HW2
CS 169/268 Optimization
Fall 2015
Due: Thursday October 15 11:59pm on EEE

As in HW1:
Allowed: Reading (but not copying) pseudocode and code in the three recommended/optional books listed first in the class Syllabus. Also, reading external pseudocode after you have tried to write your own code.
Not allowed: Other outside/external code reading or code use (eg. copying or execution).

For each problem turn in: 1-page written description of your approach and results, together with source code and I/O files proving your results.
Programming language: Your choice. (If this gets hard to grade we may limit it in later HWs.) If unsure, use Python.

In like manner to HW1:

1. (Undergrad + Grad students) Implement and test the conjugate-gradient method of optimization for multi-variable unconstrained optimization problems. Test on two multivariable unconstrained optimization problems, of dimensions at least 2 and 10. You may choose the problems but give them nontrivial dependencies among the variables. (For example, Rosenbrock's function for dimension 2.) Parameters to vary include: number of CG iterates before restart; stopping criterion; others optional. For each value of the parameters report (a) average error of the output argument vector and (b) function value produced by the algorithm, and also (c) total number of CG iterations (not sweeps) as a measure of computational cost, along with statistical error bars on those quantities. Probability distribution to use in producing a single average error measurement includes a distribution (eg a broad Gaussian) over starting points; just say what you chose.

2. (Grad students only) Compare the performance of your CG numerically (as above) to some other method such as coordinate descent or steepest descent. What are the pros and cons of each?