p, q) graph. Let f : V (G) → {1, 2, . . . , k} be a function where k ∈N and k > 1. For each edge uv, assign the label gcd(f (u), f (v)). f is called k-Total prime cordial labeling of G if |tf (i) − tf (j)| ≤ 1, i, j ∈{1, 2, · · · , k} where tf (x) denotes the total number of vertices and the edges labelled with x. A graph with a k-total prime cordial labeling is called k-total prime cordial graph.

Definition 2.2. Let G1, G2 respectively be (p1, q1), (p2, q2) graphs. The corona of G1 with G2 is the graph G1⊙G2 obtained by taking one copy of G1 , p1 copies of G2 and joining the ith vertex of G1 by an edge to every vertex in the ith copy of G2 where 1 ≤ i ≤ p1.

Definition 2.3. The graph irregular triangular snake ITn ( n ≥ 4) is obtained by the path Pn : u1u2 . . . un with vertex set V (I Tn) = V (Pn)∪ vi(1 ≤ i ≤ n − 2) and edge set E(I Tn) = E(Pn) ∪{uivi, ui+2vi : 1 ≤ i ≤ n − 2}.
Definition 2.4. The graph Wn = Cn +K1 is called a wheel. In a Wheel, a vertex of degree 3 on the cycle is called a rim vertex. A vertex which is adjacent to all the rim vertices is called the central vertex. The edges with one end incident with a rim vertex and the other incident with the central vertex are called spokes.

Definition 2.5. The Helm Hn is obtained from a wheel Wn by attach-ing a pendent edge at each vertex of the cycle Cn.

Definition 2.6. A Flower graph Fln is the graph obtained from a Helm by joining each pendent vertex to the central vertex of the Helm.
s
Definition 2.7. The Gear graph Gn is obtained from the wheel Wn by adding a vertex between every pair of adjacent vertices of the cycle Cn.

Theorem 2.8. [4] Every graph is a subgraph of a connected k-total prime cordial graph.

Theorem 2.9. [4] If $m \equiv 0 \pmod k$, then mG is k-total prime cordial.

Theorem 2.10. [4] If G is a (p, q) graph, then $mG \cup (k - r)K_{1,p+q}$ is k-total prime cordial, where $m = kt + r$, $0 \le r < k$.

Theorem 2.11. [4] Let G1 and G2 be (p1, q1) and (p2, q2)-graph respec-tively with $(p_1 + q_1) \equiv 0 \pmod k$ and $(p_2 + q_2) \equiv 0 \pmod k$. If G1 and G2 are k-total prime cordial graph, then the graph G1∼ G2 obtained from G1 and G2 by connecting an edge is also a k-total prime cordial.

Theorem 2.12. [4] Let G be a (p, q)-k-total prime cordial graph with $(p + q) \equiv 0 \pmod k$. Then $G - e$ is also a k-total prime cordial graph.

Theorem 2.13. [4] If G is a (p, q)-k-total prime cordial graph with $(p + q) \equiv 0 \pmod k$, then $G \cup K_2$ is also k-total prime cordial.

Theorem 2.14. [4] All paths are 4-total prime cordial.

Theorem 2.15. [4] The cycle Cn is 4-total prime cordial iff $n \notin \{4, 6, 8\}$.

Theorem 2.16. [4] If $n \equiv 0, 7 \pmod 8$, then the complete graph Kn is not 4-total prime cordial.

Theorem 2.17. [4] The star $K_{1,n}$ is 4-total prime cordial for all n.

Theorem 2.18. [4] The bistar $B_{n,n}$ is 4-total prime cordial for all n.

Theorem 2.19. [4] The join of K2 with mK1, $K_2 + mK_1$ is 4-total prime cordial iff $m \le 1$.

Theorem 2.20. [5] The comb $P_n \odot K_1$ is 4-total prime cordial.

Theorem 2.21. [5] The double comb $P_n \odot 2K_1$ is 4-total prime cordial.

Theorem 2.22. [5] The graph $C_n \odot 2K_1$ is 4-total prime cordial.

Theorem 2.23. [5] The ladder Ln is 4-total prime cordial.

Theorem 2.24. [5] The triangular snake Tn is 4-total prime cordial.

Theorem 2.25. [5] The double triangular snake D(Tn) is 4-total prime cordial.

Theorem 2.26. [5] The friendship graph C3(t) is 4-total prime cordial iff $t \equiv 0, 1, 2 \pmod 4$.

