Abstract

Graph k-Colorability (for k ≥ 3) Problem (GCP) is an well known NP-Complete problem; till now there are not any known deterministic methods that can solve a GCP in a polynomial time. To solve this efficiently, we go through Propositional Satisfiability, which is the first known NP-Complete problem [3]. However, to use the SAT solvers, there is a need to convert or encode an k-colorable graph to 3-SAT first. In this paper, we are presenting a polynomial 3-SAT encoding technique for k-colorability of graph. Alexander Tsiatas [1] gave a reduction approach from 3-Colorable graph to 3-SAT encoding. According to [1], total number of clauses generated in 3-CNF-SAT formula for 3-colorable graph G = (V, E) is ((27*|V|) + (256*|E|)). In our earlier
formulation of reduction of k-colorable graph to 3-SAT [2], we generalized [1] for k-colorable graph and generated $((kk^*(k-2)*|V|) + (22k+2 *|E|))$ clauses in 3-CNF. Here, we present our approach to encode a k-colorable graph to 3-CNF-Satisfiability (SAT) formula in polynomial time with mathematical proof. Our formulation generates total $((k-2)*|V| ) + (k*|E|)$ clauses in 3-CNF for k-colorable graph. Thus, our formulation is better than approach [1] and [2]. Also, we tested our encoding formulation approach on different graph coloring instances of DIMACS[8][9].

Reference


Index Terms

Computer Science Communications

Key words
### Polynomial 3-SAT Encoding for K-Colorability of Graph

<table>
<thead>
<tr>
<th>CNF</th>
<th>3-SAT</th>
<th>DNF</th>
</tr>
</thead>
<tbody>
<tr>
<td>graph coloring</td>
<td>NP-Complete</td>
<td>k-colorable</td>
</tr>
<tr>
<td>chromatic number</td>
<td>DIMACS</td>
<td></td>
</tr>
</tbody>
</table>