Department of Computer Science

FORMATIVE ASSESSMENT BRIEF

I. Module Learning Outcomes

1. **Select and apply appropriate AI algorithms and methodologies, with consideration for optimisation and scale to meet business objectives and performance targets.**
2. **Critically evaluate AI-methodologies through experimental design, exploratory modelling, and hypothesis testing.**
3. Critically analyse techniques for the extraction of data from systems, ensuring standards of data quality and consistency for processing by AI-systems
4. Identify and discuss appropriate application areas and problems for current AI techniques, such as: neural networks, deep learning, genetic algorithms and local search approaches.

II. Assessment Background/Scenario

We have examined three interesting local search algorithms (Steepest Ascent Hill Climbing, Simulated Annealing and Tabu Search) in the module so far.

In this assessment you are required to pick **two** of the three search algorithms and apply them to solve the knapsack problem. You should then produce a short report detailing your implementation of the algorithms, the results of your testing with analysis, and a formal conclusion.

The Dataset is provided [added in the Google Drive folder - Knapsack.csv]

The capacity of the knapsack must be kept at 1500.

III. Assessment Tasks

Questions

1. Algorithm Selection

- **a.** Select two of the three algorithms mentioned above;
- **b.** Keep a record of your selection criteria in each case;
- **c.** For each, develop a solution to the knapsack problem.

2. Algorithm Implementation

- **a.** Run your optimisation algorithms a minimum of 10 times. Keep a record of the solution obtained and the number of iterations required to arrive at that solution.

3. Analysis and Evaluation of Algorithms/Solutions

- **a.** Carry out a comparative analysis of the results from your two optimisation methods, paying close attention to metrics such as best solution, average solution (over 10 runs), and iterations required to converge to those solutions;
- **b.** Based on your analysis, complete a critical evaluation of the two solutions (keeping in mind the limitations of the chosen search methods), and identify the optimal solution of the two;
- **c.** Write a short report to include the following sections:

  - Executive summary (150 words);

- Introduction discussing the knapsack problem, algorithms chosen and their selection criteria (450 words);

- Brief review of the relevant literature. Knapsack problems can be used in a variety of real-world decision-making processes. After researching application areas of the knapsack problem, select and discuss 5 such areas where the knapsack problem has been used. You must cite relevant literature (500 words);

- A comparative analysis and evaluation of the results (750 words);

- A conclusion identifying the limitations of the chosen search methods and considering potential further development (150 words).

- You may include appendices (up to 5 pages maximum)

- Your report should also make effective use of referencing and citation where appropriate (following the IEEE referencing standard).

IV. Deliverables

Your report should be no more than **2000 words** in length, excluding elements which will not be marked (i.e. cover page, references and informative appendices).

The submission is a single document accompanied by an upload containing your proposed solutions (single .zip file). It must be provided in a format which Canvas can display (i.e. PDF or MS-Word native format).

- Your feedback will report on how you addressed the problems set, the quality of your discussion, and justification of your assumptions/choices/conclusions etc.
- You are expected to research your answers and to cite appropriate academic and/or other sources in IEEE format for the type of report you have been asked to write. It is probably not sufficient to use only the module notes.
- Present your answers on A4 pages, with a minimum 12pt font (14 point for headings), minimum 120% line spacing (what Word calls “Multiple 1.08”), and margins of at least 2cm either side.
- Paragraphs must not be excessively long. “Wall of text” answers which do not contain breaks at logical points are not acceptable.

- Each part has an indicated number of words or length in which to answer it. Cover page and reference lists or bibliographies do not count towards these limits. Excess pages will not be marked.

V. Formative feedback

Formative feedback will be given on the following areas and support the development of the learning outcomes indicated: MO1 & MO2

Learning Outcome	Section/Task	Criteria
	Question 1	
	a.	Selection of algorithms with clear evidence of selection criteria applied for each algorithm which considers the problem in context.
	b.	Evidence of selection criteria to be discussed in the main report and may be included in appendices.
	c	Provide your solutions in your zipped support files.
	Question 2	
	a.	Clearly identified data subset and evidence of training for each of the solutions including evidence of parameterization where applicable.
	Question 3	
	a.	Documentation includes a full and clear account of the test results and a comparative analysis of the two solutions which makes effective use of relevant performance metrics.
	b.	The evaluation includes a clear and justified discussion which identifies the optimal solution of the two provided with supporting evidence from the testing and analysis.
	c.	The report is well structured and flows logically, and provides a clear rationale and justification for decisions made throughout, making effective use of wider reading where appropriate.
	Overall academic best practices	
	There is evidence of research in appropriate academic contexts. Citations have been appropriately used in IEEE format and there is a clear and well-formed reference list. There is clear evidence of independent thought and the discussions/arguments are well formed.	