UCLouvain

linfo1113

2022

Numerical algorithmic

6.00 credits	30.0 h + 30.0 h	Q2

Teacher(s)	Massart Estelle ;Quertenmont Loïc ;
Language :	French
Place of the course	Louvain-la-Neuve
Prerequisites	This course assumes that the student already masters the basics of programming (instructions, variables, loops, conditions, ...) and programming methodology as taught in courses LINFO1101 or LEPL1401. The basic notions of algebra and analysis covered by courses LINFO1111 and LINFO11112 should also be mastered. *The prerequisite(s) for this Teaching Unit (Unité d'enseignement – UE) for the programmes/courses that offer this Teaching Unit are specified at the end of this sheet.*
Main themes	• Representation of floating point numbers • rounding error problem and error propagation (discussion for the methods below). • Notion of convergence and stopping criteria of iterative methods • Representation of matrices, efficient multiplication of matrices • Resolution of linear systems, including iterative methods • Interpolations and regressions • Numerical integration, numerical differentiation • Resolution of ordinary differential equations: problems with initial value • Resolution of nonlinear equations (function roots), application to simple one-dimensional optimization problems (including notion of minimum / maximum local or global) Since the course is intended for IT professionals, the emphasis will be on practical implementation of these methods. Applications and examples will be taken preferably in the other courses of the program SINF1BA (economics, electronic basics for computer science, for example). Otherwise, they will be taken in other domains (mechanical, for example) but the teacher will take care to introduce the relevant concepts.
Learning outcomes	**At the end of this learning unit, the student is able to :** Given the learning outcomes of the "Bachelor in Computer science" program, this course contributes to the development, acquisition and evaluation of the following learning outcomes: • S1.G1, S1.I3 • S2.2, S2.4 • S5.1 1 Students who have successfully completed this course will be able to: • model a simple problem using the proper mathematical notation, • identify classical numerical methods suitable for solving a simple problem expressed mathematically, • choose, on the basis of precise criteria, the most effective method for numerically solving such a problem, • implement a numerical resolution of this simple problem, • explain the problems related to the numerical resolution of equations and their impacts: rounding errors, convergence, stopping criteria.
Evaluation methods	If the sanitary conditions allow it, the exam will be carried out face-to-face, in writing with open questions and, failing that, remotely in writing with a mix of open questions and multiple-choice questions on the moodle platform. The assessment covers all the material seen during the lectures and practical work. The exam mark counts for 90% of the final evaluation, the remaining 10% coming from continuous work and attendance during the exercise sessions. The mark obtained for the continuous work and attendance holds for the whole academic year (no re-evaluation during the second exam session for this part).
Teaching methods	By presentation of the concept and by implementation. If the COVID allows it, the lectures are given face-to-face or, if not, remotely. Practical work is given entirely in the classroom if possible, otherwise it is given every other week in the classroom and every other week remotely.
Content	Introduction to numerical methods by means of description and especially implementation of concepts from algebra and analysis courses. The aim is to develop algorithms to understand the limits of implementing a mathematical concept: data representation (numbers,...) and error processing (calculation, stability, propagation,...).

	Language: Python
Inline resources	https://moodleucl.uclouvain.be/course/view.php?id=12977
Faculty or entity in charge	INFO

Programmes containing this learning unit (UE)				
Program title	Acronym	Credits	Prerequisite	Learning outcomes
Master [120] in Data Science : Statistic	DATS2M	6		🔍
Bachelor in Computer Science	SINF1BA	6	LINFO1101 AND LINFO1111 AND LINFO1112	🔍