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Theorem 2.27. [6] The subdivision of comb S(Pn⊙ K1) is 4-total prime cordial.

Theorem 2.28. [6] The subdivision of double comb S(Pn⊙ 2K1) is 4-total prime cordial.

Theorem 2.29. [6] The subdivision of star S(K1,n) is 4-total prime cordial.

Theorem 2.30. [6] The subdivision of bistar S(Bn,n) is 4-total prime cordial.

Theorem 2.31. [6] The subdivision of triangular snake S(Tn) is 4-total prime cordial.

Theorem 2.32. [6] The subdivision of ladder S(Ln) is 4-total prime cordial.

Theorem 2.33. [6] The subdivision of double triangular snake S(DTn) is 4-total prime cordial.

Theorem 2.34. [7] The Jelly fish J (n, n) is 4-total prime cordial for all values of n.

Corollary 2.34.1. [7] The Jelly fish J (m, n) is 4-total prime cordial for $m \neq n$ and $m, n \geq 8$.

Theorem 2.35. [7] The irregular triangular snake I Tn is 4-total prime cordial for $n \geq 4$.

Theorem 2.36. [8] The armed crown graph ACn is 4-total prime cordial for all $n \geq 3$.

Theorem 2.37. [8] The subdivision of jelly fish J (n, n), S(J (n, n)) is 4-total prime cordial for all values of n.

Theorem 2.38. [9] If $n \equiv 1 \pmod 4$, then Pn2 is 4-total prime cordial.

Theorem 2.39. [9] The shadow graph D2(Pn) is 4-total prime cordial iff $n \notin \{2, 4\}$.

Theorem 2.40. [9] The corona of Tn with K2, Tn⊙K2 is 4-total prime cordial for all $n \geq 2$.

Theorem 2.41. [9] The subdivision of Tn with K2 (Tn⊙ K1), S(Tn⊙ K1) is 4-total prime cordial for all $n \geq 2$.

Remark. 2- total prime cordial graph is 2-total product cordial graph.

## III. MAIN RESULTS

Theorem 3.1. The flower graph Fln is 4-total prime cordial iff $n \neq 3$.

Proof.LetCnbe the cycleu1u2. . . unu1. LetV(F Ln) = {u, ui, vi: $1 \leq i \leq n$} andE(F Ln) =E(Cn)∪ {uui, uvi, uivi: $1 \leq i \leq n$}. Clearly |V(F Ln)| + |E(F Ln)| = 6n+ 1.
Case 1. $n \equiv 0 \pmod 4$.
Let n = 4r, r > 1 and r ∈N.

Subcase 1. r is even.
Assign the label 4 to the central vertex u. Next assign the label 4 to the vertex u1, u2, . . . , ur and assign 2 to the vertices ur+1, ur+2, . . . , u2r then we assign the label 3 to the vertices u2r+1, u2r+2, . . .,u 7r/2+1. Finally we assign the label 1 to the vertices u7r/2+2,...,u4r . Now we consider thevertices vi ($1 \leq i \leq n$). Assign the label 4 to the vertices v1, v2, . . . , vr and assign 2 to the vertices vr+1, vr+2, . . . , v2r then we assign the label 3 to the vertices v2r+1, v2r+2, . . . , v7r/2. Finally we assign the label 1 to the vertices v7r/2+1, . . ., v4r . Here tf (1) = tf (2) = tf (4) = 6r and tf (3) = 6r + 1.

Subcase 2. r is odd.

Assign the label 4 to the central vertex u. Next assign the label 4 to the vertex u1, u2, . . . , ur and assign 2 to the vertices ur+1, ur+2, . . . , u2r then we assign the label 3 to the vertices u2r+1, u2r+2, . . . , u 7r-1/2+1. Finally we assign the label 1 to the vertices u 7r-1/2+2, . . . , u4r . Now we consider the vertices vi (1 ≤ i ≤ n). Assign the label 4 to the vertices v1, v2, . . . , vr and assign 2 to the vertices vr+1, vr+2, . . . , v2r then we assign the label 3 to the vertices v2r+1, v2r+2, . . . , v u7r-1/2+1. Finally we assign the label 1 to the vertices v u 7r-1/2+2, . . . , v4r . Clearly tf (1) = tf (2) = tf (4) = 6r and tf (3) = 6r + 1.

Case 2. n ≡ 1 (mod 4).
Let n = 4r + 1, r > 1 and r ∈N.

