Homework Module Ib
Report

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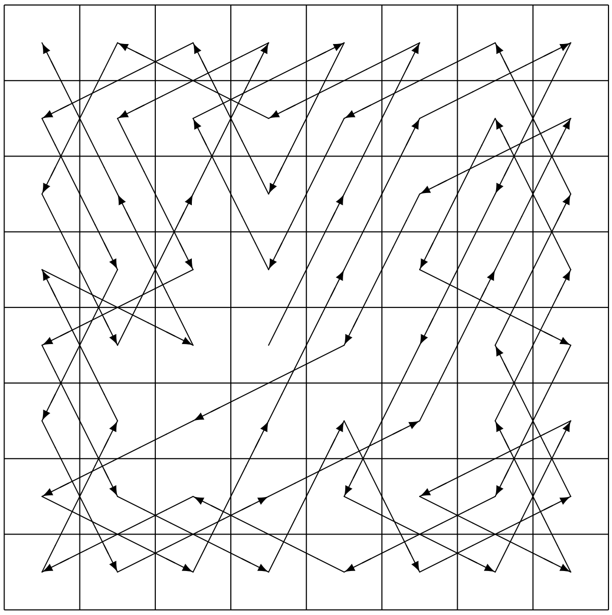


1 Introduction

In this report, I will briefly describe the evolutionary algorithm I wrote for the second part of the homework module, the Knight's Tour. The classes for specimen and populations is just reused from the first part of the module, and described in that report. Here, I will describe any changes or new methods specific to this problem.

2 Methods associated with the specimen class

The most obvious changes here are the methods for finding the phenotypes and the fitness. While the fitness for the OneMax problem is trivial, for the Knights tour one must calculate the length of the longest string of legal moves. I did this by beginning at a specified starting square, and adding to the list of moves all the moves until a move takes the knight back to a previously visited square or outside the board.

To start with, I used the strict interpretation of the tour described in the compendium, but I quickly realised that this was hopelessly slow, and implemented the loose interpretation instead.

The genome was generated in the same way as for the OneMax-problem, i.e. as a random bitstring, but the length was specified as 3 bits times the number of moves in solution. A string of 3 bits was converted into a number from 0 to 7, and used to represent a move, as discribed in the compendium.

