Notice for the PhD Viva-Voce Examination

Ms Agnes Poovathingal (Registration Number: 1981504), PhD Scholar at the School of Sciences, CHRIST (Deemed to be University), Bangalore will defend her PhD thesis at the public viva-voce examination on Thursday, 27 February 2025 at 10.30 am in Room No. 044, Ground Floor, R & D Block, CHRIST (Deemed to be University), Bengaluru - 560029, Karnataka, India.

Title of the Thesis	:	**Perfect Italian Domination**
Discipline	:	**Mathematics**
External Examiner - I	:	**Dr R Sundara Rajan** Professor Department of Mathematics Hindustan Institute of Technology and Science Rajiv Gandhi Salai (OMR) Padur, Chennai – 603103 Tamil Nadu
External Examiner - II	:	**Dr P S K Reddy** Professor and Head Department of Mathematics JSS Science and Technology University Mysuru - 570006 Karnataka
Supervisor	:	**Dr Joseph Varghese** Professor Department of Mathematics School of Sciences CHRIST (Deemed to be University) Bengaluru-560029 Karnataka

The members of the Research Advisory Committee of the Scholar, the faculty members of the Department and the School, interested experts and research scholars of all the branches of research are cordially invited to attend this open viva-voce examination.

Registrar (Academics)

Place: Bengaluru
Date: 24 February 2025

ABSTRACT

This thesis explores the concept of Perfect Italian Domination in graph theory. It is an extension of the well known graph parameter-Domination. This combines the concepts of Italian domination and Perfect domination providing new perspectives on vertex control in network architectures. A set S is called a dominating set, if every vertex in the graph is either belonging to the set S or adjacent to a vertex in the set. The number of vertices in the smallest possible dominating set of a graph G is called its domination number $\gamma(G)$. We explore the concept of perfect Italian domination, where an assignment of 0, 1 or 2 to a vertex represents a scenario in which every unguarded vertex needs to be in the neighborhood of a "well guarded" vertex or in the neighborhood of two "semi guarded" vertices. In a graph G, Perfect Italian Domination (PID) assigns labels 0, 1, 2 to the vertices such that a vertex labeled 0 has either a vertex labeled 2 and the remaining vertices labeled 0 in its neighborhood or two vertices in its neighbor-hood labeled 1 each and the remaining vertices in its neighborhood labeled 0. Perfect Italian domination number $\gamma_I^P(G)$ is the smallest possible sum of the labels on the vertices of G satisfying a perfect Italian domination. We do a comparative analysis of perfect Italian domination with domination concept and finally characterize a class of graphs having equal domination and perfect Italian domination number. This study also provides a thorough analysis of the properties and applications of perfect Italian domination. We explore the characteristics and variations of perfect Italian domination in different graph classes such as regular graphs, split graphs, Petersen graph, Mycielskian graphs, etc. Applications of these concepts are discussed, especially in areas of networking, optimizations, security strategies, resource allocations etc.

This research also looks into how perfect Italian domination are impacted by graph operations like - join and corona. How perfect Italian domination number changes as a result of these graph operations offer new insights on how perfect Italian domination varies as graphs undergo transformations. We study the behaviour of graph complements and how the perfect Italian domination number varies between a graph and its complement. The N ordhaus − Gaddum type inequalities in the perfect Italian domination numbers are also discussed. Further we investigate the criticality concepts in Perfect Italian domination. We examine a few graph classes and discuss in detail the effect of vertex removal in perfect Italian domination. We also define perfect Italian domination (γ_I^P)-stable graphs and perfect Italian domination critical graphs. Following our definitions of γ_I^P-stable and perfect Italian domination critical graphs, we have grouped some graph classes. We characterize a family of trees that is γ_I^P-stable. Hence these all results contribute to the thorough analysis of Perfect Italian domination.

Keywords: Domination, Italian domination, Perfect Italian domination, Split graphs, Regular graphs, Mycielskian of a graph, Petersen graph, Join operator, Corona operator, Graph complements, Nordhaus-Gaddum inequalities

Publications:

1. **Agnes Poovathingal** and Joseph Varghese Kureethara, "On Some Graphs the Domination number is the Perfect Italian Domination Number," in Congress on Intelligent Systems, pp. 191-200, Springer, 2023.
2. **Agnes Poovathingal** and Joseph Varghese Kureethara, "Modelling Networks with Attached Storage using Perfect Italian Domination", International Conference on MAchine inTelligence for Research & Innovations, pp. 23-33, Springer, 2023.
3. Joseph Varghese Kureethara, Sanjana Theresa, and **Agnes Poovathingal**, "Graph Theory in Security, Utility, Aesthetics and Affordability", American Institute of Physics Conference Series,Volume-2763, pp. 060003, 2023.
4. **Agnes Poovathingal** and Joseph Varghese Kureethara, "A Study on Perfect Italian Domination of Graphs and their Complements", URAL Mathematical Journal, Communicated.
5. **Agnes Poovathingal** and Joseph Varghese Kureethara, "Vertex removal on Perfect Italian Domination and γ_I^P-stability of graphs", Turkish Journal Of Mathematics and Computer Science, Communicated