Subcase 1. r is even.
As in subcase(1) of case 1, assign the label to the vertices u, ui (1 ≤ i ≤ n − 1) and vi (1 ≤ i ≤ n − 2). Finally we assign the labels 1, 2, 4 to the vertices u4r , v4r−1 and v4r respectively. Clearly tf (1) = tf (2) = tf (4) = 6r + 2 and tf (3) = 6r + 1.

Subcase 2. r is odd.
As in subcase(2) of case 1, assign the label to the vertices u, ui (1 ≤ i ≤ n −1) and vi (1 ≤ i ≤ n −2). Finally we assign the labels 1, 2, 4 to the vertices u4r , v4r−1 and v4r respectively. Obviously tf (1) = tf (2) = tf (4) = 6r + 2 and tf (3) = 6r + 1.

Case 3. n ≡ 2 (mod 4).
Let n = 4r + 2, r > 1 and r ∈N.

Subcase 1. r is even.
As in subcase(1) of case 2, assign the label to the vertices u, ui (1 ≤ i ≤ n − 2) and vi (1 ≤ i ≤ n − 2). Finally we assign the labels 3, 4, 2, 3 respectively to the vertices u4r−1, u4r , v4r−1 and v4r . Clearly tf (1) = tf (3) = tf (4) = 6r + 3 and tf (2) = 6r + 4.

Subcase 2. r is odd.
As in subcase(2) of case 1, assign the label to the vertices u, ui (1 ≤ i ≤ n − 3) and vi (1 ≤ i ≤ n − 3). Finally we assign the labels 3, 2, 1, 4, 4, to the vertices u4r−2, u4r−1, u4r , v4r−2, v4r−1 and v4r respectively. It is easy to verify that tf (1) = tf (2) = tf (3) = 6r + 3 and tf (4) = 6r + 4.

Case 4. n ≡ 3 (mod 4).
Let n = 4r + 3, r > 1 and r ∈N.

Subcase 1. r is even.
As in subcase(1) of case 3, assign the label to the vertices u, ui (1 ≤ i ≤ n − 4) and vi (1 ≤ i ≤ n − 4). Finally we assign the labels 2, 3, 4, 3, 2, 3, 1, 4 respectively to the vertices u4r−3, u4r−2, u4r−1, u4r , v4r−3, v4r−2, v4r−1 and v4r . Here tf (1) = 6r + 4 and tf (2) = tf (3) = tf (4) = 6r + 5.

Subcase 2. r is odd.
As in subcase(2) of case 3, assign the label to the vertices u, ui (1 ≤ i ≤ n − 2) and vi (1 ≤ i ≤ n − 2). Finally we assign the labels 1, 3, 3, 2 to the vertices u4r−1, u4r , v4r−1 and v4r respectively. It is easy to verify that tf (1) = tf (2) = tf (3) = 6r + 5 and tf (4) = 6r + 4.

Case 5.n = 3.
Suppose f is a 4-total prime cordial labeling of Fl3, then any one of the following types occur:
Type 1: tf (1) = tf (2) = tf (3) = 5 and tf (4) = 4.
Type 2: tf (2) = tf (3) = tf (4) = 5 and tf (1) = 4.
Type 3: tf (1) = tf (3) = tf (4) = 5 and tf (2) = 4.
Type 4: tf (1) = tf (2) = tf (4) = 5 and tf (3) = 4.

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Subcase 1.
For this, it is easy to verify that 4 must be labeled to 3 consecutive vertices of F L3. That is, 4 must be labeled to all the three vertices of an induced subpath P3 v1uu2 of Fl3. Similarly for tf (3) = 5, 3 must be labeled to all the three vertices of another induced subpath P3′ v3u3u1 of Fl3 which is disjoint from P3. Now we have only one vertex remaining in Fl3. If this vertex is labeled by 2, then tf (2) > 4, a contradiction to Type 3.

Subcase 2.
For Type 2, the proof is symmetry to subcase 1.

Subcase 3.
For this, it is easy to verify that 4 must be labeled to 3 consecutive vertices of Fl3. That is, 4 must be labeled to all the three vertices of an induced subpath P3 v1uu2 of Fl3. Similarly for tf (3) = 4, 3 must be labeled to all the two vertices of another induced subpath P2 u3u1 of Fl3 which is disjoint from P3. Now we have only two vertices remaining in Fl3. If any one of the vertex are labeled by 3 which is non-adjacent to the vertex labeled by 3. Now we have only one vertex remaining in Fl3. If it is labeled by 2, then tf (2) < 5, a contradiction to Type 4.