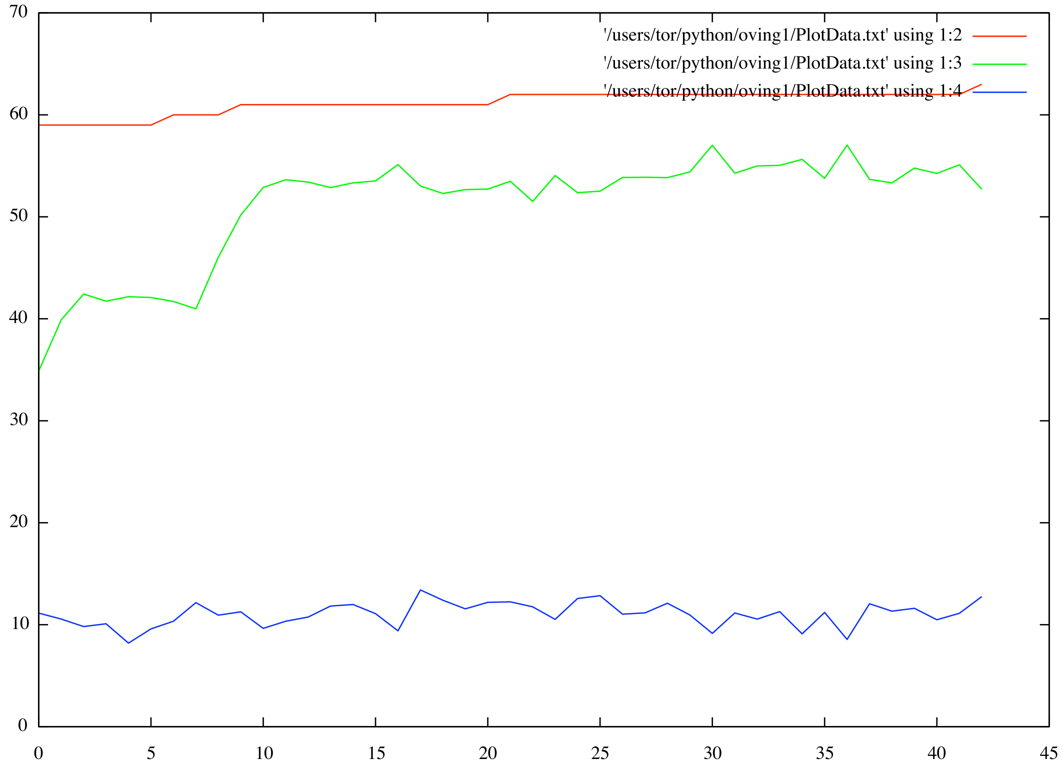
3 Plotting

In addition to plotting the same statistics as in the first part of the homework module, I wrote a routine for generating a LaTeX-figure showing the solution. An example can be seen on the first page of this report.

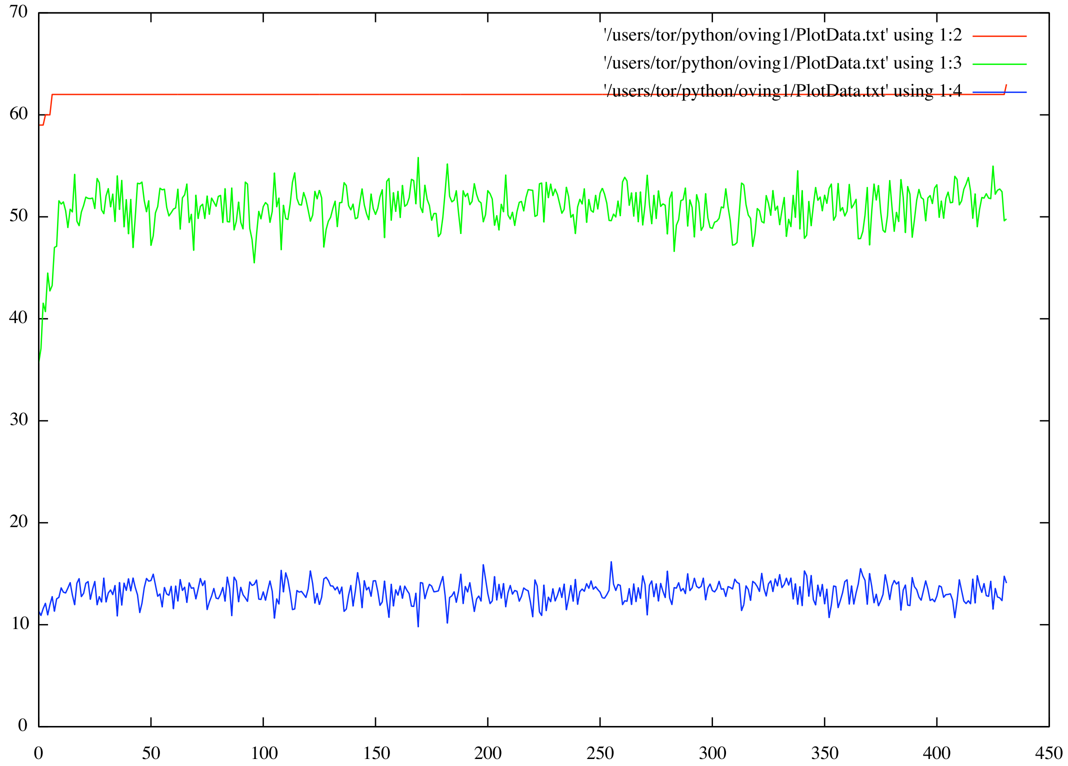
4 Results

It seems my algorithm takes somewhat longer to yield results than those of other students I have spoken to. I am not entirely sure where the problem lies. Below is two graphs showing two runs on an 8x8 board. The following parameters was used in both runs, yet the number of generations to find a solution is different by a factor 10.

