

**Homework 2: Univariate optimization - Direct search methods**

*Due date: August 21, 2024*

*Note: You can choose to work with Matlab or Python. You will submit the codes as individual files. The results will be submitted as a single pdf file.*

The objective of this homework is to solve unconstrained univariate optimization problems using direct search (gradient-free) methods. For this homework, you are going to use golden section method. The specific steps involved are as follows:

1. The first step is interval bracketing. Given a user-input function, an initial guess point and a step parameter value, implement Swan's algorithm to bracket the optimum point.
2. Use Golden section method to take this bound as an input (along with other user-specified inputs) to estimate the optimum point. The user can also specify the length of the final confidence interval (to be used as a termination criteria). The output should include the optimal value of the decision variable (can be taken as the midpoint of the final interval) and the corresponding objective function value.

Test the code for the following problems.

1.  $f(x) = \frac{-0.1x}{(1+0.1x)(1+0.05x)}, x > 0$
2.  $f(x) = x \log(x), x > 0$
3.  $f(x) = 2x^2 + \frac{16}{x}$
4.  $f(x) = -4x \sin(x), x \in [0, \pi]$