MATH 408 WINTER 2010
FIRST PROGRAMMING ASSIGNMENT

Due Friday 08/02/10

GENERAL GUIDELINES:

1. All programs must be written in MATLAB. You may use any machine at your disposal that runs MATLAB. Accounts on the math sciences computing center machines are available.

2. The program should be well documented and all output should be clearly labeled for ease of reference.

3. The interpretation of the numerical output will count for 25% of the grade on the computing projects. That is, you must observe and explain what happened in your numerical experiments in light of the theory we have studied.

4. Turn in the write-up of your interpretations, your program output, and your program listings (in that order), attached together, by the beginning of class on the due date. Please separate the pages of the computer output and trim your output down to 8 1/2 by 11. (Plan for this as you format your output.)

5. Please start early. No late programming sets will be accepted. Leave time to interpret your results.

INSTRUCTIONS FOR THE FIRST ASSIGNMENT:

Write Matlab .m files to implement

1. Newton’s method for minimization (unit step length, so there is no line search),

2. the method of steepest descent with a backtracking line search, and

Apply these programs to the problem

$$\min_{x \in \mathbb{R}^3} f(x) := (x_1 - 2)^4 + (x_1 - 2)^2 x_2^2 + (x_2 + 1)^2,$$

which has solution $x^* = [2; -1]$.

**initial point:** Run each method twice, the first run with initial point $(x_1, x_2) = (1, 1)$ and the second run with initial point $(x_1, x_2) = (10, 10)$.

**backtracking parameters:** $\gamma = 0.5$ and $c = 0.001$

**stopping criteria:** $\min \{\|\nabla f(x_k)\|, \|x_k - x_{k-1}\|\} \leq 10^{-9}$ or the iteration count exceeds 50.

**per iteration printout:** $k$, $x_k$, $f(x_k)$, $\nabla f(x_k)$, $\|x_k - x_{k-1}\|$, and the total number of function calls on that iteration.

**termination printout:**

1. A declaration of why the procedure terminated.
2. The total number of function calls.
3. The total number of derivative calls.
4. The total number of Hessian calls.