Evolutionary Algorithms 2017

Practical Assignment I

Solving Low Autocorrelation for Binary String (LABS) Problems using Genetic Algorithms

Assignment

Implement a Genetic Algorithm (GA) in MATLAB according to the generational GA model (see slide 27 of lecture 3 - Genetic Algorithms) that search for a bit-string of length n, which yield as small autocorrelation as possible. Test the performance on the 6 dimensions and compare the performance of your GA implementation to Monte Carlo (MC) search of which an implementation is available in **mc.m**. Use ***a maximum of 5,000 * dimension*** function evaluations for each run, and report on your results ***averaged over 20 runs*** per approach.

Deadline: before Wednesday 8 November 2012, 23.59.

Your submission should consist of two files (no more, no less): a report in PDF format (≥3 pages) and your GA implementation in MATLAB. These are to be
sent by email to f.ye@liacs.leidenuniv.nl

Read carefully the *MATLAB Implementation Details* and the *Report Structure Guidelines* provided below.

PA1.zip containing all files mentioned can be downloaded from http://liacs.leidenuniv.nl/EA/pa/PA1.zip.

Once again, the experiment settings are:

- Evaluation budget: ***5,000 * dimension***
- Dimension (length of the bit-string) to test: ***10, 20, 40, 80, 160***

MATLAB Implementation Details

Your GA implementation should consist of **single** .m file named ***lastname1_lastname2*_ga.m** (replacing lastname1 and lastname2 by your own names) and should be structured as follows:

```
function [xopt, fopt] = lastname1_lastname2_ga(n, eval_budget)

…

end
```

Here, *n* is the length of binary sequences, *eval_budget* is the number of function evaluations that the GA is allowed to use per run (i.e., the allowed number of calls to **labs.m**, see below, not the number of

generations!), *xopt* is the best bitstring found by the algorithm, and *fopt* the accompanying best fitness. For your convenience, we provide **labs.m**: it returns fitness of the candidate solutions.

We will compare all submissions using an automated script, this requires all ***plotting, printing to the command line etc. to be disabled*** in the submitted version of your work!

Some References for Further Reading

- https://arxiv.org/pdf/1512.02475.pdf
- https://en.wikipedia.org/wiki/Autocorrelation
- http://iopscience.iop.org/article/10.1088/0305-4470/29/18/005/meta

Report Structure Guidelines (≥4 pages)

Title + Authors (names, email addresses, and student numbers)

Introduction

Introduction text here.

Problem Description

Brief description of the optimization problem here.

Implementation

Outline of your algorithm, algorithm parameters, and settings used for those parameters. Make sure that the algorithm and the results are reproducible from your description.

In case you implement advanced/experimental algorithm components (e.g., parameter tuning), please do report them in detail.

Experiments

Description of the experiments and the results. Use the following tables and figures to report on the results:

	Monte-Carlo Search		Genetic Algorithm	
Dimension	Avg	Std dev	Avg	Std dev
10				
20				
40				
80				
160				

Table 1: Final solution quality after 5,000 * dimension function evaluations, averaged over 20 runs

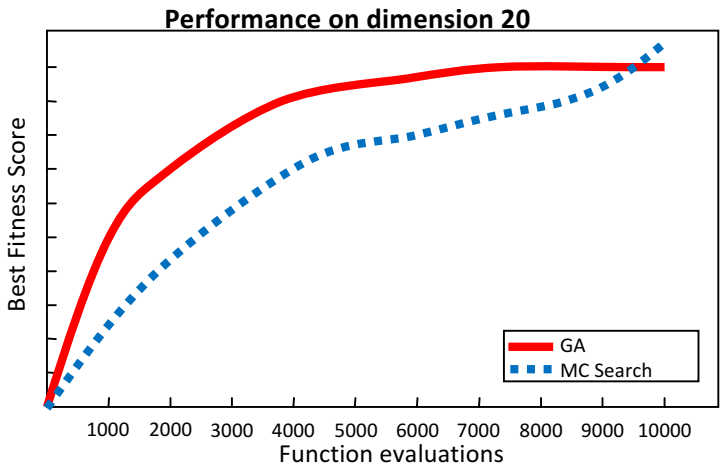

Figure 1: Final solution quality after 10,000 function evaluations, averaged over 20 runs

Make sure to present your results in a way that is convenient to the reader, do not blindly include plots of all your experiments, try to combine data in figures!

Discussion and Conclusion

Summarize the results and conclude your report.