

Assignment 3 - Nonlinear optimization

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Problem 1

Using the bisection method calculate at least one zero for $f(x) = -x^3 + 4x^2 - 2$ starting for a suitable initial guess. You may want to reuse the code provided in the exercise session.

Problem 2

Consider the following minimization problem: $\min f(x_1, x_2) = 2x_1^2 + x_1x_2 + 2(x_2 - 3)^2$.

1. Apply an iteration of the gradient method by performing the line search in an exact way, starting from the point $A = (-1, 4)^\top$. Report all the steps of the method, not just the result.
2. Apply an iteration of Newton's method from point A. Verify that the point found is the minimum of function f . Report all the steps of the method, not just the result.
3. How many iterations of Newton's method are required to optimize a quadratic function?

Problem 3

Use the Simulated annealing algorithm to find the global minimum of the following function.

$$f(x) = 34e^{-\frac{1}{2}(\frac{x-88}{2})^2} + (\frac{x}{10} - 2\sin(\frac{x}{10}))^2$$

Notice that $f(x)$ may have several local optima, thus restarting and a careful selection of the algorithm parameters may be necessary.