Project 2: Solver Madness

Due date: Friday, October 26, at the beginning of class.

Overview: The goal of this project is very simple: you are to write a general purpose piece of software that, when given a function \( f : \mathbb{R}^m \rightarrow \mathbb{R} \) and a starting point \( x_0 \), endeavors to find \( x_{\text{opt}} \), where

\[
x_{\text{opt}} \equiv \min_{x \in \mathbb{R}^m} |f(x)|.
\]

On Friday, October 26th, during class, we will have a “solve-off”, wherein I supply all teams with a test-suite of trial functions (unknown in advance), and you will use your software to minimize them. We will record both speed and accuracy. The team whose software performs best overall will be invited to ceremonial brownies on Monday.

Details: Your write-up for this project should assume the guise of a “User Guide.” It should contain the following features:

- An Introduction section in which you give a big picture overview of what your code does, who might want to use it, what kinds of functions it handles, etc.

- A body, broken into sections as necessary, explaining the guts of the code. What methods are you using? Are you using a Newton algorithm? A gradient descent algorithm? Both? What is your criterion for convergence? On what sorts of functions have you tested this code? Do you have speed benchmarks for certain simple functions? Are there graphs you can include which demonstrate performance? Are there classes of functions for which you anticipate trouble? What kinds of problems will your code definitively not handle? Possible section headings include things like Underlying Theory, How The Code Was Tested, Performance Benchmarks, Usage/Syntax, etc.

- A Conclusion, in which you review strengths and weaknesses of your code, perhaps suggest to the reader ways in which the code might be modified to be more effective (on certain classes of problems), point to other references, etc.

The code itself should, as usual, be well commented and written with meaningful variable names. It should definitely include a “help” section, so I can type \texttt{help }<\texttt{yourcodename}> \texttt{at the command line and figure out how it works. Store your code in your dropbox before class. Please put the code in a folder called “project2”, and give your files meaningful names (ideally names that also identify the code’s authors.)}

Grading: Your project write-up and your code will be graded as a single entity, and by the same rubric as last time, i.e. for

- spelling/grammar
- style
- mathematical content
- relevance

(See the worksheet I passed out last time for clarification on how I understand these terms.)