

Algorithmic and Computational Mathematics

AM41AC

Coursework 1

The coursework aims at assessing understanding the material taught at the lectures and practical skills trained at the tutorials. The tasks are specific numerical problems that should be solved providing necessary explanations. The specific requirements on what is expected in the report describing the solutions are given in the accompanied "Assignment Brief" document.

For the function $f(x_i) = \sum_{i=1}^n -x_i \sin \sqrt{x_i}$ defined in the region $x_i < 1000, i = 1..n$:

1. Give the description of Simulated Annealing function optimisation method for minimising continuous functions. Include its concept, mathematical formulation, and algorithmic implementation. (4 marks)
2. In what aspect(s) the method can be varied? How do variations influence its performance? What are the advantages and deficiencies of the variants of the method? (4 marks)
3. Minimise the function for $n = 2$ using your implementation of the method. Analyse the results for various values of the parameters of the method. (4 marks)
4. Quantitatively estimate the performance of the method. Explain the differences in performance depending on the parameters of the method. (4 marks)
5. Plot the optimisation trajectory, analyse its dependence on the parameter of the method. (4 marks)

Total: **20 marks**.

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Coursework 2

The coursework aims at assessing understanding the material taught at the lectures and practical skills trained at the tutorials. The tasks are specific numerical problems that should be solved providing necessary explanations. The specific requirements on what is expected in the report describing the solutions are given in the accompanied "Assignment Brief" document.

For the function defined in Coursework 1 and $n = 2$:

1. Construct a new function as the intersection of $f(x_i)$ with the plane $x_0 = x_1$. Provide mathematical expression for this function and plot it. Analyse the function for its roots, extreme points and its behaviour at the limits (5 marks)
2. Find the root(s) of the function using a numerical method of your choice. Compare to the analytical result. (5 marks)
3. Integrate the function using a numerical method of your choice and analytically. Compare the results. (5 marks)
4. How will the function change if constructed as the intersection with the plain containing a different line on the $x_0 - x_1$ plane? (5 marks)

Total: **20 marks**.