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# Chromatic number of *S*-Antipodal Graph

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***Abstract***

*Chromatic number of a graph G is the minimum number of colors with which a graph can be colored properly and it is denoted by* $\chi$ *(G). In this paper we are finding the chromatic number of S-Antipodal graph, also we discussed the chromatic number of different properties of S-Antipodal graph.*

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**Keywords:** Chromatic number, S-Antipodal graph, complete graph, diameter, center of a graph, Hamiltonian graph.

## I. INTRODUCTION:

### Antipodal graph

Singleton (1968) introduced the concept of the Antipodal graph of a graph *G*, denoted 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 [1].

### *S*-Antipodal graph

The eccentricity *e(v)* of a vertex *v* in the graph *G* is the distance to a vertex farthest from *v*. The maximum eccentricity is the diameter of *G* and the minimum is the radius of *G*. The center *C(G)* of a graph *G* is the set of vertices with minimum eccentricity.

A graph *G* is self centered, if all its vertices lie in the center. Equivalently, a self centered graph is a graph whose diameter equals to its radius.

Radhakrishnan Nair and Vijaykumar [5] introduced the concept of *S*-antipodal graph of a graph *G* as the graph $A^*$ (*G*) has the vertices in *G* with maximum eccentricity and two vertices of $A^*$ (*G*) are adjacent if they are at a distance of *diam (G)* in *G*.

### Chromatic number of *S*-Antipodal graph

By the motivation of existing definition of Chromatic number of a graph and *S*-Antipodal graph we can find the Chromatic number of *S*-Antipodal graph. We consider only finite undirected graphs *G* = (V,E) without loops and multiple edges and follow Harary [3] for notation and terminology.

## II. RESULTS AND DISCUSSION:

**Proposition 1.** For a graph *G*, $\chi(G) = \chi(A^*(G))$ if, and only if G is complete or Hamiltonian
For any positive integer k, the k th iterated *S*-antipodal graph $A^*(G)$ is defined as follows:

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

**Corollary 2.** For any graph G, and any positive integer k, $\chi((A^*)^k(G)) = \chi(A^*(G))$

.

**Proposition 3. (Aravamudhan and Rajendran [5])** If *G* is a regular self- complementary graph, then $A^*(G) = \bar{G}$

In view of the above, we have the following result:

**Proposition 4.** If *G* is a regular self- complementary graph, then $\chi(A^*(G)) = \chi(\bar{G})$

**Proof.** Since *G* is regular self-complimentary graph, then by proposition3 $A^*(G) = \bar{G}$ that is $A^*(G) \cong \bar{G}$ there is one to one correspondence between edges and vertices so, $\chi(A^*(G)) = \chi(\bar{G})$

**Proposition 5. (Aravamudhan and Rajendran [5])** $A^*(G) = A^*(\bar{G})$ if and only if G is either complete or totally disconnected

**Proposition 6.** For a graph $G = (V,E)$, $\chi(A^*(\bar{G})) = \chi(A^*(G))$ if, and only if, *G* is either complete or totally disconnected.

**Corollary 7.** If *G* is a graph of diameter 3 and G is not disconnected then,

$$\chi(A^*(G)) < \chi(\bar{G}).$$

**Proposition 8. (Aravamudhan and Rajendran [5])** Let *G* be a graph, A(*G*) its antipodal graph and $A^*(G)$ its *S*- Antipodal graph then $A^*(G) = A(G)$ if and only if *G* is self centered.

**Proposition 9.** Let *G* be a graph , A(*G*) its antipodal graph then $A^*(G)$ its *S*- Antipodal graph then $\chi(A^*(G)) = \chi(A(G))$ if and only if *G* is self centered.

**Proof:** I f G is self centered, then by proposition 8 $A^*(G) = A(G)$ that is $A^*(G) \cong A(G)$ then $A^*(G)$ and $A(G)$ having one to one correspondence with vertices and edges hence $\chi(A^*(G)) = \chi(A(G))$.
If $\chi(A^*(G)) = \chi(A(G))$ then $A^*(G) \cong A(G)$ that is $A^*(G) = A(G)$ by proposition 8 *G* is self centered.

## III. CONCLUSION:

In this paper we compare the chromatic number of general graph and *S*-Antipodal graph and we conclude with some properties.

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