Subcase 4.
For Type 1, the proof is symmetry to subcase 3.
Case 6. n = 4, 5, 6, 7.

***Table 1. A 4-total prime cordial labeling***

| n | 4 | 5 | 6 | 7 |
|---|---|---|---|---|
| u | 4 | 4 | 4 | 4 |
| u1 | 4 | 4 | 4 | 4 |
| u2 | 2 | 2 | 4 | 4 |
| u3 | 3 | 3 | 2 | 2 |
| u4 | 3 | 3 | 3 | 3 |
| u5 | | 3 | 3 | 3 |
| u6 | | | 3 | 3 |
| u7 | | | | 3 |
| v1 | 4 | 4 | 4 | 4 |
| v2 | 2 | 2 | 2 | 2 |
| v3 | 3 | 3 | 2 | 2 |
| v4 | 3 | 2 | 3 | 3 |
| v5 | | 4 | 3 | 4 |
| v6 | | | 1 | 3 |
| v7 | | | | 2 |

Theorem 3.2. The gear graph Gn is 4-total prime cordial iff n ≠ 3.

Proof.LetCnbe the cycleu1u2. . . unu1. Letube the central vertex ofthe cycle Cn. Let vi be the vertex subdivide the edge in the cycle Cn. Clearly |V (Gn)| + |E(Gn)| = 5n + 1.
Case 1. n ≡ 0 (mod 4).
Let n = 4r, r > 1 and r ∈N.

Subcase 1. r is even.

Assign the label 4 to the central vertex u. Next assign the label 4 to the vertex u1, u2, . . . , ur and assign 2 to the vertices ur+1, ur+2, . . . , u2r then we assign the label 3 to the vertices u2r+1, u2r+2, . . . , u7r/2 . Finally we assign the label 1 to the vertices u7r/2+1, . . . , u4r . Now we consider the vertices vi ($1 \le i \le n$). Assign the label 4 to the vertices v1, v2, . . . , vr and assign 2 to the vertices vr+1, vr+2, . . . , v2r then we assign the label 3 to the vertices v2r+1, v2r+2, . . . , v3r+1. Finally we assign the label 1 to the vertices v3r+2, v3r+3, . . . , v4r . Here tf (1) = tf (2) = tf (4) = 5r and tf (3) = 5r + 1.

Subcase 2. r is odd.

Assign the label 4 to the central vertex u. Next assign the label 4 to the vertex u1, u2, . . . , ur and assign 2 to the vertices ur+1, ur+2, . . . , u2r then we assign the label 3 to the vertices u2r+1, u2r+2, . . . , u 7r-1/2. Finally we assign the label 1 to the vertices u 7r-1/2+1 , . . . , u4r . Now we consider the vertices vi ($1 \le i \le n$). Assign the label 4 to the vertices v1, v2, . . . , vr and assign 2 to the vertices vr+1, vr+2, . . . , v2r then we assign the label 3 to the vertices v2r+1, v2r+2, . . . , v3r+1. Finally we assign the label 1 to the vertices v3r+2, v3r+3, . . . , v4r . Clearly tf (1) = 5r + 1 and tf (2) = tf (3) = tf (4) = 5r.

Case 2. $n \equiv 1 \pmod 4$.

Let n = 4r + 1, r > 1 and r ∈N.

Subcase 1. r is even.

As in subcase(1) of case 1, assign the label to the vertices u, ui ($1 \le i \le n-1$) and vi ($1 \le i \le n-2$). Finally we assign the labels 3, 2, 4 to the vertices u4r , v4r−1 and v4r respectively. Clearly tf (1) = tf (2) = 5r + 1 and tf (3) = tf (4) = 5r + 2.

Subcase 2. r is odd.

As in subcase(2) of case 1, assign the label to the vertices u, ui ($1 \le i \le n-1$) and vi ($1 \le i \le n-2$). Finally we assign the labels 3, 2, 4 to the vertices u4r , v4r−1 and v4r respectively. Obviously tf (1) = tf (4) = 5r+2 and tf (2) = tf (3) = 5r + 1.

Case 3. $n \equiv 2 \pmod 4$.

Let n = 4r + 2, r > 1 and r ∈N.

Subcase 1. r is even.

Assign the label to the vertices u, ui ($1 \le i \le n - 2$) and vi ($1 \le i \le n - 3$) by subcase(1) of case 1. Finally we assign the labels 1, 2, 3, 3, 4 respectively to the vertices u4r−1, u4r , v4r−2, v4r−1 and v4r . Clearly tf (1) = tf (2) = tf (3) = 5r + 3 and tf (4) = 5r + 2.

