Exchange programme Vrije Universiteit

Vrije Universiteit Amsterdam - Exchange programme Vrije Universiteit - 2022-2023

Exchange

Vrije Universiteit Amsterdam offers many English-taught courses in a variety of subjects, ranging from arts & culture and social sciences, neurosciences and computer science, to economics and business administration.

The International Office is responsible for course approval and course registration for exchange students. For details about course registration, requirements, credits, semesters and so on, please visit the exchange programmes webpages.

Linear Algebra

Course Code	X_400649
Credits	6.00
Period	P5
Course Level	200
Language Of Tuition	English
Faculty	Faculty of Science
Course Coordinator	prof. dr. J. Hulshof
Examiner	prof. dr. J. Hulshof
Teaching Staff	prof. dr. J. Hulshof, E. Sandin Vidal
Teaching method(s)	Seminar, Lecture, Practical

Course Objective

All that's below falls under:
- Knowledge and understanding
- Applying knowledge and understanding
- Making judgements
- Communication
- Lifelong learning skills (since Linear Algebra appears in all of science and industry)

Besides to be able to explain, interrelate, know the basic properties of, and construct simple arguments with the concepts listed above, the student will learn the following skills (organized by topic):

Linear systems:
- Can solve systems of linear equations using row-reduction
- Can determine the number of solutions of a linear system
- Can prove or disprove simple statements concerning linear systems

Linear transformations:
- Can determine if a linear transformation is one-to-one and onto
- Can compute the standard matrix of a linear transformation
- Can use row-reduction to compute the inverse of a matrix
- Can prove or disprove simple statements concerning linear transformations

Subspaces and bases:
- Can compute bases for the row and column space of a matrix
- Can compute the dimension and determine a basis of a subspace
- Can prove or disprove simple statements concerning linear systems

Eigenvalues and eigenvectors:
- Can compute the eigenvalues of a matrix using the characteristic equation
- Can compute bases for the eigenspaces of a matrix
- Can diagonalize a matrix
- Can prove or disprove simple statements concerning eigenvalues and eigenvectors

Orthogonality:
- Can compute the orthogonal projection onto a subspace
- Can determine an orthonormal basis for a subspace using the Gramm-Schmidt algorithm
- Can solve least-squares problems using an orthogonal projection
- Can orthogonally diagonalize a symmetric matrix
- Can compute a singular value decomposition of a matrix
- Can prove or disprove simple statements concerning orthogonality

Course Content

The topics that will be treated are listed below. For every topic, the relevant concepts are listed.

Linear systems:
linear system (consistent/inconsistent/homogeneous/inhomogeneous), (augmented) coefficient matrix, row equivalence, pivot position/column, (reduced) echelon form, basic/free variable, spanning set, parametric vector form, linear (in)dependence.

Linear transformations:
linear transformation, (co)domain, range and image, standard matrix, one-to-one and onto, singularity, determinant, elementary matrices.

Subspaces and bases:
subspace, column and null space, basis, coordinate system, dimension, rank.

Eigenvalues and eigenvectors:
eigenvalue, eigenvector, eigenspace, characteristic equation/polynomial, algebraic multiplicity, similarity, diagonalization and diagonalizability.

Orthogonality:
dot product, norm, distance, orthogonality, orthogonal complement, orthogonal set/basis, orthogonal projection, orthonormality, orthonormal basis, Gramm-Schmidt process, least squares problem/solution, orthogonal diagonalization, singular value/vector, singular value decomposition, Moore-Penrose inverse.

Additional Information Teaching Methods

The course is spread over a period of seven weeks. Each week there will be two theoretical classes of 90 minutes each and two exercise classes of 90 minutes each.

Method of Assessment

There is a written exam at the end of the course.

Literature

Linear Algebra and its Applications, by David C. Lay, Steven R. Lay en Judi J. McDonald, global edition (fifth edition), Pearson.

Additional Information Target Audience

Bachelor Artificial Intelligence (year 2)
Bachelor Computer Science (year 2)