MATH 309 Fall 2014 – Homework 3

The due date is 11:59 pm, October 29th (Wednesday). Please submit your source codes and the required results via email to TJ Yusun at tyusun@sfu.ca. No late submission will be accepted. Partial points will be deducted for those who copy or duplicate the others' homework or work.

Problem 1: Implement the line search Newton's method with the Hessian modification to minimize the Rosenbrock function:

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

Choose the step length to satisfy strong Wolfe conditions with $c_1 = 10^{-4}$ and $c_2 = 0.1$. Set the initial step length $\alpha_0 = 1$ and the initial point $x^0 = (0, 1)^T$. Terminate the algorithm once $\|\nabla f(x^k)\| \leq 10^{-4}$. Report the objective function value f, the step length α and the norm of gradient ∇f of the **last 10** iterations. (**The codes for finding the step length to satisfy strong Wolfe conditions with $c_1 = 10^{-4}$ and $c_2 = 0.1$ are the same ones as posted before on Canvas.**)

1) The Hessian is modified by adding a matrix with *minimum Frobenius norm* so that all eigenvalues of the resulting modified Hessian are at least $\delta = 10^{-3}$ (namely, the non-diagonal modification studied in class).

2) The Hessian is modified by adding a matrix with *minimum Euclidean norm* so that all eigenvalues of the resulting modified Hessian are at least $\delta = 10^{-3}$ (namely, the diagonal modification studied in class).

3) The Hessian is modified by adding a multiple of the identity by specifying $\beta = 10^{-3}$.

4) The Hessian is modified by the modified Cholesky factorization approach with $\delta = 10^{-3}$ and $\beta = 10^6$.

5) Compare the results obtained by the above four Hessian modification schemes and conclude which one is best.