cLAB 1 – Genetic Algorithms

Requirements

- Python + Jupyter Notebook

Methodology

1. Download the 'Genetic_Algorithm_Lab.ipynb' Jupyter notebook and open it up.
2. Implement a genetic algorithm for solving the Travelling Salesman Problem (TSP) by replacing codes marked as #TODO in the notebook, hence implementing loading city coordinates from a text file, parent selection, survivor selection, crossover, mutation, and plotting.
3. For the parent selection, crossover, and mutation functions, implement at least two of each.
4. Test your genetic algorithm on the data sets provided ('tsp_case0N.txt' files, where N is 0, 1, 2, and 3).
5. Evaluate the performance (fitness and time taken) for your algorithm and its' components.
6. Once you have chosen the best combination of functions, try to obtain the best solution to the data set 'tsp_case04.txt' which contains 14,051 coordinates. You may run your algorithms multiple times, use boot-strapping, anything you want. A portion of your marks will come from how well your best route compares to all the routes submitted for this lab.
7. Don't forget to run the final cell when you have gotten a good result to save the actual route to a text file, this is required for submission!

Report

- Your report should present your results and your analysis of those results.
- Pay special attention to the relative performance and effectiveness of the functions you implemented.
- There is no page limit, but be sensible. Aim for 4-6 pages (less is better than more).
- Be sure to report the best distance in the report.

Submission

- Your submission comprises of ONE (1) Jupyter notebook, ONE (1) PDF document (Word files not accepted), and ONE (1) text file containing the best route you have been able to find.
- Submission deadline is exactly 7 days after your lab finishes (5.30pm on the next Friday after your lab). Submission is through a Google Form[1].

Competitive Mark Component

- A portion of the marks for this lab (see the marking rubric for details) will be awarded based on the relative performance of your algorithm vs all submitted algorithms within your lab session.
- Non-submission of this component (text file containing the route itself) means ZERO (0) marks awarded for this component.
- Marks awarded for submitted routes will range from 10% to 25%, with the best submitted route awarded 25% and the worst submitted route awarded 10%. A linear interpolation will be used, with the following formula $10\% + \frac{W - L}{W - B} \times 5$, where W is the worst distance, B is the best distance, and L is your submitted distance.

[1] – https://tinyurl.com/AI2019GASubmission

LAB 1 – Genetic Algorithms Marking Rubric

Graded Components Weightage

- Presentation and Formatting (15%)
- Results (15%)
- Analysis and Justification (25%)
- Code Quality (20%)
- Competitive Mark Component (25%)

Presentation and Formatting Rubrics

0 Unreadable report.
1 Difficult to read, with obvious errors in formatting, grammar etc.
2 Acceptable, with some errors in formatting, grammar etc.
3 Good readability, appropriate use of graphics/tables. Minimal grammatical and formatting errors.
4 Outstanding presentation and formatting, no errors at all.

Results Rubrics

0 Not reported.
1 Inaccurate or incomplete results.
2 Basic results reported.
3 Results reported well, with thought given to organizing and summarizing data appropriately.
4 Reporting of results is impeccable, summary is easily viewable at a glance.

Analysis and Justification Rubrics

0 Not provided.
1 Perfunctory analysis and/or justification, off-topic or nonsensical.
2 Brief (but correct) analysis or justification provided.
3 Good analysis and justification which clearly provides rationale/reasoning.
4 Very good analysis and justification which convinces the reader.

Code Quality Rubrics

0 Not submitted.
1 Very poor code (no cells, hard to read etc.) or provided code does not work.
2 Working code.
3 Code is well organised and commented.
4 Code is easy to read because it is very well organised, showing proper planning.

Tabulation of Marks

Each graded component receives a mark based on the above rubrics. This assigned mark N is then divided by the maximum mark for the rubric M and multipled by the weightage W. So the sum of your report marks S will be $S = \sum_{i=1}^{n} \frac{N_i}{M_i} \times W_i$