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The Radial Radio Number and the Clique Number of a Graph

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Abstract: ***Let*** $G(V(G),E(G))$ ***be a graph. A radial radio labeling, f, of a connected graph G is an assignment of positive integers to the vertices satisfying the following condition:*** $d(u,v)+|f(u)-f(v)|\geq 1+r(G)$***, for any two distinct vertices*** $u,v\in V(G)$***, where*** $d(u,v)$ ***and*** $r(G)$ ***denote the distance between the vertices u and v and the radius of the graph G, respectively. The span of a radial radio labeling f is the largest integer in the range of f and is denoted by span(f). The radial radio number of G,*** $r(G)$***, is the minimum span taken over all radial radio labelingsof G. In this paper, we construct a graph a graph for which the difference between the radial radio number and the clique number is the given non negative integer.***

Keywords: diameter, frequency assignment problem, radius, radio labeling, radio number, radial radio number, radial radio number.AMS Subject Classification Code(2010):05C78

I. INTRODUCTION

In this paper, by a graph, we mean only finite, simple, undirected and connected graph. For basic notations and terminology, we follow [4]. Let $G=(V(G),E(G))$ be a graph. The *distance* $d(u,v)$ between any two vertices u and v, is the length of a shortest $(u,v)-$ path in G. The *eccentricity*, $e(u)$, of a vertex u in $V(G)$ is the distance of a vertex farthest from u. The *radius* of a graph G is the minimum eccentricity among all the vertices and is denoted by $r(G)$ or r. The *diameter* of G is the maximum eccentricity among all the vertices and is denoted by $diam(G)$ or d. The relation between $r(G)$ and $diam(G)$ is given by the inequality $r(G)\leq diam(G)\leq 2r(G)$ [8]. For further details on distance in graphs, one can refer [5].

For a subset S of $V(G)$, let $<S>$ denote the induced subgraph of G induced by S. A *clique* C is a subset of $V(G)$ with maximum number of vertices such that $<C>$ is complete. The *clique number* of a graph G, denoted by $\omega(G)$ or ω, is the number of vertices in a clique of G.

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In 1960's Rosa[12] introduced the concept of graph labeling. A *graph labeling* is an assignment of numbers to the vertices or edges or both, satisfying some constraints. Rosa named the labeling introduced by him as $\beta-valuation$ and later on it becomes a very famous interesting graph labeling called *graceful labeling*, which is the origin for any graph labeling problem. Motivated by the real life problems, many mathematicians introduced various labeling concepts[9]. Here, we see one of the familiar graph labelings in graph theory.

The problem of assigning frequencies to the channels for the FM radio stations is known as *Frequency Assignment Problem* (FAP). This problem was studied by W. K. Hale[10].

In a telecommunication system, the assignment of channels to FM radio stations play a vital role. Motivated by the FAP, Chartrand et al.[6] introduced the concept of radio labeling. For a given k, $1\leq k\leq diam(G)$,a *radio k-coloring*, f, is an assignment of positive integers to the vertices satisfying the following condition:

$$d(u,v)+|f(u)-f(v)|\geq 1+k \qquad (1)$$

for any two distinct vertices $u,v\in V(G)$. Whenever, $diam(G)=k$, the radio k- coloring is called a *radio labeling*[7] of G. The *span* of a radio labeling f is the largest integer in the range of f and is denoted by $span(f)$. The *radio number* of G is the minimum span taken over all radio labelings of G and is denoted by $rn(G)$. Motivated by the work of Chartrand et al., on radio labeling, KM. Kathiresan and S. Vimalajenifer[11] introduced the concept of radial radio labeling. A *radial radio labeling* f of G is a function $f:V\rightarrow\{1,2,...\}$ satisfying the condition,

$$d(u,v)+|f(u)-f(v)|\geq 1+r(G) \qquad (2)$$

for any two distinct vertices $u,v\in V(G)$. This condition is obtained by taking $k=r(G)$ in (1). The above condition is known as *radial radio condition*. The *span* of a radial radio labeling f is the largest integer in the range of f. The *radial radio number* is the minimum span taken over all radial radio labelings of G and is denoted by $rr(G)$.

That is, $rr(G)=\min_{f}\ \max_{v\in V(G)} f(v)$, where the minimum runs over all radial radio labelings of G.

Let f be a radial radio labeling of a graph G and let C be a clique in G.

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