Math 164, Lecture 2, Vese
Homework #10, due on Friday, Dec. 9nd, 2005
(no late homework accepted)

Notes:
REMINDER: Final exam on Friday December 16, 2005, 8:00am-11:00am, Room: MS 6229 (the usual lecture room).

- The final is a closed-book and closed-note exam. No exam at a time other than the designated ones will be allowed (exceptions for illness with document proof, or emergency).
- Additional office hours and review session will be scheduled during the week of finals (we discuss this on Friday, last day of lectures).
- Sample practice problems will be posted on the class web page
- All sections and topics are covered for the final. However, more questions will be from the second part (topics covered after the midterm).

Sections covered for the final exam:

- 1.2-1.5, 2.2-2.3, 3.1, 4.1-4.4, 5.2 (already covered for the midterm)
- 6.1, 6.2, 6.2.1 (section 6.2.2. is not included)
- Appendices A6, B4, B5, B6, B7.
- 2.3.1, 2.6,
- 2.7 (except the convergence thm.), 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 (just to know the stated results, and apply them to a specific example)

Problems:
Page 434, # 1, #2, #9, and page 307, #6.
(for #6 see also appendix B5)

[**1**] (Page 307, #6) 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. (see also Thm. 2.1, page 22)

[**2**] (Page 434, #1) Consider the problem

$$\text{minimize } f(x) = x_1^2 + x_1^2 x_3^2 + 2x_1x_2 + x_2^4 + 8x_2$$

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

(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 staionary point is a local minimizer, a local maximizer or a saddle point.

[**3**] (Page 434, #2) Solve the problem

$$\text{maximize } f(x) = x_1x_2x_3$$

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

[**4**] (Page 434, #9) Let Z be a null-space matrix for the matrix A. Prove that if $\nabla f(x_*) = A^T\lambda$ for some λ, then $Z^T\nabla f(x_*) = 0$.