

# EC Practical Assignment

## Genetic Local Search for Graph Coloring

The goal of this practical assignment is to implement and experimentally study genetic local search (GLS) for solving the graph coloring (GC) problem. The GLS used is based on the Greedy Partitioning Crossover (GPX) and the Vertex Descent Local Search (VDLS) as explained in the lectures.

1. Implement the partitioning representation of the graph coloring problem.
2. Implement VDLS and GPX.
3. Integrate VDLS and GPX in your family competition GA scheme from the first practical assignment.
4. Test your algorithm on the le450\_15 graph:  
[http://www.info.univ-angers.fr/pub/porumbel/graphs/le450\\_15c.col](http://www.info.univ-angers.fr/pub/porumbel/graphs/le450_15c.col)  
(see also <http://www.info.univ-angers.fr/pub/porumbel/graphs/>)
5. Start with  $K = 18$  colors and see whether you can find an optimal coloring. If so continue trying to solve the GC with one color less until you are no longer able to find an optimal coloring.
6. Do the experiments with a population size  $N = 100$ .
7. GPX generates offspring which have generally more conflicting edges than their parents. VDLS improves the offspring by locating the nearest local optimum (note that this is used in the family competition). The fitness landscape of GC has large plateau's: VDLS is stopped after  $L = 100$  iterations without fitness improvement.
8. Compute the crossover correlation coefficient of GPX with and without VDLS - this is, respectively between random solutions and their offspring after GPX, and between local optimal parents (using VDLS) and their offspring obtained from GPX + VDLS.
9. If your implementation is fast enough and you still have time left you might also try a more complex graph:  
<http://www.info.univ-angers.fr/pub/porumbel/graphs/dsjc250.5.col>  
(use  $N = 100$ ,  $L = 100$  and start from  $K = 30$  colors).

## References:

1. P. Galinier and J.-K. Hao, Hybrid evolutionary algorithms for graph coloring. Journal of Combinatorial Optimization (1999).
2. C. Glass, Celia and A. Prugel-Bennett, Genetic Algorithm for Graph Coloring: Exploration of Galinier and Hao's Algorithm. Journal of Combinatorial Optimization (2003).

## Report:

Write a report discussing your results and send it to d.thierens@uu.nl. The report should be in **PDF format !!!** The source code should be in SEPARATE, compressed archive file (program.tar.gz). **Do NOT include** your report.pdf file in this archive !

The report should at least contain the following topics:

1. Give a short description of the implemented program.
2. Tabulate and/or plot the experimental results. You should report the number of Vertex Descent moves, the number of generations run, the CPU time required. Average your results over at least 5 independent runs, report the worst, median and best result.
3. Discuss your findings.

## Deadline:

**April 15, 23:59 hrs.**

## Questions:

Any remaining questions about the assignment can be asked during the break or after each lecture.