College of Arts Technology & Environment
ACADEMIC YEAR 2023/24

Assessment Brief

Submission and feedback dates

Submission deadline: Before 14:00 on 7th December 2023

Is eligible for 48 hour late submission window

Marks and Feedback due on: Monday 22nd January 2024

N.B. all times are 24-hour clock, current local time (at time of submission) in the UK

Submission details

Module title and code: Artificial Intelligence 2 UFCF9S-15-2

Assessment type: Report

Assessment title: Optimisation Assignment

Assessment weighting: 75% of total module mark

Size or length of assessment: Around 5000 words in template provided.

Module learning outcomes assessed by this task:

1. Demonstrate the ability to select appropriate paradigms and solve one or more problems with Artificial Intelligence techniques

Completing your assessment

This is an individual assignment.

If you have questions about this assignment, please contact the module leader.

What am I required to do on this assessment?

Broadly speaking, the assignment requires you to write a report on your attempts to solve a set of simple problems as effectively as possible using any form of evolutionary optimisation covered on the course. This requires you to write your own code, in a language of your choice, building upon your own code written and developed in the first lab sessions. No marks will be given for completion of the worksheets alone. The aim is for you to learn the basic methodology for applying AI techniques to problems effectively.

There are three worksheets on Blackboard which take you through the implementation of a simple evolutionary algorithm. This assignment requires you to complete all three

worksheets and then extend the algorithm to tackle two optimisation problems provided here. Thereafter you are asked to find other well-known algorithms for comparison.

To pass the assignment, you must implement a system that successfully evolves solutions to the two minimisation fitness functions below (separately) and demonstrate the effects of parameter changes, through graphs and tables, including your understanding of what is happening.

Approaches you might like to consider are different forms of mutation and crossover, as well as selection. For the final section it is acceptable to use implementations of other related algorithms for comparison with your own code on the functions here and other benchmark functions. E.g., the use of tools such as Matlab for non-evolutionary algorithms is acceptable.

$f(\mathbf{x}) = (x_1 - 1)^2 + \sum_{i=2}^{d} i\left(2x_i^2 - x_{i-1}\right)^2$	$f(\mathbf{x}) = \sum_{i=1}^{d} x_i^2 + \left(\sum_{i=1}^{d} 0.5ix_i\right)^2 + \left(\sum_{i=1}^{d} 0.5ix_i\right)^4$
where $-10 \le x \le 10$, start with d=20	where $-5 \le x \le 10$, start with d=20

All reports should start with the experimentation section on the use of evolutionary search, describing the representation and operators used, showing example runs and the gradual improvement of solutions found from different algorithmic choices. More marks will be given to the effective use of more systematic and sophisticated approaches. The task is to solve the given functions as well and as quickly as possible. A comparison section should then explore the relative performance of your evolutionary algorithm to other search algorithms.

The intention is your hand-in approximates to a research paper – please use the template provided, submitted as PDF (zip or other file formats will not be opened). Include commented source code as an Appendix.

The practical sessions will begin with the worksheets and then be given over to the assignment. As such, informal weekly feedback will be available during those sessions. As noted above, please contact the module leader with any questions and written feedback will be given with marks on Blackboard.

Where should I start?

By completing the three worksheets provided, you will have all the basic code required to tackle the (fitness) functions given here.

What do I need to do to pass?

To implement the functions given and present results from parameter variations that give improved performance over initial parameter settings.

How do I achieve high marks in this assessment?

The marking criteria indicates the characteristics of work that achieves a 2:1 or 1st.

How does the learning and teaching relate to the assessment?

The basic evolutionary approach will be presented in the first lecture of the module. Thereafter, many aspects of subsequent lectures, particularly in the first half of the module which focuses on optimisation, will be relevant to – and may possibly be included in – the assessment.

What additional resources may help me complete this assessment?

Everything you need to pass is provided, but more general resources can be found here: https://www.uwe.ac.uk/study/study-support/study-skills

What do I do if I am concerned about completing this assessment?

UWE Bristol offer a range of Assessment Support Options that you can explore through this link, and both Academic Support and Wellbeing Support are available.

For further information, please see the Academic Survival Guide.

How do I avoid an Assessment Offence on this module? [2]

Use the support above if you feel unable to submit your own work for this module. Direct inclusion of unattributed work from published papers or code are common errors.

Marks and Feedback

Your assessment will be marked according to the following marking criteria.

You can use these to evaluate your own work before you submit.

	0-40%	40-50%	50-60%	60-70%	70-100%
General approach – technical writing style and visual impression (10%)	Use of template and basic word processing skills.	Coherent structure in presentation, including some graphs.	Coherent structure in presentation, including graphs of key results.	Well structured, results presented in graphs and/or tables.	Well structured, results presented in multiple/suitable ways.
Experimental Method – no. of experiments, systematic parameter changes, etc.(30%)	Presentation of attempts on the two functions.	Presentation of increasingly successful attempts on functions given.	Presentation of increasingly successful attempts on functions, moving to others.	Presentation of optimal solutions on functions, moving to others.	Presentation of optimal solutions on functions, moving to others and also finding optimal/competitive performance.
Analysis and Discussion – presentation and discussion of learning behaviour (30%)	Brief discussion of apparent effects of varying one or more parameters.	Discussion of apparent effects of varying one or a few parameters.	Discussion of apparent effects of varying parameters clearly supported by results.	Discussion of effects from systematic parameter sweeps.	Demonstration of clear insight of effects from parameter sweeps and/or operators.
Comparison – appropriate use of other search approaches (20%)	Brief use of a simple approach such as a random hillclimber on the functions.	Effective use of a simple approach such as a random hillclimber on the functions.	Use of one or more other modern search algorithm(s) on the functions given.	Systematic comparison with another algorithm, ensuring equivalence, on the functions.	Systematic comparison with other algorithm(s), ensuring equivalence, on the functions and others.
Conclusions (5%)	Concise summary.	Summary showing understanding.	Summary showing wider understanding.	Demonstration of clear understanding of results.	Demonstration of clear understanding and implications of results.
Citation and Reference Scheme (5%)	A small number of relevant EA refs.	Some refs to relevant EA work.	Some good refs to relevant EA and comparison algorithm.	Some good refs to relevant EA work and comparison algorithms/functions.	Sets of refs for EA, comparison algorithms/functions, optimisation in general, etc.

1. In line with UWE Bristol's Assessment Content Limit Policy (formerly the Word Count Policy), word count includes all text, including (but not limited to): the main body of text (including headings), all citations (both in and out of brackets), text boxes, tables and graphs, figures and diagrams, quotes, lists.
2. UWE Bristol's UWE's Assessment Offences Policy requires that you submit work that is entirely your own and reflects your own learning, so it is important to:
    - Ensure you reference all sources used, using the UWE Harvard system and the guidance available on UWE's Study Skills referencing pages.
    - Avoid copying and pasting any work into this assessment, including your own previous assessments, work from other students or internet sources
    - Develop your own style, arguments and wording, so avoid copying sources and changing individual words but keeping, essentially, the same sentences and/or structures from other sources
    - Never give your work to others who may copy it
    - If an individual assessment, develop your own work and preparation, and do not allow anyone to make amends on your work (including proof-readers, who may highlight issues but not edit the work) and

    When submitting your work, you will be required to confirm that the work is your own, and text-matching software and other methods are routinely used to check submissions against other submissions to the university and internet sources. Details of what constitutes plagiarism and how to avoid it can be found on UWE's Study Skills pages about avoiding plagiarism.