COURSEWORK SPECIFICATION

ECM3428 – Algorithms that changed the world

Module Leader: **Chunbo Luo**

Academic Year: 2024/25

Title: **Continuous Assessment**

Submission deadline: **11 December 2024**

This assessment contributes **40%** of the total module mark and assesses the following **intended learning outcomes**:

- Appreciate the principles of algorithm design and implementation;
- Analyse the time complexity of some important classes of algorithms;
- Implement and analyse some fundamental algorithms;
- Apply programming skills to convert abstract specifications into practical realisations;
- Demonstrate an analytical approach to computational problems;
- Appreciate the importance of complexity considerations in the practical deployment of programs at different scales;
- Approach problem-solving tasks in a systematic and disciplined way.

This is an individual assessment and you are reminded of the University's Regulations on Collaboration and Plagiarism. You must avoid plagiarism, collusion and any academic misconduct behaviours. Further details about Academic Honesty and Plagiarism can be found at `https://ele.exeter.ac.uk/course/view.php?id=1957`.

Instructions

Problem Statement

In this assessment, you are asked to write a technical report of an algorithm chosen by yourself, implement it using a programming language, and create a video to demonstrate your code and its results.

- Your report is suggested to include the following contents about the chosen algorithm:
  - The main principles of the algorithm;
  - The pseudo code to describe the algorithm. The pseudo code can be in a figure so that it does not contribute to the word count;
  - The complexity analysis of the algorithm;
  - The limitations or constraints of the algorithm and the methods or tools that could overcome them;
  - The applications of this algorithm in the real world systems for problem solving (e.g. how the algorithm changed or is changing the world).
  - A mandatory appendix.

  The report should be no more than 1500 words. The title page, pseudo code, references and appendices are not counted. Please respect the following formatting constraints: Times New Roman or Arial (If you use Latex, the default font, Computer Modern, is fine.), at least font size 11, margins (2.0cm sides, 2.0cm top and bottom), and single line spacing.

  A separate title page containing the title, student number, abstract, word count and a signed declaration stating: *I certify that all material in this report which is not my own work has been identified.* should be provided.

  The mandatory appendix

  Your report needs a mandatory appendix as follows. Use the following prompts to ask AI tools (e.g., ChatGPT or other models and the specific version being used) to help write a report about the same algorithm:

  - "You are a computer science final year student. Write the main principles about the ... (THE ALGORITHM IN THIS REPORT) ... algorithm." For example, "You are a computer science final year student. Write the main principles about the Pagerank algorithm."
  - "Write the pseudo code to describe ... "
  - ... (continue to finish the report in a similar structure like the main report)

  In the end of the appendix, write a critical comparison (No more than half a page) between your report and AI generated report, e.g., the areas you did well, the areas AI did well, how to better use AI tools to enhance your learning of algorithms etc.

- Implement the algorithm using a programming language of your choice (Python and Matlab are recommended), and submit the source code along with the report. Your script should perform correctly and have sufficient comments.

- Create a short video (no more than 5 minutes) to introduce the algorithm including its background, principles, importance and your implementation, and demonstrate how the code works. You can submit the video file to the module ELE page, or upload it to a publicly accessible website (e.g. Youtube or Vimeo) and include the link to this video in the report clearly.

Algorithms

You can choose an algorithm from the list below. Alternatively, you can suggest an algorithm that is not covered by this module (in this case, you should discuss your choice with the module leader within one week of receiving this handout).

- Multicast routing algorithm for communication networks.
- Frequent pattern growth (FP-Growth) algorithm.
- The Edmonds-Karp algorithm for finding the maximum flow.
- Orthogonal range searching and k-d trees algorithms.
- An algorithm of the A* family.
- Boruvka's algorithm.
- Reed-Solomon algorithm.
- Quickhull algorithm.
- Neural compression algorithms.
- Iterative solvers, e.g. Jacobi, Gauss Seidel.
- One derivative-free optimization algorithm.

Writing

Your technical report must be well structured and written in good English. Pay attention to the following:

- Spelling, punctuation and grammar.
- Writing in short, snappy sentences.
- Making sure to define acronyms.
- Referencing properly.

References

If you refer to other published documents in your report, you must cite the source using a standard citation style (e.g. IEEE, Harvard, etc.). All references must be presented in a consistent and uniform style.

Generative AI, e.g. ChatGPT, policy

Please refer to the GenAI statement for the use of AI tools.

Deliverables

The deliverables for this coursework comprise one **electronic** submission. You should name the submission as *StudentID_CandidateNumber_yourinitials* (for example, 6100001_24232_AB).

- The source code, video file and report should be compressed into one single file and submitted to ELE via the submission link.

  If the file size is too big, you should submit the video to a **publicly accessible** website such as YouTube and clearly indicate the link in the report.

You are suggested to complete the submission at least a few hours before the deadline, leaving enough time for potential last-minute amendments.

Marking criteria

Criteria	Marks
Report ▪ The degree to which the report describes the principles of the algorithm clearly (10). ▪ The degree to which the pseudo code of the algorithm is well presented (5). ▪ The degree to which the complexity of the algorithm is correctly analysed, including reasoning behind this complexity (5). ▪ The degree to which the report describes the limitations of the algorithm and possible advances that could overcome these limitations (5). ▪ The degree to which one or more applications of the algorithm is clearly described (5). ▪ The degree to which the report is logically structured and written clearly, with appropriate sections, references, diagrams/images, and a neat/polished appearance (5). ▪ The degree to which the critical comparison between the AI generated report and your own work is well presented (5). ▪ -5 per 200 words beyond 1500 words; -5 if the mandatory appendix is absent.	40
Source code ▪ The degree to which the source code produces the intended results (10). ▪ The degree to which effective expression of the algorithm using proper data structures and good design is provided (5). ▪ The degree to which the code is clear, including instructions to test the code (5). ▪ The degree to which sufficient comments are provided (5). ▪ The degree to which the results are properly displayed with appropriate test cases (5).	30
Video ▪ The degree to which the introduction is effective and informative (5). ▪ The degree to which code of the algorithm is clearly and logically presented (10). ▪ The degree to which the presentation is well organised (5). ▪ The degree to which the visual aids, e.g., slides, source code etc., are well prepared (5). ▪ The degree to which a speaker uses an audible voice, and gives a clear presentation (5).	30
Total	100