Deadline: Sun Jan. 28, 2024, 8:00 am Submit single unzipped PDF file on learn-web course "SoSe 2023: 3104 Modern Optimization Techniques

Instructions

Please following these instructions for solving and submitting the exercise sheet.

1. Student should clearly write his/her name, matriculation number and tutorial group number (i.e. "Group 1: Tuesday Tutorial", "Group 2: Wednesday Tutorial").
2. The submission should be made before the deadline, only through learnweb to your group submission link.
3. Should be submitted as a single unzipped PDF file on learn-web course "SoSe 2023: 3104 Modern Optimization Techniques".
4. Each student must submit an individual solution in-order to be eligible for bonus points.
5. Group submission are acceptable but will not contribute towards bonus points.

1 Inequality Constrained Minimization Problems (10 points)

a) For inequality-constrained optimisation problem, can we find the search direction (Δx) in active set method without using gradient projection? If so, please explain one method. Given function to be minimized is quadratic and the constraints are affine. (3 pts)

b) What is null space of a matrix and why is it needed for the gradient projection method? (2 pts)
Given:
$A = \begin{pmatrix} 2 & 3 & 4 \\ -1 & 2 & 3 \end{pmatrix}$
Compute the null space of A and prove it. (3 pts)

2 Computing the Dual Problem (10 points)

a) Solve the following optimization problem using quadratic programming: (5 pts)

$$\begin{array}{ll} \text{minimize} & x_1^2 + x_2^2 \\ \text{subject to:} & x_1 + x_2 \leq 1 \\ & x_2 - 2x_1 = 1/2 \end{array}$$

b) Solve the same optimization problem using Newton method with $x^{(0)} = (1 \quad 1)$ until the solution reaches convergence threshold of 0.1. (5 pts)