Asian Research Journal of Mathematics

Volume 18, Issue 12, Page 16-26, 2022; Article no.ARJOM.94077
ISSN: 2456-477X

Rings Domination Number of Some Mycielski Graphs

Marvanessa G. Dinorog [a*]
and Isagani S. Cabahug, Jr. [a]

[a] *Mathematics Department, College of Arts and Sciences, Central Mindanao University, Musuan, Maramag, Bukidnon, Philippines.*

Authors' contributions

This work was carried out in collaboration between both authors. Both authors read and approved the final manuscript.

Article Information

DOI: 10.9734/ARJOM/2022/v18i12621

Open Peer Review History:
This journal follows the Advanced Open Peer Review policy. Identity of the Reviewers, Editor(s) and additional Reviewers, peer review comments, different versions of the manuscript, comments of the editors, etc are available here: https://www.sdiarticle5.com/review-history/94077

Received: 23/09/2022
Accepted: 27/11/2022
Published: 03/12/2022

Original Research Article

Abstract

A set S of a graph $G = (V(G), E(G))$ is a rings dominating set if S is a dominating set and for every vertex in the complement of S has atleast two adjacent vertices. The caridinality of the minimum rings dominating set is the rings domination number of graph G, denoted by $\gamma_{ri}(G)$. In this paper we determine the exact rings domination number of the mycielski graphs of path graph, cycle graph, and crown graph including its parameter.

Keywords: Rings domination; rings domination number; Mycielski graph.

2020 Mathematics Subject Classification: 05C35.

**Corresponding author: E-mail: s.dinorog.marvanessa@cmu.edu.ph*

1 Introduction

Domination is one of the fundamental concepts used as an active tool in graph theory. The initiation of a new parameter in domination in graphs called ”rings domination number” has been of great interest among mathematicians [1, 2, 3, 4, 5] . It was Abed and Al-Harere in [6] who first presented the notion of rings domination which put a condition to a set $V(G) - S$. The rings dominating set of G, where G is a nontrivial connected graph with no isolated vertex, is defined as, a non-empty subset $S \subseteq V(G)$ such that S is a dominating set and every vertex $v \in V(G) - S$ has atleast two adjacent vertices in $V(G) - S$.

On one hand, Jan Mycielski in 1955 showed that there exist a triangle-free graphs with arbitrarily large chromatic number. Mycielski [7] introduced the graph-transformations as follows. Let G be a traingle-free graph. For each $v_i \in V(G)$, add a vertex v_i' to U adjacent to the same vertices of G that v_i is adjacent to. Finally, add a vertex w adjacent to each v_i' [8].

In this paper, we investigate the rings domination number of the Mycielski graph of path graphs, cycle graphs, and crown graphs. For basic graph theory terminologies not specifically defined in this paper, please refer to either [9] or [6].

2 Preliminary Notes

This section contains some of the fundamental concepts necessary for the understanding of the study.

Definition 2.1. [10] (**Crown Graph**) A crown graph $G(n, n)$ is a graph on $2n$ vertices with two sets of vertices u_i and v_j and with an edge from u_i to v_j whenever $i \neq j$.

Example 2.1. *The graph in Fig. 1 can be partitioned into two partite sets, U and V. Pick the vertex u_1. Then, u_1 is adjacent to the vertices v_2, v_3, and v_4, except to the vertex v_1. Hence, it is therefore equivalent to the complete bipartite graph $K_{(n,n)}$ without the horizontal edges.*

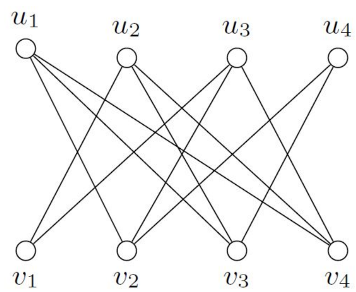

Fig. 1. The crown graph of G(4,4)

Definition 2.2. [11] (**Mycielski Graph**) Consider a graph G with $V(G) = \{v_1, v_2, v_3, ..., v_n\}$. Apply the following steps to the graph G:

(i) Take the set of new vertices $U = \{u_1, u_2, u_3, ..., u_n\}$ and add edges from each vertex u_i of U to the vertices v_j if the corresponding vertex v_i is adjacent to v_j in G.

