

Optimization Algorithms (ACM 41030)

Second Written Exam

23/04/2026

The second written exam is worth 50% of the module grade. This will take place as a full end-of-trimester exam in the RDS. Note the duration: the exam will last **60 minutes**.

The exam will contain 4 questions, For maximum marks, all 4 questions must be answered. The exam format is **closed book**. Non-programmable calculators are permitted.

The questions will involve a mixture of theory and calculations / exercises. The following theory is examinable:

- The projection operator – Section 12.4
- First-order optimality conditions in case of a single inequality constraint – Section 13.2
- Showing that if the LICQs are satisfied, then the Lagrange Multipliers are unique - Section 15.1, Theorem 15.2
- Showing that the tangant cone is inside the set of LFDDs; showing that the tangant cone and the LFDDs are the same when the LICQs are satisfied – Section 15.2, Theorem 15.3.

NOTE: you can assume without proof that the matrix $\begin{pmatrix} A \\ Z^T \end{pmatrix}$ has full row rank.

- Assuming Farkas's Lemma, prove the necessary conditions (KKT conditions) for a feasible point \mathbf{x}_* to be a minimizer - Section 16.4

The calculations / exercises will come exclusively from Exercises 5 and 6:

- Everything on Exercises 5 is examinable.
- Everything on Exercises 6 is examinable except for:
 - Question 5, which requires a computer for the solution.