# CMSC 501 – ADVANCED ALGORITHMS PROJECT REPORT

Praveena Kondepudi
V# V00933455

## 1. Super Graph Coloring

Greedy Graph Coloring algorithm is implemented in Java.
The Greedy approach works by checking if there is a color assigned to each node.
1) Consider the currently picked vertex and color it with the
lowest-numbered color that has not been used on any previously
colored vertices adjacent to it.
2) For any unavailable color, Add a new color.
3) Once color is assigned to a node, then it considers the next neighbor vertex.

```
praveenakondepudi@Praveenas-MacBook-Pro →  src git:(main) ✗ javac project/SuperGraphColoring.java
Note: project/SuperGraphColoring.java uses unchecked or unsafe operations.
Note: Recompile with -Xlint:unchecked for details.
praveenakondepudi@Praveenas-MacBook-Pro →  src git:(main) ✗ java project.SuperGraphColoring
Vertices: 9 Edges: 18
Maximum number of edges : 36
Total colors : 3
Addl. new colors used : 1
1 2 3 2 3 1 3 1 2 %
praveenakondepudi@Praveenas-MacBook-Pro →  src git:(main) ✗
```

## 2. Number of colors (Random Graph) & Maximum degree

| Vertices | Edges | Colors |
|---|---|---|
| 50 | 100 | 4 |
| 100 | 1000 | 9 |
| 200 | 4000 | 14 |
| 300 | 10000 | 20 |
| 400 | 20000 | 28 |
| 500 | 50000 | 50 |

| Vertices | Max Edges | Colors |
|---|---|---|
| 50 | 1225 | 50 |
| 100 | 4950 | 100 |
| 200 | 19900 | 200 |
| 300 | 44850 | 300 |
| 400 | 79800 | 400 |
| 500 | 124790 | 500 |

The maximum number of edges in an undirected graph is **n(n-1)/2,** the maximum number of colors are equal to number of vertices for maximum number of edges.

Praveena Kondepudi
V# V00933455

## 3. Sudoku Graph

For 81 vertices and 810 edges below is output

```
praveenakondepudi@Praveenas-MacBook-Pro →  src git:(main) ✗ java project/SudokuSolver.java
<-----------Input Sudoku----------->
-1,-1,1,-1,-1,-1,-1,-1,4,
-1,2,3,1,-1,-1,9,-1,-1,
-1,8,6,-1,5,-1,3,-1,-1,
-1,6,-1,-1,4,-1,-1,-1,-1,
3,-1,-1,9,-1,1,-1,-1,5,
-1,-1,-1,-1,7,-1,-1,3,-1,
-1,-1,4,-1,3,-1,6,1,-1,
-1,-1,2,-1,-1,5,8,4,-1,
7,-1,-1,-1,-1,-1,5,-1,-1,
<-----------Ouput Sudoku----------->
Maximum colors available: 9
5,7,1,3,9,6,2,8,4,
4,2,3,1,8,7,9,5,6,
9,8,6,4,5,2,3,7,1,
2,6,7,5,4,3,1,9,8,
3,4,8,9,2,1,7,6,5,
1,9,5,6,7,8,4,3,2,
8,5,4,2,3,9,6,1,7,
6,3,2,7,1,5,8,4,9,
7,1,9,8,6,4,5,2,3,
praveenakondepudi@Praveenas-MacBook-Pro →  src git:(main) ✗
```