(ii) Take another new vertex w_0 and add edges joining each element in U.

Here, the new graph obtained is the Mycielski graph, denoted by $\mu(G)$ of graph G.

Example 2.2. *The graph G in Fig. 2 is a path graph P_3. By (i), we take a new vertex set U that has the same cardinality of G. By (ii), we add a new vertex, w_0.*

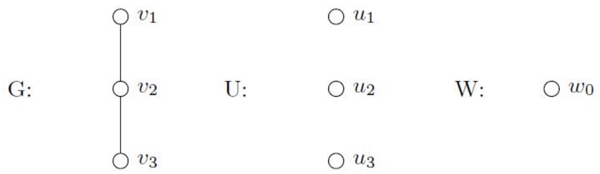

Fig. 2. The Mycielski construction of path graph $\mathbf{P}_3$

By definition 2.2, we obtained the Mycielski graph of path graph $\mu(P_3)$ illustrated in Figure 3 below. Observe that we add the edges from each vertex $u_i \in U$ to the vertices v_j to the corresponding vertex v_i adjacent to v_j in G. Finally, we add an edge joining each $u_i \in U$ and the vertex w_0.

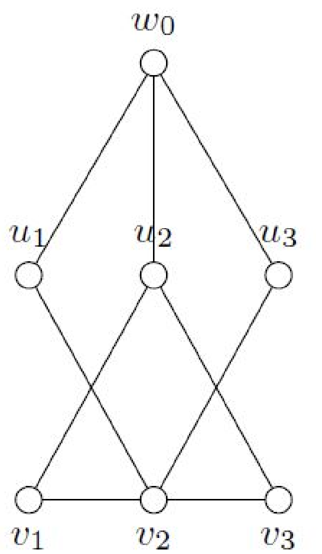

Fig. 3. The Mycielski graph of $\mu(P_3)$

Definition 2.3. [6] (**Rings Dominating Set, Rings Domination Number**) Let $G = (V(G), E(G))$ be a nontrivial connected graph with no isolated vertex. A non-empty set $S \subseteq V(G)$ is rings dominating set of graph G if, S is a dominating set and for every $v \in V(G) - S$ has atleast two adjacent vertices in $V(G) - S$. The cardinality of a minimum rings dominating set of G is the rings domination number of G, denoted by $\gamma_{ri}(G)$. A set $S_0 \subseteq V(G)$, where $\mid S_0 \mid = \gamma_{ri}(G)$ is called the γ_{ri}-set of G.

Example 2.3. *Consider the graph G in Fig. 4 below. Take the set $S = \{u_{13}\}$. Clearly, the set S is a dominating set. Moreover, every vertex in $V(G) - S$, $deg(u_1) = deg(u_2) = deg(u_3) = deg(u_4) = 4$ and $deg(u_5) = deg(u_6) = deg(u_7) = deg(u_8) = deg(u_9) = deg(u_{10}) = deg(u_{11}) = deg(u_{13}) = 2$, has atleast two adjacent vertices in $V(G) - S$. Obviously, S is a minimum rings dominating set of graph G. Hence, the rings domination number of G is $\gamma_{ri}(G) = 1$.*

