AMSC/CMSC 660 Quiz 7 , Fall 2010

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. (20) Fill in the following table, giving features of various algorithms for minimizing $f(\boldsymbol{x})$. The first line has been completed, as an example.

Method	convergence rate	Storage	f evals/itn	$\boldsymbol{g}$ evals/itn	$\boldsymbol{H}$ evals/ itn
Newton	2	$O(n^2)$	0	1	1
Truncated Newton					
Quasi-Newton					
Steepest descent					
Conjugate gradients					

- Assume that all of these methods are convergent and that any linesearch is exact (i.e., the true optimal value of the stepsize parameter is used).
- Don't include the cost of the linesearch in the table entries. We are omitting this cost because it is the same, independent of method.
- f is the function, $\boldsymbol{g}$ is the gradient, and $\boldsymbol{H}$ is the Hessian matrix. "evals/itn" means the number of evaluations per iteration.
- The convergence rate should be "1" for linear, ">1" for superlinear, or "2" for quadratic.
- Storage should be either $O(1)$, $O(n)$, or $O(n^2)$, where n is the number of variables (i.e., the dimension of $\boldsymbol{x}$).
- Storage of a matrix can be counted as $O(n^2)$; i.e., ignore any sparsity in the matrix.
- "Conjugate gradients" means the nonlinear conjugate gradient method, not the one for solving linear systems (minimizing quadratics).
- "Quasi-Newton" means the usual method (BFGS or DFP), not the limited-memory variant.