Assignment #3b of Mathematical Programming
Deadline July 3, 2006

1. **Exercise 3.39 (d):** Hint: Follow the hint in p.121. The essential is to show that f^{**} is the pointwise supremum of all affine global underestimators of f. To show it, consider the function

$$z \in \mathbf{dom}\, f, \quad y \in \mathbf{dom}\, f^*, \quad g(z, y) = z^T y - f^*(y) = z^T y - \sup_{x \in \mathbf{dom}\, f} \{x^T y - f(x)\}.$$

   Then

$$f^{**}(z) = \sup_{y \in \mathbf{dom}\, f^*} g(z, y).$$

   Show that $g(z, y)$ is linear in z, and $f(z) - g(z, y) \geq 0$ for every $z \in \mathbf{dom}\, f$.

2. **Exercise 3.43:** Hint: Follow the proof of the first order condition for convexity in p.70.

3. **Exercise 3.60:** The proof is easy if we use the definition of K-convexity carefully. Be sure that the function f maps $\Re^n$ to "$\Re^m$."