

COMP6370 / COMP8370 – Natural Computation

Assessment 2: Short Essay

Instructions and General Marking Scheme, 2023/24

General Instructions

For this assignment you are required to write a *short essay*, with at most 1,000 words (not counting the space taken by the “References” section), on the topic below. In order to do this you will need to investigate the topic using whatever resources you can find, in particular the university library and the internet.

This is an individual assessment.

This assessment is worth 20% of the total marks for this module.

The general topic of the essay is “Real-World Applications of Genetic Algorithms”.

More precisely, for this essay, you have to choose TWO types of real-world problems and, for each type of problem, describe precisely the following two components of a Genetic Algorithm (GA) for solving that problem: (a) the individual representation (encoding of a candidate solution), and (b) the fitness function.

You can choose any two real-world problems *except* problems that were already discussed in the lectures (like e.g. the problem of estimating electricity demand for a country, discussed in the second lecture on evolutionary algorithms). The two real-world problems that you choose can either be in the same broad application area (e.g., two types of problems in biomedicine, or two problems in finance), or they can be from different application areas (e.g., one problem in medicine, another in finance). In addition, your description of the individual representation should not be too abstract (like e.g. referring to generic variable names such as “A” or “B” in a candidate solution); it should refer to names of variables and concepts with meaning in the real world. For example, in the case of the above problem of estimating electricity demand for a country, the individual representation described in the lecture referred to variables like the ‘gross national product’ and the ‘population’ of a country, with a real meaning in the target real-world application. As mentioned above, you are not allowed to choose this particular problem as one of the two real-world applications for your essay, but the contents of the lecture describing a GA for that problem (the second lecture on evolutionary algorithms) can serve as an example for what is meant by a “real-world application of GA” in the context of this essay.

Submission Instructions

Submit a Word file or a pdf file via Moodle.

The deadline for submission is 06 December (23:55 hours).

At the start of your assessment, please mention your name, your login, your module code (COMP6370 or COMP8370) and the number of words (not counting the References section) in your assessment. If you don’t mention these pieces of

information you will lose some marks (see Marking Criteria). You will also lose marks if your essay has more than 1,000 words (without counting the References section).

Notes on Plagiarism

Senate has agreed the following definition of plagiarism:

"Plagiarism is the act of repeating the ideas or discoveries of another as one's own. To copy sentences, phrases or even striking expressions without acknowledgement in a manner that may deceive the reader as to the source is plagiarism; to paraphrase in a manner that may deceive the reader is likewise plagiarism. Where such copying or close paraphrase has occurred the mere mention of the source in a bibliography will not be deemed sufficient acknowledgement; in each such instance it must be referred specifically to its source. Verbatim quotations must be directly acknowledged either in inverted commas or by indenting."

The work you submit must be your own, except where its original author is clearly referenced. We reserve the right to run checks on all submitted work in an effort to identify possible plagiarism, and take disciplinary action against anyone found to have committed plagiarism. When you use other peoples' material, you must clearly indicate the source of the material.

Notes on essay writing

- An essay should have a structure. It should begin with an introduction which summarizes the essay so that the reader has some idea of what will be covered and how it will be structured. It should fall into several sections, each of which considers a particular aspect of the topic; you should mark out these sections explicitly by the use of section headings. You should end with some conclusions, which summarize the main points made and suggest questions which the reader might want to think about or outline directions for future reading.
- You may find it useful (once you have done your reading) to sit down with a few blank sheets of paper and "brainstorm" some ideas for the essay; the important ideas which have been stressed over and over in your reading will hopefully float to the top of your imagination during this process.
- Always acknowledge quotations. An essay can be enlivened and an argument strengthened by using quotations from other people/books/papers, but you need to note carefully where these quotations have come from. The simplest way to do this is to make a numbered alphabetical list at the end of the essay of the books and papers used, then you can refer to any quotation you use by the number of the reference. Even when you are not using any direct quotation, the references listed at the end of essay should be also cited along the main text of essay, in the part(s) of the essay they are most relevant, in order to support the essay's discussion of the corresponding concept or method discussed in more detail in a reference.
- You can quote references obtained from both the library and the internet. However, you should consider that some references obtained from the internet might be very "informal", reflecting the views of the author without a peer-review process – unless the reference was also published in a more formal

format. By contrast, references obtained from the Library – in the form of books, papers published in proceedings of conferences and academic journals, etc. – tend to be more reliable, because typically they have passed through a peer-review process before publication. When you get a reference from the internet that has also been formally published, quote the formal reference too, instead of quoting just the web page address. The next item explains how to quote a formal reference.