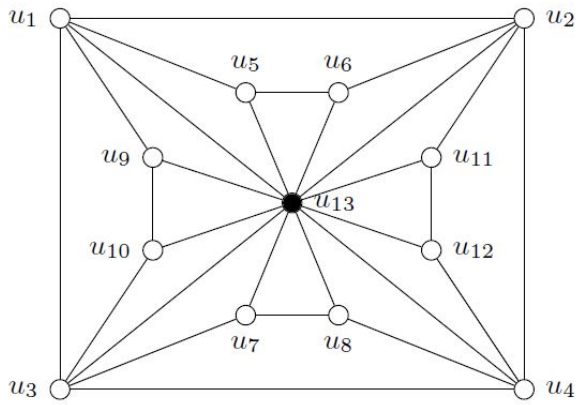

Fig. 4. The graph G

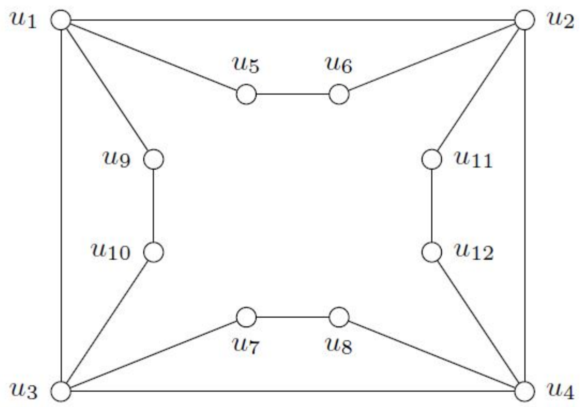

Fig. 5. The subgraph S of graph G

3 Main Results

In this section, the rings domination number of Mycielski graph of path graph, cycle graph, and crown graph are shown. As well as, the parameter of a rings domination number of the mentioned graphs.

3.1 Rings domination number of the mycielski graph of path graph, $\mu(P_n)$

For convenience, we consider the path graph P_n of order $n \geq 4$ with vertex set $V(P_n) = \{v_1, v_2, ..., v_n\}$. The following shows the parameter of the rings domination number of the mycielki graph of path graph via modulus.

Theorem 3.1. *Let P_n be a path graph with $n \geq 4$. Then,*

$$\gamma_{ri}(\mu(P_n)) = \begin{cases} \frac{n+4}{2}, & if \quad n \equiv 0 (mod\ 4) \\ \frac{n+5}{2}, & if \quad n \equiv 1 (mod\ 4) \ or\ n \equiv 3 (mod\ 4) \\ \frac{n+6}{2}, & if \quad n \equiv 2 (mod\ 4) \end{cases}$$

Proof: Let $V(\mu(P_n)) = V(P_n) \cup U \cup W$, where $V(P_n) = \{v_1, v_2, ..., v_n\}$, $U = \{u_1, u_2, ..., u_n\}$, and $W = \{w_0\}$. Suppose S is a γ_{ri}-set. Consider the following cases.

Case 1: $n \equiv 0 \pmod 4$

Choose $R = \{v_1, v_5, v_9, ..., v_{n-3}\} \cup \{v_4, v_8, ..., v_n\} \cup \{u_1, u_n\}$. Clearly, R is a rings dominating set. Since S is a γ_{ri}-set, $|R| \geq |S|$. Thus, $|R| = \frac{n}{2} + 2 \geq |S|$. On the other hand, since S is a γ_{ri}-set, then S must have atleast $\frac{n}{2} + 2$ vertices in $\mu(P_n)$. Thus, $|S| \geq \frac{n}{2} + 2$. Therefore, $\gamma_{ri}(\mu(P_n)) = |S| = \frac{n}{2} + 2 = \frac{n+4}{2}$.

Case 2: $n \equiv 1 \pmod 4$ or $n \equiv 3 \pmod 4$

For $n \equiv 1 \pmod 4$. Choose $R = \{v_1, v_5, v_9, ..., v_n\} \cup \{v_4, v_8, ..., v_{n-1}\} \cup \{u_1, u_n\}$. Clearly, R is a rings dominating set. Since S is a γ_{ri}-set, $|R| \geq |S|$. Thus, $|R| = \frac{2n+2}{4} + 2 \geq |S|$. On the other hand, since S is a γ_{ri}-set, then S must have atleast $\frac{2n+2}{4}+2$ vertices in $\mu(P_n)$. Thus, $|S| \geq \frac{2n+2}{4}+2$. Therefore, $\gamma_{ri}(\mu(P_n)) = |S| = \frac{2n+2}{4}+2 = \frac{n+5}{2}$.

Similarly for $n \equiv 3 \pmod 4$ by letting $R = \{v_1, v_5, v_9, ..., v_n\} \cup \{v_4, v_8, ..., v_{n-3}\} \cup \{u_1, u_n\}$.

