# Chromatic number of Antipodal Graph

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***Abstract***

Chromatic number of a graph is the minimum number of colors with which a graph can be colored properly. In this paper we are finding the chromatic number of Antipodal graph, also we discussed the chromatic number of different properties of Antipodal graph.

**Keywords:** *Chromatic number, Antipodal graph, complete graph, diameter.*

## I. INTRODUCTION:

Singleton (1968) introduced the concept of the Antipodal graph of a graph G, denoted **Antipodal graph**

by A( G ), is the graph on the same vertices as of G, two vertices being adjacent if the distance between them is equal to the diameter of G.

### Chromatic number of Antipodal graph

By the motivation of existing definition of Chromatic number of a graph and Antipodal graph we can find the Chromatic number of Antipodal graph. We consider only finite undirected graphs G = (V,E) without loops and multiple edges and follow Harary [4] for notation and terminology.

## II. RESULTS AND DISCUSSION:

**Proposition 1. (Aravamudhan and Rajendran [1])** For a graph G = (V,E), G = A(G)) if, and only if G is complete.

From the above result we have the following

**Proposition 2.** For a complete graph G = (V, E), $\chi$ (G) = $\chi$ (A(G))

**Proof.** Since G is a complete graph and n is the number of vertices of G, $\chi$ (G) = n and by Proposition 1, G = A(G) hence $\chi$ (G) = $\chi$ (A(G)) = n

For any positive integer k, the k $^{th}$ iterated antipodal graph A(G) is defined as follows:

$A^0(G) = A(G)$, $A^k(G) = A(A^{k-1}(G))$

**Corollary 3.** For any graph G, and any positive integer k, $\chi(A^k(G)) = \chi(A(G))$

.

**Proposition 4. (Aravamudhan and Rajendran [1])** For a graph G = (V, E), $\bar{G}$ = A(G) if, and only if, i). G is of diameter 2 or ii). G is disconnected and the components of G are complete graphs.
In view of the above, we have the following result:

**Proposition 5.** For a graph G = (V,E), $\chi(A(G)) = \chi(\bar{G})$ if, and only if,
i). G is of diameter 2 or ii). G is disconnected and the components of G are complete graphs.

**Proof.** Suppose that , $\chi(A(G)) = \chi(\bar{G})$ then clearly we have A(G) = $\bar{G}$ and hence G satisfies the conditions of Proposition 4.
Conversely, G satisfies the conditions of Proposition 4 then $\bar{G}$ = A(G), obviously, $\chi(A(G)) = \chi(\bar{G})$.

**Proposition 6.** For a graph G = (V,E), $\chi(A(\bar{G})) = \chi(A(G))$ if, and only if,
i). G is of diameter 3 or ii). G is disconnected and the components of G are complete graphs.

**Corollary 7.** If G is a graph of diameter 2 and G is not disconnected then,
$\chi(A(\bar{G})) < (A(G))$ .

**III. ACKNOWLEDGEMENTS:**
The author is thankful to the reviewers for their valuable suggestions to enhance the quality of our article. Also, the author very much thankful to Dr. P. Siva Kota Reddy , Associate Professor, Siddaganga Institute of Technology, Tumkur for his constant support.

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