

CSC355 Artificial Intelligence – Genetic algorithm (GA) coursework

The general traveling salesman problem (TSP) is stated as follows: *Given a number of cities, and the distances from each city to every other, one (the salesman) must find the shorter route to travel through all the cities without visiting the same city twice.*

For this coursework you will have to design, implement and evaluate a system that generates solutions for the TSP problem using genetic algorithms. Specifically you need to:

- Specify and elaborate (i.e. describe and explain the rationale for your design decisions) on the following aspects of your system:
 - a. Chromosome encoding
 - b. Genetic operators used
 - c. Fitness evaluation process and heuristics used to optimise the fitness assessment
 - d. Selection process
 - e. Convergence criteria (when does the algorithm exit/finish)

[5 marks]
- Provide a flow diagram or pseudo-code description of your algorithm

[5 marks]
- Implement and run the system several times (at least 5-10 runs) for each of 3 different configurations (5, 25 and 70 cities, randomly placed every time). The implementation language is your choice (e.g. C, C++, Java, Python, Perl). You should log statistics on the following:
 - a. Size of population used
 - b. Number of generations produced in each run
 - c. For each generation log the minimum/maximum/average fitness of the population and how many times each genetic operator was performed in every generation
 - d. Whether solution(s) was/were found or not in every run, and if so highlight the best one (then plot it).

Then report your observations on the following phenomena in relation to your system:

- Premature convergence
- Epistasis
- Performance

when you:

- a. Breed an initial population (say 30% or any percentage or it) as opposed to stochastically creating one
- b. As you change the population size

[5 marks]

What do you need to submit?

All of the above should be described in a README style document (maximum 3 A4 pages long). Also you should submit the code that you developed and the statistics that you have collected. Make sure they are decently organized and grouped in files per configuration and per run. In the submission, you should include a brief list of files and what they correspond to. The whole set should be zipped together for submission.

This coursework aims to assess the following:

- Understanding of how GAs work and the important aspects in their design.
- Ability to develop and sufficiently evaluate a complete system based on GAs.
- Ability to observe and assess the system's behaviour and suitability in relation to its design versus parameter tuning.

Don't focus too much on improving your system if it does not work well, so long as you can understand why it does not. Any questions, please contact Manolis (mjs@comp.lancs.ac.uk).