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Cordially Divisor Rhombus Grid Graph

P. Mugindhar Amarnath[1], R. Anitha[2]
[1]*M.Phil. Scholar, Dept. of Mathematics, Ponnaiyah Ramajayam Inst. of Science and Tech., Thanjavur, India*
[2]*Assistant Professor, Dept. of Mathematics, Ponnaiyah Ramajayam Inst. of Science and Tech., Thanjavur, India*

***Abstract*: In this paper, we introduce some album grid divisor cordial graphs. Further, we investigate the graphs obtained by the identification of some vertices of a divisor cordial graphs to certain rhombus grid graphs are divisor cordial.**

***Keywords*: Divisor Cordial graph, Vertices, edges, album.**

1. Introduction

Number Theory is a fascinating subject in mathematics. It has so many interesting concepts. The concepts of primality and divisibility play an important role in Number Theory.
Definition 1.

Let $G = (V, E)$ be the function of $f{:}v$ is denoted by the set $\{0,1\}$ with an each edge xy, is ascribed by the label 1 if f(x) divides f(y) or f(y) divides f(x) and 0 or other else, then the edges are labeled with 0 and 1 differ by at most 1 [1].

For each edge xy, assign the label 1 if either $[f\ (x)]^2|f\ (y)$ or $[f\ (y)]^2|f\ (x)$ and the label 0 otherwise. f is called a rectangular divisor cordial labeling if $|e_c(0) - e_c(1)| \leq 1$. A graph with a rhombus divisor cordial labeling is called a *rhombus divisor cordial graph*.

Definition: 1.1
One edge union of cycles having same length is called a notebook. By common, the edge is said to be the base of the notebook. If we assume t copies of cycles of length m then the notebook is denoted by $R_m^{(t}$. Note that $R_m^{(t)}$ has $(m - 2)$t + 2 vertices and $(m - 1) + 1$ edges.

Theorem: 1.2
Let P be the rhombus grid pages is divisor cordial.
Proof:
Let R be the rhombus grid. Note that it has 2t +2 vertices and 3t +1 edges. Label the vertices of common edge by 1 and 2. Then label the vertices of the edges which are parallel to common edge as given below.
Example: 1.3
Let us consider the rhombus grid. Note that it has 6 vertices and 7 edges.
Here, we have $e_f(0)$ = 3 and
$e_f(1)$= 4.

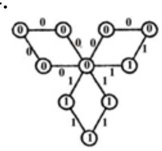

Fig. 1. Rhombus grid

In the first page, label the numbers 4 and 3, second page 5 and 6, Since 1 divides all the integers it contributes t+1 to $e_f(1)$, 2 divides all the even integers it contributes $\frac{t}{2}$ to each $e_f(0)$ and $e_f(1)$.
When t is even,

$$e_f(0)= \frac{t+1}{2} \text{ and}$$
$$e_f(1)= \frac{t-1}{2}.$$

When t is odd, $m \neq m+1$ for any integer $m > 1$, the parallel edges are assinged t to $e_f(0)$.
Consequently,
Case (1) if t is even,

$$e_f(0)= \frac{3t}{2} \text{and}$$
$$e_f(1)= \frac{3t}{2} + 1 \text{ and}$$

Case (2) if t is odd, then

$$e_f(0) = \frac{3t+1}{2} \text{ and}$$
$$e_f(1)= \frac{3t+1}{2}$$

Thus, $|e_f(0) - e_f(1)| \leq 1$. As a consequence, R shows divisor cordial.

*Corollary:*1.4
A rhombus grid with even number is divisor dominated cordial but not strict.
Proof:
The rhombus grid N is divisor dominated cordial graph. If we interchange the labels of second page, then N becomes non divisor dominated cordial.

Theorem: 1.5.
Let G be a divisor cordial graph and R be the rhombus grid. Then G_R* R is divisor cordial.
Proof:
Let us assume G is a divisor cordial graph of order p and size q and the vertices labeled 1 and 2 are not adjacent. Here, f^* be the divisor.

Let R be a rhombus grid labeled at f_R . Now identify the vertices labeled 1 and 2 in G to the vertices of common edge of R. We already proved that $G_N *R$ be the divisor cordial. Let f be the labeling of $G_N *R$.
Case (i): if p is even.
Since G is divisor cordial, we have $e_{f^*}(0) = e_{f^*}(1)= \frac{t}{2}$.

Case (ii): if t is even, the vertices of the parallel edges in R to edge of the vertices are labeled 1 and 2 as follows.
If n is even,

$e_f(0) = \frac{m}{2} + \frac{3t}{2}$ and

$e_f(1) = \frac{m}{2} + \frac{3t}{2} + 1.$

If t is odd, divisor dominated cordial which implies

$e_{f^*}(0) = \frac{m+1}{2}$ and

$e_{f^*}(1) = \frac{m+1}{2}$

In all cases, $|e_f(0) - e_f(1)| \leq 1$. So, $G_N *$R.is divisor cordially.

Example: 1.6
Consider the following divisor cordial graph G
It has even order and even size. Note that the vertices labeled 1 and 2 are not adjacent.
Now, we shall connected with the album P with rectangular pages to G
Here, we see that $e_f(0) = 4$ and $e_f(1) = 4$
This example illustrates the subcase(a) of Case (i) for even order of G.
Next, we shall explain the subcase (a) of Case (ii) by the following example.

Example .1.7.
Consider the following divisor cordial graph G of odd size.
Here, m = 5 and n = 4 and $e_f(0) = 2$ and $e_f(1) = 3$
Then rhombus grid is attached with pages as given below.

Here, we see that $e_f(0) = 4$ and $e_f(1) = 5$

Theorem .1.8.
Let G be a divisor cordial graph and R be a rhombus grid and let e be the common edge of R. Then G $*$G (R− e) is divisor cordial.
Proof:
Here the vertices labeled 1 and 2 in G are adjacent.
Case (i): (a) if m is even. t is even.
Here $e_f(0) = e_f(0) = \frac{m}{2} + \frac{3t}{2}$.
(b)if m *is* even, *t* is odd
Here $e_f(0) = \frac{m}{2} + \frac{3t}{2}$ and $e_f(0) = \frac{m}{2} + \frac{3t}{2}$.
Case (ii): (a) if *m* is odd, *t* is even.
Here $|e_f(0) - e_f(1))| \leq 1$.
(b): *m* is odd, *t* is odd.
From this, we were interchanging the labels of the vertices of R.
Then, we have $|e_f(0) - e_f(1)| \leq 1$.
Thus, in all the cases we see that $G *_G (R - e)$ is divisor cordial.

2. Conclusion

The rhombus grid divisor cordial graphs are discussed and also, we can prove that the graphs obtained by the identification of some vertices of a divisor cordial graphs to certain rhombus grid graphs are divisor cordial.

References

[1] D. M. Burton, "Elementary Number Theory," Second Edition, Wm. C. Brown Company Publishers, 1980.