

## Homework 7 (Modified Newton method with Armijo line search)

Please write a code for a modified Newton method for finding the minimum of the function:

$$f(x) = 100(x_2 - x_1)^2 + (1 - x_1)^2$$

$$x_0 = (-1.2, 1)^T$$

$$\varepsilon = 10^{-6}$$

Use line search Newton with modification i.e. factorize via Cholesky decomposition (code provided) the matrix:

$$B_k = \nabla^2 f(x_k) + E_k$$

$$\text{i.e. } \nabla^2 f(x_k) + E_k = LDL^T$$

Where  $E_k = 0$  if  $\nabla^2 f(x_k)$  is sufficiently positive definite; otherwise  $E_k$  is chosen to ensure that  $B_k$  is sufficiently positive definite.

Solve

$$B_k p_k = -\nabla f(x_k)$$

Use a backtracking line search i.e. set

$$x_{k+1} = x_k + \alpha_k p_k$$

where  $\alpha_k$  satisfies Armijo backtracking conditions i.e.:

$$f(x_k + \alpha p_k) \leq f(x_k) + \mu \alpha p^T \nabla f(x_k)$$

$$\text{Stop if } \frac{\|\nabla f(x)\|}{(1 + |f(x)|)} \leq \varepsilon$$

or if number of maximum iterations is exceeded:

ITMAX>1000.