

**DS4003 Optimization Method**  
**Assignment 2 — 2022 Spring**

1. Consider the problem:

$$\begin{array}{ll}\min & x^2 + 2x + 1 \\ \text{s.t.} & -3 \leq x \leq 5\end{array}$$

And suppose that we use one of the following two methods to solve the problem:

(a) Exhaustive Search Method; (b) Golden Section Method.

If the length of the *final* interval of uncertainty needs to be less than 0.2, determine how many function values should be calculated in each case.

2. Use the Golden Section Method to solve problem 1, and stop when the length of the interval is at most 0.2.

3. Consider the problem:

$$\min \quad x^4 - 1$$

Solve the problem using Newton's Method. Start from  $x_0 = 4$  and perform three iterations.

4. Repeat problem 3, but this time use the Scant Method. Start from  $x_0 = 4$  and  $x_{-1} = 6$ , and perform three iterations.

5. For both of the sequences listed below, find the *limit* and determine the *order of convergence*:

(a) The sequence 1.05, 1.0005, 1.000005, ... with general term  $x_k = 1 + 5 \times 10^{-2k}$  for  $k = 1, 2, 3, \dots$

(b) The sequence 4, 2.5, 2.05, ... with  $x_0 = 4$  and general term  $x_{k+1} = (x_k/2) + (2/x_k)$  for  $k = 1, 2, 3, \dots$

6. Suppose that sequence  $x_k$  converges to  $x^*$  with an order  $p$ . Define a second sequence  $y_k$  by  $y_k = cx_k$  where  $c$  is some non-zero constant. Determine the *order of convergence* of  $y_k$ .