

Homework 4 (due on Wednesday 05/30/2018)

Problem 1. Exercise 6.1 in the textbook. (Hint: if a function $f(x)$ is strongly convex, there exists $\sigma > 0$ such that $v^\top \nabla^2 f(x) v \geq \sigma \|v\|^2$ for any vector v .)

Problem 2. Exercise 6.4 in the textbook.

Problem 3. Exercise 7.1 in the textbook. (You can code Limited Memory BFGS using either Algorithm 7.4 or the following recursive function call as we discussed in the lecture.

% Algorithm for Limited Memory BFGS. H_k^0 is set to be γI

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function d = LBFGSrec(S, Y, d,  $\gamma$ , k)
if k > 0
     $\alpha \leftarrow \frac{s_k^\top d}{y_k^\top s_k};$ 
     $d \leftarrow d - \alpha y_k;$ 
     $d \leftarrow \text{LBFGSrec}(S, Y, d, \gamma, k - 1);$ 
     $d \leftarrow d + (\alpha - \frac{y_k^\top d}{y_k^\top s_k}) s_k;$ 
else
     $d \leftarrow \gamma d;$ 
end
```