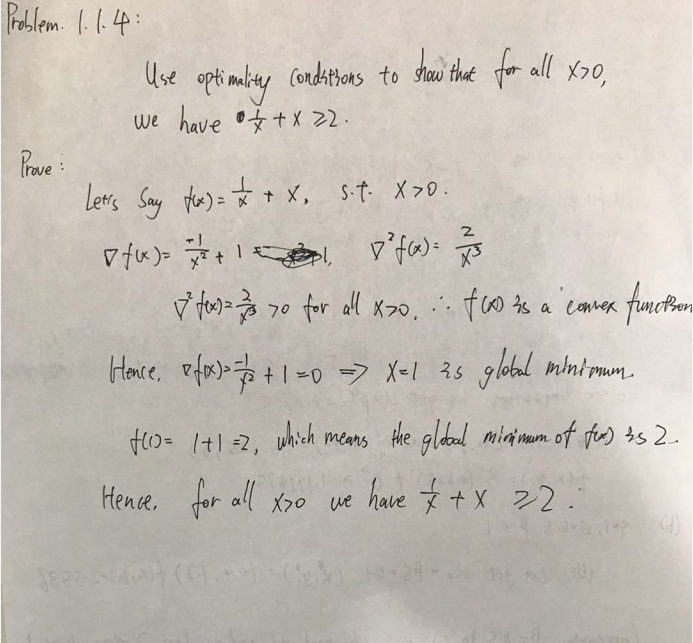
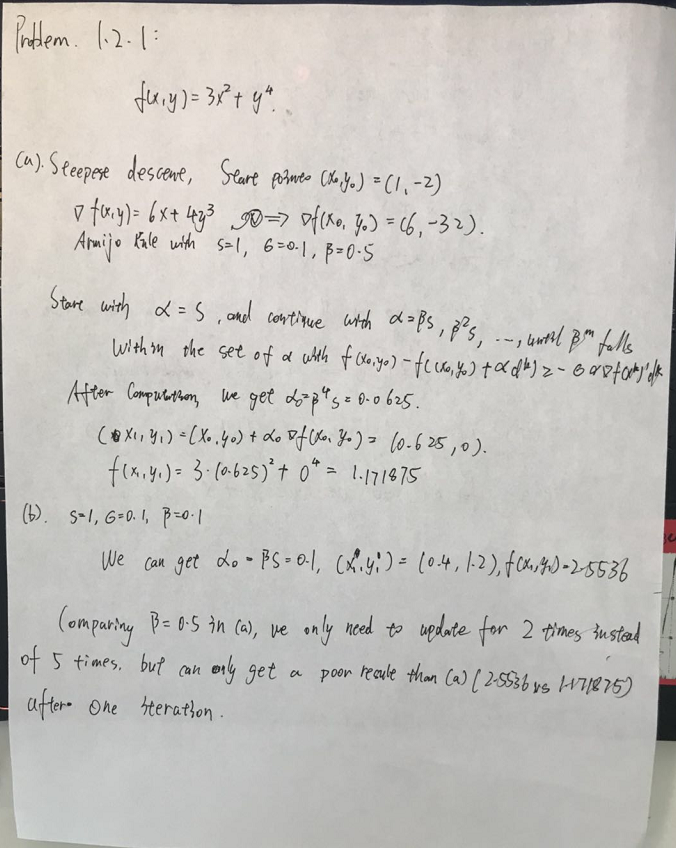
**CSE 543T Algorithms for Nonlinear Optimization: Homework 1**

