Homework No 8 (Quasi-Newton DFP method)

Use the DFP quasi-Newton update of the inverse Hessian approximation:

$$H_{k+1} = H_k - \frac{H_k y_k y_k^T H_k}{y_k^T H_k y_k} + \frac{p_k p_k^T}{y_k^T p_k} \qquad (1)$$

Starting with

$H_1 = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$ being the unit matrix

and minimize the function:

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

with initial guess $X_1 = (-2, -2)^T$

Use accuracy condition $\|\nabla f_k\| < \varepsilon$ (2)

with

$\varepsilon = 10^{-3}$

Compute the search direction:

$p_k = -H_k \nabla f_k$

set:

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

where α_k is computed from a line search to satisfy Wolfe condition.

Define $$p_k = x_{k+1} - x_k$$ $$y_k = \nabla f_{k+1} - \nabla f_k$$

Compute H_{k+1} by means of (1).

Check if accuracy condition (2) is satisfied if not set $k \leftarrow k+1$ and repeat the loop.

Please write your own code or use the code dfpmintest.f based on Numerical Recipes:

http://www.library.cornell.edu/nr/bookfpdf/f10-7.pdf

Use ITMAX maximal number of iterations as ITMAX =200

If you use above code please flowchart it. Explain why the problem of minimizing f is more difficult by considering its condition number.