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

Choose $R = \{v_1, v_5, v_9, ..., v_{n-1}\} \cup \{v_2, v_6, ..., v_n\} \cup \{u_1, u_n\}$. Clearly, R is a rings dominating set. Since S is a γ_{ri}-set, $|R| \geq |S|$. Thus, $|R| = \frac{2n+2}{4} + 2 \geq |S|$. On the other hand, since S is a γ_{ri}-set, then S must have atleast $\frac{2n+4}{4} + 2$ vertices in $\mu(P_n)$. Thus, $|S| \geq \frac{2n+4}{4} + 2$. Therefore, $\gamma_{ri}(\mu(P_n)) = |S| = \frac{2n+4}{4} + 2 = \frac{n+6}{2}$. □

Example 3.2. *Consider the Mycielski graph of path graph $\mu(P_4)$ in Figure 6. It can be seen that if we let $S \subseteq V(\mu(P_4))$, where $S = \{v_1, v_4, u_1, u_2\}$, then clearly, S is a dominating set of the mycielski graph of $\mu(P_4)$. Moreover, every vertex in $V(\mu(P_4)) - S = \{v_2, v_3, u_2, u_3, w_0\}$ has atleast two adjacent vertices in $V(\mu(P_4)) - S$. Observe that the set S has the smallest cardinality of all the rings dominating set in $\mu(P_4)$. Hence, the rings domination number of $\mu(P_4)$ is $\gamma_{ri}(\mu(P_4)) = 4$.*

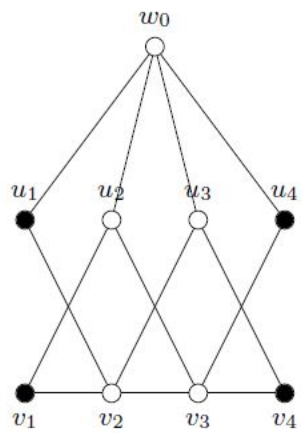

Fig. 6. The Mycielski graph of $\mu(P_4)$ and its rings dominating set $S = \{v_1, v_4, u_1, u_2\}$

Example 3.3. *Consider the Mycielski graph of path graph $\mu(P_5)$ in Figure 7. It can be seen that if we let $S \subseteq V(\mu(P_5))$, where $S = \{v_1, v_4, v_5, u_1, u_5\}$, then clearly, S is a dominating set of the mycielski graph of $\mu(P_5)$. Moreover, every vertex in $V(\mu(P_5)) - S = \{v_2, v_3, u_2, u_3, u_4, w_0\}$ has atleast two adjacent vertices in $V(\mu(P_5)) - S$. Observe that the set S has the smallest cardinality of all the rings dominating set in $\mu(P_5)$. Hence, the rings domination number of $\mu(P_5)$ is $\gamma_{ri}(\mu(P_5)) = 5$.*

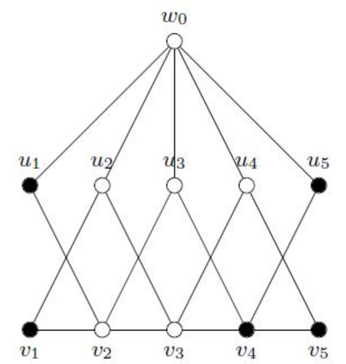

Fig. 7. The Mycielski graph of $\mu(P_5)$ and its rings dominating set $S = \{v_1, v_4, v_5, u_1, u_5\}$

Example 3.4. *Consider the Mycielski graph of path graph $\mu(P_7)$ in Figure 8. Let $S \subseteq V(\mu(P_7))$, where $S = \{v_1, v_4, v_7, u_1, u_4,$
$u_7, w_0\}$, then clearly, S is a dominating set of the mycielski graph of $\mu(P_7)$. Moreover, every vertex in $V(\mu(P_7)) - S = \{v_2, v_3, v_5, v_6, u_2, u_3, u_4, u_5, u_6, w_0\}$ has atleast two adjacent vertices in $V(\mu(P_7)) - S$. Observe that the set S has the smallest cardinality of all the rings dominating set in $\mu(P_7)$. Hence, the rings domination number of $\mu(P_7)$ is $\gamma_{ri}(\mu(P_7)) = 6$.*

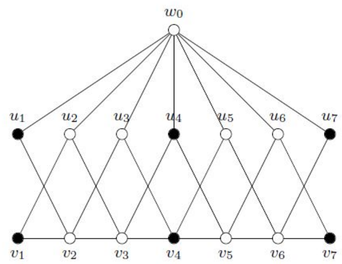

Fig. 8. The Mycielski graph of $\mu(P_7)$ and its rings dominating set $S = \{v_1, v_4, v_7, u_1, u_4, u_7\}$

