Fachbereich Mathematik und Statistik
Prof. Dr. Stefan Volkwein
Roberta Mancini, Sabrina Rogg, Stefan Trenz

# Numerische Verfahren der restringierten Optimierung 

http://www.math.uni-konstanz.de/numerik/personen/volkwein/teaching/

## Sheet 1

## Deadline for hand-in: 30.10.2014 at lecture

## Exercise 1

(2 Points)
Consider the problem of finding the point on the parabola $y=\frac{1}{5}(x-1)^{2}$ that is close to $(x, y)=(1,2)$, in the Euclidean norm sense. We can formulate this as

$$
\min f(x, y)=(x-1)^{2}+(y-2)^{2} \quad \text { u.d.N. }(x-1)^{2}=5 y .
$$

a) Find all the KKT points for this problem. Are all points regular points?
b) Which of these points are solutions?

Exercise 2 Solve the problem

$$
\min _{x} x_{1}+x_{2} \quad \text { s.t. } x_{1}^{2}+x_{2}^{2}=1
$$

by eliminating the variable $x_{2}$. Show that the choice of sign for the square root operation during the elimination process is critical; the "wrong" choice leads to an incorrect answer.

## Exercise 3

Consider the problem

$$
\min _{x}\left(x_{1}-\frac{3}{2}\right)^{2}+\left(x_{2}-t\right)^{4} \quad \text { s.t. }\left[\begin{array}{l}
1-x_{1}-x_{2} \\
1-x_{1}+x_{2} \\
1+x_{1}-x_{2} \\
1+x_{1}+x_{2}
\end{array}\right] \geq 0
$$

where $t$ is a parameter to be fixed prior to solving the problem.
a) For what values of $t$ does the point $x^{*}=(1,0)^{\top}$ satisfy the KKT conditions?
b) Show that when $t=1$, only the first constraint is active at the solution, and find the solution.

