Convex Optimization and Modeling	Jun.-Prof. Matthias Hein
Exercise Sheet 5 - 12.05.2010	due: 19.5.2010

Exercise 9 - Solution of simple QCQPs

a. **(6 Points)** Exercise 4.21. The introduction of the new variable $y = A^{-\frac{1}{2}}x$ simplifies all problems. Note additionally, that for a symmetric matrix A the smallest eigenvalue $\lambda_{\min}(A)$ of A is given as

$$\lambda_{\min}(A) = \min\{\langle y, Ay\rangle \mid \|y\|^2 = 1\},$$

or equivalently,

$$\lambda_{\min}(A) = \min_y \frac{\langle y, Ay\rangle}{\|y\|^2}.$$

Exercise 10 - Robust quadratic programming

Robust programming is useful in many applications where full knowledge of the problem parameters is unavailable. Robust programming optimizes the worst case over all possible parameter possibilities.

a. **(4 Points)** Exercise 4.28a) and b). For b) it might be helpful to first consider the effect of such a perturbation on a fixed vector x,

$$\langle x, (P - P_0)x\rangle .$$

Exercise 11 - Lagrangian, dual problem and strong duality

a. **(5 Points)** Exercise 5.1a)-c).