Example 3.5. *Consider the Mycielski graph of path graph $\mu(P_6)$ in Figure 9. It can be seen that if we let $S \subseteq V(\mu(P_6))$, where $S = \{v_1, v_2, v_5, v_6, u_1, u_6\}$, then clearly, S is a dominating set of the mycielski graph of $\mu(P_6)$. Moreover, every vertex in $V(\mu(P_6)) - S = \{v_3, v_4, u_2, u_3, u_4, u_5, w_0\}$ has atleast two adjacent vertices in $V(\mu(P_6)) - S$. Observe that the set S has the smallest cardinality of all the rings dominating set in $\mu(P_6)$. Hence, the rings domination number of $\mu(P_6)$ is $\gamma_{ri}(\mu(P_6)) = 6$.*

3.2 Rings domination number of the mycielski graph of cycle graph, $\mu(C_n)$

For convenience, we consider the cycle graph C_n of order $n \geq 4$ with vertex set $V(C_n) = \{v_1, v_2, ..., v_n\}$. The following shows the parameter of a rings domination number of the mycielski graph of cycle graph via modulus.

Theorem 3.6. *Let C_n be a cycle graph with $n \geq 4$, then*

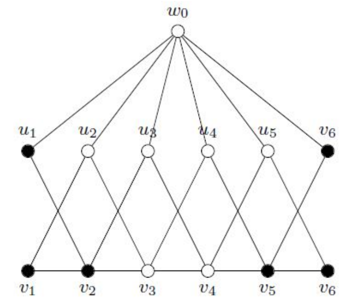

Fig. 9. The Mycielski Graph of $\mu(P_6)$ and its rings dominating set $S = \{v_1, v_2, v_5, v_6, u_1, u_6\}$

$$\gamma_{ri}(\mu(C_n)) = \begin{cases} \frac{n+2}{2}, & \text{if} \quad n \equiv 0(mod\ 4) \\ \frac{n+5}{2}, & \text{if} \quad n \equiv 1(mod\ 4) \\ \frac{n+2}{2}, & \text{if} \quad n \equiv 2(mod\ 4) \\ \frac{n+1}{2}, & \text{if} \quad n \equiv 3(mod\ 4) \end{cases}$$

Proof: Let $V(\mu(C_n)) = V(C_n) \cup U \cup W$, where $V(C_n) = \{v_1, v_2, ..., v_n\}$, $U = \{u_1, u_2, ..., u_n\}$, and $W = \{w_0\}$. Suppose S is a γ_{ri}-set. Consider the following cases.

Case 1: $n \equiv 0 \pmod 4$

Choose $R = \{v_1, v_5, v_9, ..., v_n\} \cup \{v_4, v_8, ..., v_{n-3}\} \cup \{u_1\}$. Clearly, R is a rings dominating set. Since S is a γ_{ri}-set, $|R| \geq |S|$. Thus, $|R| = \frac{2n}{4} + 1 \geq |S|$. On the other hand, since S is a γ_{ri}-set, then S must have atleast $\frac{2n}{4} + 1$ vertices in $\mu(C_n)$. Thus, $|S| \geq \frac{2n}{4} + 1$. Therefore, $\gamma_{ri}(\mu(C_n)) = |S| = \frac{2n}{4} + 1 = \frac{n+2}{2}$.

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

Choose $R = \{v_1, v_5, v_9, ..., v_n\} \cup \{v_4, v_8, ..., v_{n-1}\} \cup \{u_1, u_n\}$. Clearly, R is a rings dominating set. Since S is a γ_{ri}-set, $|R| \geq |S|$. Thus, $|R| = \frac{2n+2}{4} + 2 \geq |S|$. On the other hand, since S is a γ_{ri}-set, then S must have atleast $\frac{2n+2}{4} + 2$ vertices in $\mu(C_n)$. Thus, $|S| \geq \frac{2n+2}{4} + 2$. Therefore, $\gamma_{ri}(\mu(C_n)) = |S| = \frac{2n+2}{4} + 2 = \frac{n+5}{2}$.

