Evaluation Criteria for TANA15
Numerical Linear Algebra

EXAMINATION

TEN1	Written Exam	2.5 hp	U, 3, 4, 5
LAB1	Computer Laborations	1.5 hp	U, G

Intended learning outcomes

The course is intended to provide basic knowledge about important matrix decompositions; such as the LU or SVD decompositions, and show how matrix decompositions can be used for analyzing and solving both practical and theoretical problems. The course also covers various important techniques from Linear Algebra, such as the Shur complement, convolutions, polynomial manipulation, or orthogonal basis generation. Both linear and non-linear least squares problems are also discussed in the course.
After the course students should be able to:

M1 Discuss the most common matrix factorizations, and explain their properties.

M2 Understand how the most common matrix factorizations are computed; and implement numerical algorithms for computing the most important factorizations.

M3 Use matrix factorizations for solving both theoretical problems and practical problems from applications.

M4 Use Linear Algebra techniques when solving important application problems, such as pattern recognition, data compression, signal processing, search engines, or model fitting.

Course content

- **Linear algebra:** LU-decomposition, SVD, psuedoinverse, orthogonal transformations, Householder transformations, Projections, QR-decomposition and least squares problems.
- **Eigenvalues:** Normal forms, perturbation theory, Rayleigh quotient, the power method, invers iteration, transformation to Hessenberg and tridiagonal form, QR-iteration.
- **Non-linear system of equations and least squares problems:** Newton's and Gauss-Newton's methods. Updating methods.

Evaluation Criteria for the Examination

Here we describe the criteria used for the different grades available for the course. We also demonstrate how the intended learning outcomes relates to the examination for the course.

Grade	Criteria (what is required of the student)	Examination
3	The student can demonstrate sufficient knowledge: **M1**: discuss the basic matrix decompositions included in the course, and also use the decompositions to discuss basic linear algebra concepts, such as rank or the range of a linear operator. **M1-M2**: discuss the algorithms used for computing the basic decompositions and their properties. **M3**: implement a selection of the the algorithms discussed in the course on a computer. **M4**: Solve practical problems from applications using a computer and standard software.	TEN1 LAB1
5	The student can demonstrate knowledge, in addition to the criteria for a lower grade: **M1**: present proofs for existance and uniqueness for a selection of the decompositions included in the course. **M2**: present proofs that demonstrate that the algorithms discussed in the course actually computes the correct decomposition.	TEN1

For Grade 4 everything needed for Grade 3 is required, and also an understanding of a significant portion of the material needed for Grade 5 needs to be demonstrated.