- Mention all the relevant details of each reference that you quote. This includes the name of the author(s), the title of the paper/book/book chapter, the title of the conference proceedings (in the case of a conference paper) or the title and the number of the volume/issue of the journal where the paper was published (in the case of journal papers), the year of publication, etc. See examples of references later.
- If you can draw on multiple sources of information it makes the essay stronger. This demonstrates that you can read around a topic and bring different ideas together, rather than just recapitulating what another author has written.
- Illustrations can summarize important points, provide an overview of complex concepts, and demonstrate visual ideas. You can create your own illustrations or you can use illustrations from elsewhere, again being certain to say where the illustration came from so that it does not look like you are passing off other work as your own. Content is more important than artistic merit for the purposes of this assignment.
- Using too many words to express a simple idea and distilling your writing to the point where it becomes hard to read are equally problematic. Try and use enough words to express your ideas and make the sentences flow, but don't overwrite.
- Don't start writing too soon. Spend some time to read about the topic and make notes before you start writing the main text. It may be useful to block off a substantial block of time (e.g. a whole day in a weekend) to write the main draft of the essay, so that you can collect your thoughts and remain "in the experience" as you are working on it.
- After you have written a draft version don't revise it straight away; put it away for a couple of days and then revise it. One obvious ramification of this piece of advice is that you have to start writing more than a day before the deadline.
- Don't be afraid to cut material out as you revise your work. Don't be afraid to have a go at rewriting a problematic section from scratch rather than trying to revise it.

Reference

- [1] Higham, Nicholas J., "Handbook of Writing for the Mathematical Sciences",
Second edition, SIAM, August 1998

Examples of how to specify the bibliographical details of references for each category of reference

Conference paper

- [2] G.L. Pappa and A.A. Freitas. Automatically evolving rule induction algorithms. In:
Machine Learning: ECML 2006 – Proceedings of the 17th European Conference on

Machine Learning. Lecture Notes in Artificial Intelligence, 4212, pp. 341-352. Springer, 2006.

Journal paper

- [3] M.A. Potter and K.A. De Jong. Cooperative coevolution: an architecture for evolving coadapted subcomponents. *Evolutionary Computation*, Vol. 8, No. 1, pp. 1-30, 2000.

Book

- [4] D.E. Goldberg. *Genetic Algorithms in Search, Optimization and Machine Learning*. Addison-Wesley, 1989.

Book chapter

- [5] J.R. Koza. Human-competitive applications of genetic programming. In: A. Ghosh and S. Tsutsui (Eds.) *Advances in Evolutionary Computing: Theory and Applications*, pp. 663-682. Springer, 2002.

Marking Criteria

Your essay will be assessed mainly based on the technical soundness and quality of the contents of the essay, how well you explained concepts and methods, and to what extent you followed the general instructions at the start of this document. In general, the more advanced (and correct) the technical concepts and arguments of the essay, and the more clearly explained they are, the higher the mark. As secondary criteria, your essay will also be assessed in terms of having a clear structure (with section headings), presence of some figure(s) to make the discussion clearer, and proper citation of references – which should be mainly peer-reviewed papers published in the proceedings of specialized journals or conferences, rather than informal webpages.

Your essay will be assigned a mark based on a *discrete (categorical) marking scale* used by the University for marking essays and similar types of coursework, as mentioned below.

In addition, recall that, as mentioned in the Submission Instructions, at the start of your essay you have to mention your name, your login, your module code (COMP6370 or COMP8370) and the number of words in your essay (not counting the words in the References section). If you don't mention your name, login or the essay's number of words, as a penalty, your essay's mark will be decreased by one discrete mark. For instance, if the mark before applying the penalty is 72, after applying the penalty your mark would be 68 (the next lower discrete mark after 72), according to the range of available discrete marks in the university's *discrete (categorical) marking scale*, which is as shown below.

In addition, recall that the size limit for this essay is 1,000 words (not counting References). If your essay is longer than this size limit, as a penalty your mark would be decreased by at least one discrete mark (if your essay is just a little longer than 1,000 words), and possibly decreased by a larger number of discrete marks (if your essay is significantly longer than 1,000 words).

Mark range: 100, 95, 85, 78, 75, 72

Marks within that range are allocated based on the extent to which the essay has excellent or very good technical quality, with very clear and very precise explanations, and shows clear evidence of a deep bibliographical research.

Mark range: 68, 65, 62

Marks within that range are allocated based on the extent to which the essay has good technical quality, with clear and precise explanations in general, and shows clear evidence of some good bibliographical research.

Mark range: 58, 55, 52

Marks within that range are allocated based on the extent to which the essay has reasonable technical quality (possibly with a few technical errors), with at least some clear explanations (although some parts of the text may not be clear), and shows some evidence of bibliographical research.

Mark range: 48, 45, 42, 38, 35, 32, 20, 10, 0

Marks within that range are allocated based on the extent to which the essay has little technical detail, superficial discussions about the topic; discussion based mainly on the contents of the lectures (i.e., no substantial evidence of a bibliographical research that went beyond the contents of the lectures); text with many technical errors.