Case 3: $n \equiv 2 \pmod 4$
Choose $R = \{v_1, v_5, v_9, ..., v_{n-5}\} \cup \{v_4, v_8, ..., v_{n-3}\} \cup \{u_1, u_{n-3}\}$. Clearly, R is a rings dominating set. Since S is a γ_{ri}-set, $|R| \geq |S|$. Thus, $|R| = \frac{2n-4}{4} + 2 \geq |S|$. On the other hand, since S is a γ_{ri}-set, then S must have atleast $\frac{2n-4}{4} + 2$ vertices in $\mu(C_n)$. Thus, $|S| \geq \frac{2n-4}{4} + 2$. Therefore, $\gamma_{ri}(\mu(C_n)) = |S| = \frac{2n-4}{4} + 2 = \frac{n+2}{2}$.

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

Choose $R = \{v_1, v_5, v_9, ..., v_{n-2}\} \cup \{v_4, v_8, ..., v_{n-3}\} \cup \{u_1\}$. Clearly, R is a rings dominating set. Since S is a γ_{ri}-set, $|R| \geq |S|$. Thus, $|R| = \frac{2n-2}{4} + 1 \geq |S|$. On the other hand, since S is a γ_{ri}-set, then S must have atleast $\frac{2n-2}{4} + 1$ vertices in $\mu(C_n)$. Thus, $|S| \geq \frac{2n-2}{4} + 1$. Therefore, $\gamma_{ri}(\mu(C_n)) = |S| = \frac{2n-2}{4} + 1 = \frac{n+1}{2}$ □

Example 3.7. *Consider the Mycielski graph of cycle graph $\mu(C_4)$ in Figure 10. It can be seen that if we let $S \subseteq V(\mu(C_4))$, where $S = \{v_1, v_4, u_1\}$, then clearly, S is a dominating set of the mycielski graph of $\mu(C_4)$. Moreover, every vertex in $V(\mu(C_4)) - S = \{v_2, v_3, u_2, u_3, u_4, w_0\}$ has atleast two adjacent vertices in $V(\mu(C_4)) - S$. Observe that the set S has the smallest cardinality of all the rings dominating set in $\mu(C_4)$. Hence, the rings domination number of $\mu(C_4)$ is $\gamma_{ri}(\mu(C_4)) = 3$.*

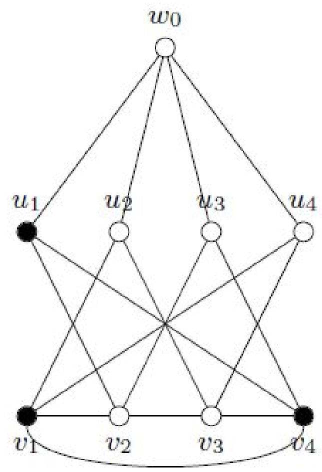

Fig. 10. The Mycielski Graph of $\mu(C_4)$ and its rings dominating set $S = \{v_1, v_4, u_1\}$

Example 3.8. *Consider the Mycielski graph of cycle graph $\mu(C_5)$ in Figure 11. It can be seen that if we let $S \subseteq V(\mu(C_5))$, where $S = \{v_1, v_4, v_5, u_1, u_5\}$, then clearly, S is a dominating set of the mycielski graph of $\mu(C_4)$. Moreover, every vertex in $V(\mu(C_5)) - S = \{v_2, v_3, u_2, u_3, u_4, w_0\}$ has atleast two adjacent vertices in $V(\mu(C_5)) - S$. Observe that the set S has the smallest cardinality of all the rings dominating set in $\mu(C_5)$. Hence, the rings domination number of $\mu(C_5)$ is $\gamma_{ri}(\mu(C_5)) = 5$.*

