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Radio Secure number of a Graph

K. N. Meera [1]

Dept.of Mathematics
Amrita Vishwa Vidyapeetham, Amrita School of Engineering, Bengaluru, Karnataka-560 035, INDIA.

B. Sooryanarayana [2]

Dept.of Mathematical and Computational Studies
Dr.Ambedkar Institute of Technology, Bengaluru, Karnataka-560 056, INDIA.

Abstract

Let $G\left(V,\ E\right)$ be a simple, finite, connected graph on n vertices. Let $f\ : V\left(G\right) \rightarrow \{1, 2 \ldots\ldots\ldots n\}$ be an injective mapping. Then the largest cardinality of a set $S \subseteq V\left(\text{G}\right)$ such that for every pair of distinct vertices $u, v \in S$, $\left|f\left(u\right) - f\left(v\right)\right| \geq diam\left(G\right) + 1 - d\left(u,\ v\right)$ is called the radio secure number of f denoted by $rs\left(f\right)$. The set S is called a radio secure set. The radio secure number of a graph G is defined as maximum value of $rs\left(f\right)$ over all such functions f and is denoted by $rs\left(G\right)$. It is obvious that $1 \leq rs(G) \leq n$. If $rs\left(G\right) = n$, then G is a radio graceful graph. In this paper, we investigate the radio secure number of certain standard graphs like complete graphs, complete bipartite graphs, wheels, paths and cycles.

Keywords: Radio labeling, Radio graceful graphs.

[1] Email: `kn_meera@blr.amrita.edu`
[2] Email: `dr_bsnrao@hotmail.com`

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1 Introduction

All graphs considered here are undirected, finite connected and simple.We use standard terminology, the terms not defined here may be found in [1,7,8]. For a large network of transmitters spread out in a planar region, the channel assignment problem or frequency assignment problem (FAP) is to assign a numerical channel, representing a frequency, to each transmitter. The channels assigned to nearby transmitters must satisfy some separation constraints so as to avoid interference. The goal is to minimize the portion of the frequency spectrum that must be allocated to the problem, so that it is desired to minimize the span (the largest frequency) of a feasible assignment. Due to rapid growth of wireless networks and to the relatively scarce radio spectrum the importance of FAP is growing significantly. Representing the transmitters or stations by vertices and stations within a certain distance as adjacent vertices, the FAP can be modelled as a labeling problem. A radio labeling problem or a mutilevel distance labeling problem is a labeling problem which helps to minimize interference at all levels i, e; between every pair of vertices. A radio labeling of a connected graph G is an injection $f : V(G) \to Z^+$ such that for every two distinct vertices u and v of G, $|f(u) - f(v)| \geq diam(G) + 1 - d(u, v)$ holds . The radio number of f, denoted by $rn(f)$ is the maximum number assigned to any vertex of G. The radio number of G, denoted by $rn(G)$ is the minimum value of $rn(f)$ taken over all radio labelings f of G. A radio labeling of C_{10} with radio number 18 is shown in the Fig. 1. A graph G on n vertices was called radio graceful if and only if $rn(G) = n$. An example of a radio graceful graph is shown in the Fig. 2.

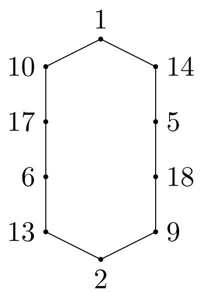

Fig. 1. A radio labeling of C_{10}

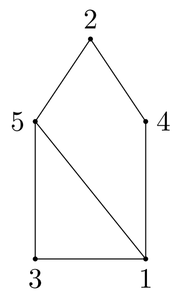

Fig. 2. A radio graceful graph

In 2001, Chartrand, Ervin, Phing Zhang and F. Harary were motivated by regulations for channel assignments of FM radio stations and introduced radio labelings of graphs [2]. They showed that if G is a connected graph of order n and diameter 2, then $n \leq rn(G) \leq 2n - 2$, and that for every pair