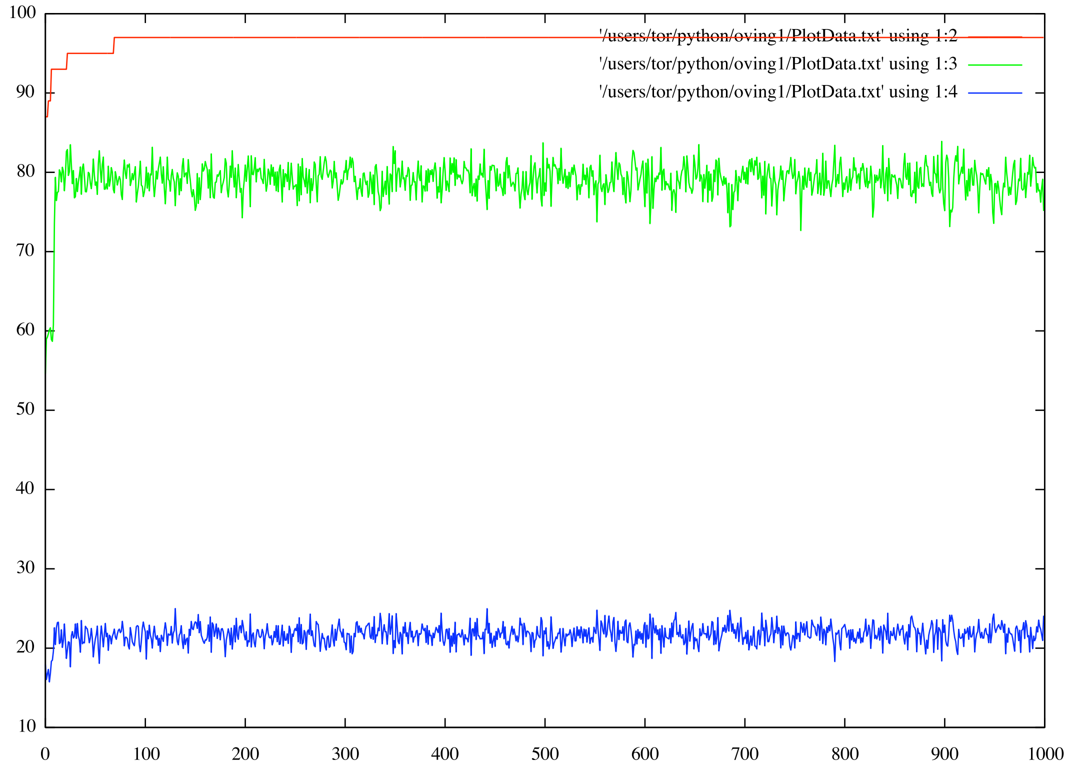
Population Size	100
Adult Selection	Sigma Scaling
Mate Selection	Boltzmann
Starting Temperature	10 (decreasing linearly)
Specimenwise mutation rate	0.3
Bitwise mutation rate	0.2
Selection Protocol	Full Generational Replacement



Figur 1: 8x8 board. The red line is the maximum fitness, the green line is the mean fitness, and the blue line is the standard deviation.



Figur 2: 8x8 board. The red line is the maximum fitness, the green line is the mean fitness, and the blue line is the standard deviation.



Figur 3: 10x10 board. The red line is the maximum fitness, the green line is the mean fitness, and the blue line is the standard deviation.

I have not been able to find a solution for a larger board than 8x8 in a reasonable amount of time. For 10x10, for example, the maximum fitness quickly reaches a quite high number, like 97, and then seems to get stuck, even though there is some variation in the population. Below is shown a graph of a run trying to solve the 10x10 puzzle. The run was aborted after 1000 generations. The settings are the same as above.