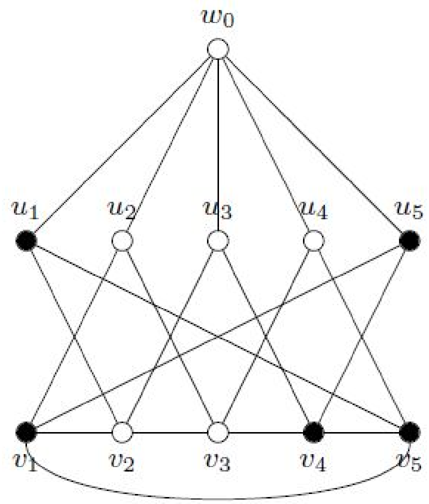

Fig. 11. The Mycielski Graph of $\mu(C_5)$ and its rings dominating set $S = \{v_1, v_4, v_5, u_1, u_5\}$

Example 3.9. *Consider the Mycielski graph of cycle graph $\mu(C_6)$ in Figure 12. It can be seen that if we let $S \subseteq V(\mu(C_6))$, where $S = \{v_1, v_4, u_1, u_4\}$, then clearly, S is a dominating set of the mycielski graph of $\mu(C_6)$. Moreover, every vertex in $V(\mu(C_6)) - S = \{v_2, v_3, v_5, v_6, u_2, u_3, u_5, u_6, w_0\}$ has atleast two adjacent vertices in*

$V(\mu(C_6)) - S$. Observe that the set S has the smallest cardinality of all the rings dominating set in $\mu(C_6)$. Hence, the rings domination number of $\mu(C_6)$ is $\gamma_{ri}(\mu(C_6)) = 4$.

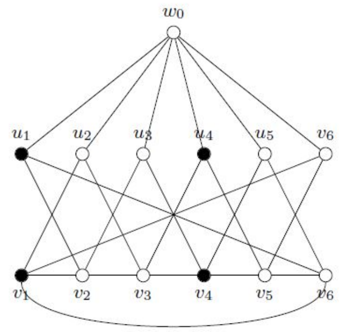

Fig. 12. The Mycielski Graph of $\mu(C_6)$ and its rings dominating set $S = \{v_1, v_4, u_1, u_4\}$

Example 3.10. *Consider the Mzycielski graph of cycle graph $\mu(C_7)$ in Figure 13. It can be seen that if we let $S \subseteq V(\mu(C_7))$, where $S = \{v_1, v_4, v_5, u_1\}$, then clearly, S is a dominating set of the mycielski graph of $\mu(C_7)$. Moreover, every vertex in $V(\mu(C_7)) - S = \{v_2, v_3, v_6, v_7, u_2, u_3, u_4, u_5, u_6, u_7, w_0\}$ has atleast two adjacent vertices in $V(\mu(C_7)) - S$. Observe that the set S has the smallest cardinality of all the rings dominating set in $\mu(C_7)$. Hence, the rings domination number of $\mu(C_7)$ is $\gamma_{ri}(\mu(C_7)) = 4$.*

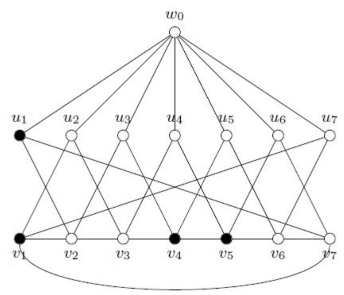

Fig. 13. The Mycielski Graph of $\mu(C_7)$ and its rings dominating set $S = \{v_1, v_4, v_5, u_1\}$

3.3 Rings domination number of the mycielski graph of crown graph, $G(n, n)$

For convenience, we consider the crown graph G of order $n \geq 4$. The following shows the parameter of a rings domination number of the mycielski graph of crown graph.

Proposition 3.1. *Let $G(n, n)$ be a crown graph with $n \geq 4$. Then, $\gamma_{ri}(\mu(G(n, n))) = 3$.*

Proof: Let $V(\mu(G(n, n))) = V(G(n, n)) \cup U \cup W$, where $V(G(n, n)) = \{u_1, u_2, ..., u_n\} \cup \{v_1, v_2, ..., v_n\}$, $U = \{u'_1, u'_2, ..., u'_n\} \cup \{v'_1, v'_2, ..., v'_n\}$, and $W = \{w_0\}$. Choose $R = \{u_1, v_1, w_0\} \subseteq V(\mu(G(n, n)))$. Clearly, R is a rings dominating set. Obviously, there can be no other rings dominating set smaller than R. Hence, $\gamma_{ri}(\mu(G(n, n))) = |R| = 3$. $\square$

