

At Louvain-la-Neuve - 120 credits - 2 years - Day schedule - In english

Dissertation/Graduation Project : **YES** - Internship : **optional**

Main study domain : **Sciences de l'ingénieur et technologie**

Organized by: **Ecole Polytechnique de Louvain (EPL)**

Programme acronym: **date2m** - Francophone Certification Framework: 7

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DATE2M - Introduction

Introduction

Introduction

The digital transformation of society has led to explosive growth in the volume of data available. Most of the players in society now place great importance on using this data to help make objective decisions and develop their disciplinary focus. These specific needs have resulted in the emergence of **new data-oriented careers**.

The engineering master's in data science offers a course in **scientific methods and technology tools** for answering social or scientific questions based on **the processing of frequently massive data sets** ("big data"). This discipline usually requires a structured model of the problem in question to be combined with statistics and mathematics to deliver a rigorous, quantitative, operational solution to the question posed. Computer infrastructure and complex calculation algorithms thus complement scientific methods in structuring and processing the data.

The **fields of application** of data science are extremely varied: political and security decision-making, real-time online advertising, e-commerce, processing network data, processing financial and industrial production data, biomedical research based on omics or imaging data.

Your future job

Your degree in data science prepares you for the posts of data scientist, data analyst, data and analytics manager or data engineer and equips you to take on responsibilities in these areas.

Your programme

The data science programme draws on four common foundations:

- Data structures and data processing algorithms.
- Theories of learning, data mining and viewing multidimensional data.
- Statistical inference and modelling.
- Applications.

DATE2M - Teaching profile

Learning outcomes

On successful completion of this programme, each student is able to :

1. Démontrer la maîtrise d'un solide corpus de connaissances en sciences des données, lui permettant de résoudre les problèmes qui relèvent de sa discipline
 - 1.1. Les structures de données et algorithmes pour l'analyse de données
 - 1.2. Les théories de l'apprentissage, la fouille de données et la visualisation de données de grande dimension
 - 1.3. L'inférence statistique, la modélisation et l'informatique statistique.
 - 1.4. Les aspects industriels et entrepreneuriaux de la science des données. L'étudiant dans l'orientation en technologies de l'information se spécialise via une option
 - 1.5. Les systèmes informatiques, y compris le calcul distribué, le calcul embarqué, les réseaux et la sécurité
 - 1.6. Les méthodes numériques et l'optimisation, y compris la programmation par contraintes, la recherche opérationnelle, l'identification et les mathématiques appliquées
2. Organiser et de mener à son terme une démarche de développement d'un système d'exploitation des données répondant aux besoins généralement complexes d'un client.
 - 2.1. