Math 164, Lecture 2, Vese
Homework #9, due on Friday, March 17,, OR on Monday, March 20
(no late homework accepted after March 20)

Notes:
REMINDER: Final exam on Monday, March 20, 2005, time 3:00pm-6:00pm.
- Sample final practice problems are posted on the class web page.
- All sections and topics are covered for the final. However, more questions will be from the second part (already covered after the midterm).

Sections covered for the final exam:
- 2.2, 2.3, 3.1, 4.1-4.4, 5.2 (except 5.2.1), 5.2.2 (already covered for the midterm)
- 6.1, 6.2 (proof of Thm. 6.2 not included), 6.2.1,
- Appendices A6, B4, B5, B6, B7.
- 2.3.1, 2.6, 2.7 (except Thm. 2.2), 2.7.1, 3.2
- 10.2, 10.3 (except Thm. 10.1)
- 14.2, 14.3 (only what is presented on page 437, not the discussion on the perturbed problem)
- 14.4 (read also Lemma 14.5, but this Lemma is not included for the final)
- 14.5.1 (just to know the sufficient conditions, and apply them to a specific example)

Problems:

[**1**] Consider the problem

$$\text{minimize } f(x) = \frac{1}{2}x^T Q x - c^T x$$

where Q is a positive definite matrix. Prove that Newton's method will determine the minimizer of f in one iteration, regardless of the starting point (use Appendix B5 and Thm. 2.1, page 22)

[**2**] Consider the problem

$$\text{minimize } f(x) = x_1^2 + x_1^2 x_3^2 + 2x_1 x_2 + x_2^4 + 8x_2$$

$$\text{subject to } 2x_1 + 5x_2 + x_3 = 3.$$

(a) Determine which of the following points are stationary points:
(i) $(0,0,2)^T$; (ii) $(0,0,3)^T$; (iii) $(1,0,1)^T$
(b) Determine whether each stationary point is a local minimizer, a local maximizer or a saddle point.

[**3**] Solve the problem

$$\text{maximize } f(x) = x_1 x_2 x_3$$

$$\text{subject to } \frac{x_1}{a_1} + \frac{x_2}{a_2} + \frac{x_3}{a_3} = 1 \quad (a_1, a_2, a_3 > 0)$$

[**4**] Solve the problem: Minimize $f(x_1, x_2) = \frac{1}{2}x_1^2 + x_2^2$ subject to

$$\begin{aligned} 2x_1 + x_2 &\geq 2 \\ x_1 - x_2 &\leq 1 \\ x_1 &\geq 0. \end{aligned}$$