Example 3.11. *Consider the Mycielski graph of crown graph $\mu(G(4,4))$ in Figure 14. It can be seen that if we let $S \subseteq V(\mu(G(4,4)))$, where $S = \{u_1, v_1, w_0\}$, then clearly, S is a dominating set of the mycielski graph of $\mu(G(4,4))$. Moreover, every vertex in $V(\mu(G(4,4))) - S$ has atleast two adjacent vertices in $V(\mu(G(4,4))) - S$. Observe that the set S has the smallest cardinality of all the rings dominating set in $\mu(G(4,4))$. Hence, the rings domination number of $\mu(G(4,4))$ is $\gamma_{ri}(\mu(G(4,4))) = 3$.*

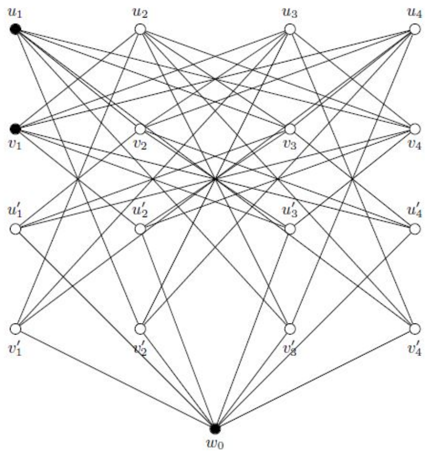

Fig. 14. The Mycielski graph of crown graph $\mu(G(4,4))$ and its rings dominating set $S = \{v_1, u_1, w_0\}$

4 Conclusion

In this article, the rings dominating set of the mycielski graph of path graph, cycle graph, and crown graph is observed. Furthermore, the parameter of the rings domination number of the mentioned graphs are determined.

Acknowledgment

The authors would like to thank the anonymous referees for helpful and valuable comments.

Competing Interests

The authors declare that they have no competing interests.

References

[1] Cabahug IS, Canoy SR. Independent dr-Power Dominating Sets in Graphs. Applied Mathematical Sciences. 2016;10(8):377-387.

[2] Cabahug IS, Canoy SR. Connected dr-Power Dominating Sets in Graphs. Advances and Applications in Discrete Mathematics. 2018;19(3):171-182.

[3] Consistente LF, Cabahug IS. Hinge Total Domination on Some Graph Families. Asian Research Journal of Mathematics. 2022;18(9):25-34.
Available: https://doi.org/10.9734/arjom/2022/v18i930404

[4] Mangubat DP, Cabahug IS. On the Restrained Cost Eective Sets of Some Special Classes of Graphs. Asian Research Journal of Mathematics. 2022;18(8):22-34.
Available:https://doi.org/10.9734/arjom/2022/v18i830395

[5] Tan KS, Cabahug IS. Safe Sets in Some Graph Families. Asian Research Journal of Mathematics. 2022;18:1-7.
DOI:10.9734/arjom/2022/v18i930399.

[6] Saja SA, Al-Harere MN. On Rings Domination in Graphs. International Journal of Mathematics and Computer Science. 2022;17(3):1313–1319.

[7] Chang GJ, Huang L, Zhu X. Circular chromatic numbers of Mycielski's graphs. Discrete Math. 1999;205:23–37.
DOI:10.1016/S0012-365X(99)00033-3.

[8] Kocay W, Kreher D. Graphs, Algorithms, and Optimization. Second edition; 2017.

[9] Chartrand G, Lesniak L, Zhang P. Graphs and Digraphs (Discrete Mathematics and Its Applications). (6th ed.), Chapman and Hall/CRC; 2015.

[10] Militante MP. Weakly Connected 2-Domination and Restrained Weakly Connceted 2-Domination in Some Grpah Families and Graph Products with Some Applications and Illustrations of the Concepts. Central Mindanao University, Maramag, Bukidnon, Philippines; 2022.

[11] Chithra KP, Sudev NK, Satheesh S, et al. On Certain Colouring Parameters of Mycielski Graphs of Some Graphs; 2017.

Peer-review history:
The peer review history for this paper can be accessed here (Please copy paste the total link in your browser address bar)
https://www.sdiarticle5.com/review-history/94077