

NW<sup>2nd</sup>-3.1: Program the steepest descent and Newton algorithms using the backtracking line search. Use them to minimize the Rosenbrock function

$$f(\vec{x}) = 100(x_2 - x_1^2)^2 + (1 - x_1)^2$$

Set the initial step length  $\alpha_0 = 1$  and report the step length used by each method at each iteration. First try the initial point  $\vec{x}_0^T = [1.2, 1.2]$  and then the more difficult point  $\vec{x}_0^T = [-1.2, 1]$ .

Suggested values:  $\bar{\alpha} = 1$ ,  $\rho = \frac{1}{2}$ ,  $c = 10^{-4}$ .

Stop when:  $|f(\vec{x}_k)| < 10^{-8}$ , or  $\|\nabla f(\vec{x}_k)\| < 10^{-8}$ .