

# Graph Coloring Solutions to Queen Graphs

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**Abstract:** Graph coloring, an NP-complete problem is used in many real-world applications. The minimum color, that is, the chromatic number of a connected graph is determined using different soft computing strategies. This article gives some of the solutions obtained for queen graphs using evolutionary methods.

**Keywords:** Graph Coloring; Chromatic Number; Soft Computing; Evolutionary Methods

## 1. Introduction

Let  $G$  be the connected graph with  $n$  vertices and  $e$  edges. The chromatic number of  $G$ ,  $\chi(G)$  is the least color count required to color the vertex set  $V(G)$  such that no two adjacent vertices are assigned with the same integer [1].  $\chi(G)$  is determined using different soft computing strategies [2,3]. This research gives  $\chi(G)$  and the optimal coloring assignments for some of the queen graphs that are obtained using the soft computing strategies.

## 2. Queen Graphs Color Assignments

The following are the color assignments obtained using various soft computing strategies for some of the queen graphs [4-8].

### 2.1. queen5\_5.col

$$\chi(G) = 5$$

Optimal color assignments:

- (3 4 2 5 1 2 5 1 3 4 1 3 4 2 5 4 2 5 1 3 5 1 3 4 2)
- (1 2 3 4 5 3 4 5 1 2 5 1 2 3 4 2 3 4 5 1 4 5 1 2 3)
- (2 3 4 5 1 4 5 1 2 3 1 2 3 4 5 3 4 5 1 2 5 1 2 3 4)
- (3 1 4 5 2 4 5 2 3 1 2 3 1 4 5 1 4 5 2 3 5 2 3 1 4)
- (1 2 3 4 5 4 5 1 2 3 2 3 4 5 1 5 1 2 3 4 3 4 5 1 2)
- (3 4 1 5 2 1 5 2 3 4 2 3 4 1 5 4 1 5 2 3 5 2 3 4 1)

### 2.2. queen6\_6.col

$$\chi(G) = 7$$

Optimal color assignments:

- (7 1 2 3 4 5 2 3 4 5 6 7 4 5 6 7 1 2 6 7 1 2 3 4 1 2 3 4 5 6 3 4 5 6 7 1)
- (5 1 2 3 4 6 2 3 4 6 7 5 4 6 7 5 1 2 7 5 1 2 3 4 1 2 3 4 6 7 3 4 6 7 5 1)
- (1 3 6 4 5 7 5 7 2 1 3 6 3 6 4 5 7 2 7 2 1 3 6 4 6 4 5 7 2 1 2 1 3 6 4 5)
- (3 2 5 6 7 4 4 6 7 2 1 5 2 5 1 3 6 7 1 4 2 7 5 3 5 7 3 1 4 6 6 1 4 5 3 2)

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### 2.3. *queen7\_7.col*

$$\chi(G) = 7$$

Optimal color assignments:

(5 6 1 3 4 7 2 7 2 5 6 1 3 4 3 4 7 2 5 6 1 6 1 3 4 7 2 5 2 5 6 1 3 4 7 4 7 2 5 6 1 3 1 3 4 7 2 5 6)  
 (1 2 3 4 5 6 7 3 4 5 6 7 1 2 5 6 7 1 2 3 4 7 1 2 3 4 5 6 2 3 4 5 6 7 1 4 5 6 7 1 2 3 6 7 1 2 3 4 5)

### 2.4. *queen8\_8.col*

$$\chi(G) = 9$$

Optimal color assignments:

(1 2 3 4 5 6 7 8 3 4 1 6 8 2 5 9 5 8 9 7 4 3 6 2 6 7 2 5 9 8 1 4 2 5 6 1 3 4 9 7 9 3 4 2 6 7 8 5 8  
 6 7 9 1 5 2 3 7 1 5 8 2 9 4 6)

### 3. Conclusions

This article presented some of the solutions obtained for queen graphs using evolutionary methods.

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