Subcase 2. r is odd.

Assign the label to the vertices u, ui ($1 \le i \le n - 2$) and vi ($1 \le i \le n - 3$) by subcase(2) of case 1. Finally we assign the labels 2, 3, 4, 3, 4 to the vertices u4r−1, u4r , v4r−2, v4r−1 and v4r respectively. It is easy to verify that tf (1) = 5r + 2 and tf (2) = tf (3) = tf (4) = 5r + 3.

Case 4. $n \equiv 3 \pmod 4$.

Let n = 4r + 3, r > 1 and r ∈N.

Subcase 1. r is even.

As in subcase(1) of case 2, assign the label to the vertices u, ui ($1 \le i \le n - 3$) and vi ($1 \le i \le n - 4$). Finally we assign the labels 4, 3, 2, 4, 3, 2, 1 respectively to the vertices u4r−2, u4r−1, u4r , v4r−3, v4r−2, v4r−1 and v4r . Clearly tf (1) = tf (2) = tf (3) = tf (4) = 5r + 4.

Subcase 2. r is odd.

As in subcase(2) of case 2, assign the label to the vertices u, ui ($1 \le i \le n-3$) and vi ($1 \le i \le n-3$). Finally we assign the labels 2, 4, 3, 3, 4, 3 to the vertices u4r−2, u4r−1, u4r , v4r−2, v4r−1 and v4r respectively. It is easy to verify that tf (1) = tf (2) = tf (3) = tf (4) = 5r + 4.

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Case 5. n = 3.
Suppose f is a 4-total prime cordial labeling of G3, then tf (1) = tf (2) = tf (3) = tf (4) = 4.

Subcase 1.
4 is the labels of the central vertex u. Suppose 4 is label of the adjacent rim vertices, then tf (4) > 4, a contradiction.

Subcase 1(a).
4 is the labels of the central vertex u. Suppose 4 is label of the non-adjacent rim vertices, then tf (4) = 4, tf (3) < 4 and tf (2) > 4, a contradiction.

Subcase 2.
In this case, we get the label tf (4) = 4. Suppose 4 is label of the consecutive rim vertices, then tf (4) > 4, a contradiction.

Subcase 2(a).
Suppose 4 is label to the not consecutive rim vertices, then tf (4) < 4, tf (3) < 4 and tf (1) > 4, a contradiction.

Subcase 2(b).
Suppose 4 is label to the non-adjacent rim vertices, then tf (2) < 4 and tf (1) > 4, a contradiction.
Case 6. n = 4, 5, 6, 7.

***Table 2. A 4-total prime cordial labeling***

| n | 4 | 5 | 6 | 7 |
|---|---|---|---|---|
| u | 4 | 4 | 4 | 4 |
| u1 | 4 | 4 | 4 | 4 |
| u2 | 2 | 2 | 4 | 4 |
| u3 | 3 | 4 | 2 | 2 |
| u4 | 3 | 3 | 3 | 3 |
| u5 | | 3 | 3 | 3 |
| u6 | | | 1 | 3 |
| u7 | | | | 2 |
| v1 | 4 | 4 | 4 | 4 |
| v2 | 2 | 2 | 2 | 2 |
| v3 | 3 | 3 | 2 | 2 |
| v4 | 1 | 3 | 3 | 4 |
| v5 | | 1 | 3 | 3 |
| v6 | | | 3 | 3 |
| v7 | | | | 1 |

Theorem 3.3. The corona of ITn with K1, ITn⊙ K1 is 4-total prime cordial for all n ≥ 4.

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Proof.LetPnbe the pathu1u2. . . un. Letvibe the vertex which isadjacent to both ui and ui+2 ($1 \leq i \leq n-2$). Let xi be the pendent vertices adjacent to ui ($1 \leq i \leq n$). Let yi be the pendent vertices adjacent to vi ($1 \leq i \leq n-2$). It is easy to verift that |V (I Tn⨀ K1)| +|E(I Tn⨀K1)| = 9n − 11.

