AMSC/CMSC 660 Quiz 5 , Fall 2008

Show all work. You may leave arithmetic expressions in any form that a calculator could evaluate. By putting your name on this paper, you agree to abide by the university's code of academic integrity in completing the quiz. Use no books, calculators, cellphones, other electronic devices, communication with others, scratchpaper, etc.

Name ____

1. Consider the limited memory quasi-Newton method using the DFP update formula with $\boldsymbol{C}^{(0)} = \boldsymbol{I}$:

$$\boldsymbol{C}^{(k+1)} = \boldsymbol{C}^{(k)} - \frac{\boldsymbol{C}^{(k)}\boldsymbol{y}^{(k)}\boldsymbol{y}^{(k)T}\boldsymbol{C}^{(k)}}{\boldsymbol{y}^{(k)T}\boldsymbol{C}^{(k)}\boldsymbol{y}^{(k)}} + \frac{\boldsymbol{s}^{(k)}\boldsymbol{s}^{(k)T}}{\boldsymbol{y}^{(k)T}\boldsymbol{s}^{(k)}}$$

As an example, let $k = 2$.

a. (5) What vectors would you store in order to be able to form $\boldsymbol{C}^{(3)}\boldsymbol{v}$ for an arbitrary vector $\boldsymbol{v}$?

b. (5) How many floating-point multiplications would it take to form $\boldsymbol{C}^{(3)}\boldsymbol{v}$?

2. (10) Suppose we measure $y(t_i)$, $i = 1, \ldots, 100$, and we model the relationship between t and y by

$$y_{pred}(t) = x_2 e^{x_1 t}$$

for some parameters x_1 and x_2. We want the "optimal" parameters, the values that minimize the least squares error:

$$\sum_{i=1}^{n} (y(t_i) - y_{pred}(t_i))^2.$$

Consider minimizing this function using `fmin`, a MATLAB-supplied function that minimizes a function of a **single** variable, or `fminunc`, a MATLAB-supplied function that minimizes a function of a vector of variables.

Write a MATLAB function `fcomp = f(x1)` that will evaluate the function to be minimized by `fmin`. (If you don't know how to do this, then for a maximum of 5 points, write a MATLAB function `fcomp = f(x)` to be used by `fminunc`.)