INSTRUCTIONS

Due in class on Tuesday January 29, 2008. All problems are from the 2nd edition of Nocedal and Wright unless otherwise specified. Please read Chapter 2 in Nocedal and Wright before beginning the assignment. No late homeworks will be accepted without prior instructor approval.

7. Problem 2.9, Page 29.
8. Consider the problem

$$\min_x ||Ax - b||^2$$

where $A$ is an $m \times n$ matrix, $b$ is an $m$ dimensional vector, and the solution $x$ is an $n$ dimensional vector.

(a) What is the first order necessary condition for optimality? Is it also a sufficient condition?

(b) Is the optimal solution unique? Give reasons for your answer.

(c) Can you give a closed form expression for the optimal solution? Specify any assumptions that you may need.

(d) Solve the problem for

$$A = \begin{bmatrix} 2 & -1 & 0 \\ 0 & 2 & 2 \\ 0 & 1 & 0 \\ 1 & 0 & 1 \end{bmatrix}, \quad b = \begin{bmatrix} 2 \\ 6 \\ 2 \\ 0 \end{bmatrix}.$$