# Problems in 02612 Constrained Optimization 2016

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Assignment 2.
You must hand in a report describing your answers to the questions in problem 1-3.

The deadline for handing in the report is 13:00, May 09, 2017. To CampusNet, you must upload 1) a pdf with your report and 2) a zip-file with all your matlab code and other material used to produce your report. You must also hand in a report to John Bagterp Jørgensen (303B/110)

## 1 Problem 1 - Interior-Point Algorithm for Linear Programming

Problem 14.15 in Nocedal and Wright, p. 419-420.

You must describe and list the algorithm you use. You must also provide a test script that tests your interior-point LP implementation.

## 2 Problem 2 - Equality Constrained SQP

1. Problem 18.3 in Nocedal and Wright (p. 562, note that they have interchanged the starting point $x_0$ and the solution $x^*$). Make a table with the iteration sequence. Describe your program and make a flow chart of its structure. You should have separate functions for computation of $f(x)$, $\nabla f(x)$, $\nabla^2 f(x)$, $c_i(x)$, $\nabla c_i(x)$, $\nabla^2 c_i(x)$.

2. Implement the procedure with a damped BFGS approximation to the Hessian matrix. Make a table with the iteration sequence.

3. Implement the procedure with a damped BFGS approximation to the Hessian matrix and line search. Make a table with the iteration sequence.

4. Plot the rate of convergence for the 3 algorithms implemented. Comment on the rate of convergence for the 3 algorithms.

## 3 Problem 3 - Inequality Constrained SQP

Consider the problem

$$\min_x \quad f(x) = (x_1^2 + x_2 - 11)^2 + (x_1 + x_2^2 - 7)^2 \tag{3.1a}$$

$$s.t. \quad c_1(x) = (x_1 + 2)^2 - x_2 \geq 0 \tag{3.1b}$$

$$c_2(x) = -4x_1 + 10x_2 \geq 0 \tag{3.1c}$$

1. Implement a SQP procedure with a damped BFGS approximation to the Hessian matrix. Make a table with the iteration sequence for different starting points. Plot the iteration sequence in a contour plot.

2. Implement the procedure with a damped BFGS approximation to the Hessian matrix and line search. Make a table with the iteration sequence. Make a table with relevant statistics (function calls etc). Plot the iteration sequence in a contour plot.

3. Implement a Trust Region based SQP algorithm for this problem. Make a table with the iteration sequence. Make a table with relevant statistics (function calls etc). Plot the iteration sequence in a contour plot.