

# Study guide: Applied Matrix Analysis MAA704

## Course homepage:

Additional information and course material is available here:  
[www.mdh.se/ukk/utbildning/amnen/matematik/kurser/kurs\\_hemsidor/maa704](http://www.mdh.se/ukk/utbildning/amnen/matematik/kurser/kurs_hemsidor/maa704)

## Objectives:

The course provides broad knowledge of applications of matrices and of the essential tools of matrix analysis in various areas of engineering and natural sciences. The basic concepts and methods of importance for further study is explained with practical examples from finance, economics, statistics, discrete mathematics and related models from energy, environment and resource optimization, systems analysis, automatic control, computer science and information technology. In addition to training in logical and geometric thinking and the modeling and computing with matrices of particular importance for applications, as well as the capacity for independent analysis and solution of mathematical problems and models is trained.

## Examination:

PRO1, 4.5 credits, marks Pass (G) or Pass with distinction (VG), Project with presentation  
INL1, 3 credits, marks Pass (G) or Pass with distinction (VG), Exercise assignment

## Course literature:

Compendium and lecture notes. For the projects some additional material will be provided. The course compendium will be updated continuously during the course, if you want to print a copy it is recommended to wait with printing a chapter until after the first lecture on that section in order to get the latest version.

See the course homepage or Blackboard for the compendium itself as well as any additional material.

## Course content:

### Lectures:

The course consists of 11 lectures between three and four hours each. Usually the Tuesday lectures will mainly consist of presentation of the theory while the Friday lectures will look more at examples and how the theory can be applied. There will also be opportunities to ask questions about the projects and assignments during the lectures.

Lecture	Contents	Remark
1	Roll call and introduction	
2	Matrix factorization	
3	Non negative matrices and Markov chains	
4	Non negative matrices and Markov chains	Last day to choose group and topic
5	Linear spaces and norms	
6	Norms and linear transformations	
7	Least square method, regression	Exercise assignment 1
8	Least square method, regression	
9	Classification and evaluation	
10	Matrix functions and matrix equations	
11	Quadratic forms	
P	Project presentations	Exercise assignment 2
D	Last day to submit project report	11/1 - 23.59

**Examination:**

PRO1, 4.5 credits, marks Pass (G) or Pass with distinction (VG), Project with presentation  
 INL1, 3 credits, marks Pass (G) or Pass with distinction (VG), Exercise assignment

Examination consists of 2 exercise assignments and one project.

Each examination can be either passed or failed and gives a number of points, the total number of points decides the final grade. The exercise assignments can give at most 15 points each and the project a maximum of 20 points. The grade is decided by the total points sum, as seen in the table below.

Examination	Maximum	Passed	Grade (ECTS)	Grade (G/VG)	Points
Exercise assignment 1	15	20 total	A	VG	45 - 50
Exercise assignment 2	15		B	VG	40 - 44
Project	20	10	C	G	34 - 39
Total	50	30*	D	G	31 - 33
			E	G	30*

\*For a passing grade at least 20 points are needed from the exercise assignments and at least 10 points are needed from the project. A presentation of the project is always required for a passing grade.

**Exercise assignments:**

Each exercise assignment consists of two parts, one part consisting of 3 – 5 elementary problems for a maximum of 10 points from each assignment. For the second part consisting of problems in applications you are to choose one of four problems to solve. This part can give up to 5 points from each assignment.

For a passing grade you need at least 20 points in total from the two assignments.

**Project:**

The projects are to be done in groups of 2 – 3 people. The project consists of a written report of approximately 5 – 15 pages and an oral presentation. There is a list of suggestions of topics available on the course homepage and Blackboard. If you have not chosen a group and a topic before 21 of November you will be assigned a group and topic by the teachers.

The presentations should be 15 minutes long (might be changed depending on number of groups) and be given during the time for project presentations on the 19th of December. It is recommended to send a draft of your project report to the teachers before the 12th of December so you have the possibility to get some feedback on your project.

The report and presentation can give a maximum of 20 points. Both the report and presentation are required to pass the project, furthermore the report and presentation must be awarded at least 10 points.

**Course evaluation:**

The course will be evaluated at the end of the course. The students are encouraged to express their opinions and give suggestions during the course as well.

**Teachers:**

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