(1) For weighted least squares problems, the weight matrix W is allowed to be any SPD matrix in general, not just diagonal matrices. However, the matrix square root $W^{1/2}$ we used in class isn't practical to compute in this case; suggest a way to solve the problem accurately (not the weighted normal equations) even when W is not diagonal. Implement and test your proposal, sending in the code.

(2) In what ways can Moving Least Squares (MLS) break down? Give examples of the problems you can think up.

(3) Adapt the Orthogonal Iteration algorithm to finding the first k singular vectors (both left and right) of a full rank matrix A, and also get the corresponding singular values. Explain your algorithm in the write-up; implement and test it to make sure it works—send your code as well. (MATLAB is fine, as is any other language).

(4) For the model quadratic problem we used in class, also implement Steepest Descent with back-tracking line search. Compare it to the "exact" line search we used. How significant is the quality of line search for the speed of convergence?