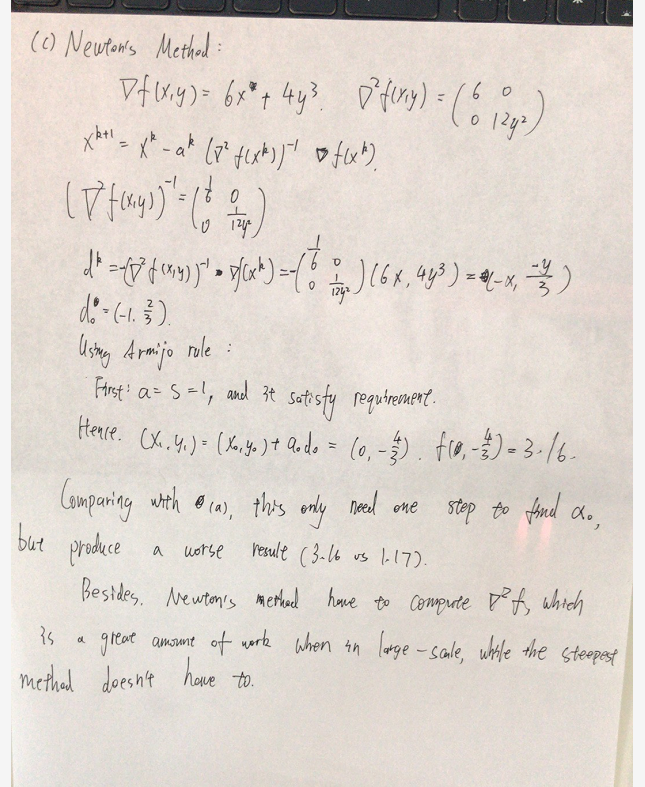
I. Problem 1.1.4



II. Problem 1.2.1



Problem II.(c)



III.

Question1:

1.b.1 Brief about L-BFGS-B

1)Introduction:

L-BFGS-B is a limited-memory quasi-Newton Algorithm for bound-constrained optimization, i.e. for problems where the only constraints are of the form l<= x <= u, and BFGS stands for Broyden–Fletcher–Goldfarb–Shanno, the inventors’ name of this method

2)Algorithm[1]:

The method works by identifying fixed and free variables at every step (using a simple gradient method), and then using the L-BFGS method on the free variables only to get higher accuracy, and then repeating the process.

The L-BFGS-B works as follows for one iteration:

1.

Find an approximation of the Cauchy point for

|  |  |  |
| --- | --- | --- |
|  | \begin{displaymath} \Phi(\lambda)=m({\bf x}(\lambda))=m(P({\bf x_k - \lambda g_k})),  \end{displaymath} |  |

2.

Minimize the quadratic form in equation

|  |  |
| --- | --- |
|  | \begin{displaymath} m({\bf x}) = f({\bf x_k}) + {\bf g_k^T(x-x_k) + (x-x_k)^T B_k  (x-x_k)}/2,\end{displaymath} |

for the unconstrained variables. This step gives a search direction.

3.

Perform a line search along the new search direction to find the minimum of ![$f({\bf
 x})$](data:image/gif;base64,R0lGODlhHgASAKIAAAAAAO7u7oiIiP///7u7uwAAAAAAAAAAACH5BAEAAAMALAAAAAAeABIAQANgOLqsQC2O1yizjAC8uNSQdAlBFTqkGIHO2blEHMRE+Y71rV4ukOoKzWPza6FsQJTQNREWeTtoBeNDqljS5I6z6fW6G+7J4xFWTVrPpBuxqLlgtk6NjU5IMpFazxTlon8JADs=).

4.

Update the Hessian with the L-BFGS method and check if convergence is obtained.

1.b.2 Generate a table that lists the solution time (an estimate will do) and solution quality of the three problems.

|  |  |  |
| --- | --- | --- |
| Case Name | Time(estimation) | Quality(objective) |
| dqrtic | 5s | 1.998169937e-14  good |
| eigenbls | 6s | 3.220988192e-08  good |
| freuroth | 10s | 608159.189  poor |

Problem III.

Question 2:

My code :

param N := 1000;

set idx := 1..N;

var x {1..N} <= 5.12, >= -5.12;

minimize f:

sum {i in 1..N} x[i]^2-10\*cos(6.28 \*x[i]);

solve; display f;

I don’t know why but it cannot be runned on the server, always ‘ syntax error’ or ‘ i is not defined’

2.b

|  |  |  |
| --- | --- | --- |
| n | time | quality |
| 10 |  |  |
| 20 |  |  |
| 50 |  |  |
| 100 |  |  |
| 1000 |  |  |
| 10000 |  |  |

Reference:

[1]http://sepwww.stanford.edu/data/media/public/docs/sep117/antoine1/paper\_html/node6.html