Case 1. n ≡ 0 (mod 4).
Let n = 4r, r > 1 and r ∈N. Assign the label 4 to the vertices u1, u2, . . . , ur and assign the label 2 to the vertices ur+1, ur+2, . . . , u2r . Next we assign the label 3 to the vertices u2r+1, u2r+2, . . . , u3r then we assign 1 to the vertices u3r+1, u3r+2, . . . , u4r−2. Finally we assign the labels 4, 3 to the vertices u4r−1 and u4r respectively. Next we consider the vertices vi ($1 \leq i \leq n-2$). Assign the label 4 to the vertices
v1, v2, . . . , vr and assign the label 2 to the vertices vr+1, vr+2, . . . , v2r−1 and we assign the label 3 to the vertices v2r , v2r+1, . . . , v3r−1. Finally we assign the label 1 to the vertices v3r , v3r+1, . . . , v4r−2. Now we move to the vertices xi ($1 \leq i \leq n$). Assign the label 4 to the vertices x1, x2, . . . , xr and assign the label 2 to the vertices xr+1, xr+2, . . . , x2r . Next we assign the label 3 to the vertices x2r+1, x2r+2, . . . , x3r then we assign 1 to the vertices x3r+1, x3r+2, . . . , x4r−2. Finally we assign the labels 3, 2 to the vertices x4r−1 and x4r respectively. Next we consider the vertices yi ($1 \leq i \leq n-2$). Assign the label 4 to the vertices y1, y2, . . . , yr and assign the label 2 to the vertices yr+1, yr+2, . . . , y2r−1 and we assign the label 3 to the vertices y2r , y2r+1, . . . , y3r−2. Finally we assign the label 1 to the vertices y3r−1, y3r , . . . , y4r−2. Clearly tf (1) = tf (2) = tf (3) = 9r − 3 and tf (4) = 9r − 2.

Case 2. n ≡ 1 (mod 4).
Let n = 4r + 1, r > 1 and r ∈N. As in case 1, assign the label to the vertices ui ($1 \leq i \leq n-1$), vi ($1 \leq i \leq n-3$), xi ($1 \leq i \leq n-1$) and yi ($1 \leq i \leq n-3$). Finally we assign the labels 3, 2, 4, 4 respectively to the vertices u4r , v4r−2, x4r and y4r−2 respectively. Here tf (1) = tf (3) = 9r − 1 and tf (2) = tf (4) = 9r.

Case 3. n ≡ 2 (mod 4).
Let n = 4r + 2, r > 1 and r ∈N. As in case 2, assign the label to the vertices
ui ($1 \leq i \leq n-1$), vi ($1 \leq i \leq n-3$), xi ($1 \leq i \leq n-1$) and yi ($1 \leq i \leq n-3$). Finally we assign the labels 3, 2, 4, 4 respectively to the vertices u4r , v4r−2, x4r and y4r−2 respectively. It is easy to verify that tf (1) = tf (2) = tf (4) = 9r + 2 and tf (3) = 9r + 1.

Case 4. n ≡ 4 (mod 4).
Let n = 4r + 3, r > 1 and r ∈N. As in case 3, assign the label to the vertices ui ($1 \leq i \leq n-1$), vi ($1 \leq i \leq n-3$), xi ($1 \leq i \leq n-2$) and yi ($1 \leq i \leq n-3$). Finally we assign the labels 4, 4, 3, 2, 3 respectively to the vertices u4r , v4r−2, x4r−1, x4r and y4r−2 respectively. Here tf (1) = tf (2) = tf (3) = tf (4) = 9r + 4.
Case 5. n = 4, 5, 6, 7.

***Table3. A 4-total prime cordial labeling***

| n | 4 | 5 | 6 | 7 |
|---|---|---|---|---|
| u1 | 4 | 4 | 4 | 4 |
| u2 | 2 | 4 | 4 | 4 |
| u3 | 3 | 2 | 2 | 2 |
| u4 | 3 | 3 | 3 | 2 |
| u5 | | 3 | 3 | 3 |
| u6 | | | 3 | 3 |
| u7 | | | | 1 |
| v1 | 4 | 4 | 4 | 4 |
| v2 | 2 | 2 | 2 | 4 |
| v3 | | 1 | 1 | 3 |
| v4 | | | 1 | 3 |

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|---|---|---|---|---|
| v5 | | | | 1 |
| x1 | 4 | 4 | 4 | 4 |
| x2 | 2 | 2 | 4 | 4 |
| x3 | 3 | 2 | 2 | 2 |
| x4 | 1 | 3 | 3 | 2 |
| x5 | | 3 | 3 | 3 |
| x6 | | | 3 | 3 |
| x7 | | | | 1 |
| y1 | 4 | 4 | 4 | 4 |
| y2 | 3 | 3 | 2 | 2 |
| y3 | | 1 | 2 | 2 |
| y4 | | | 1 | 3 |
| y5 | | | | 1 |

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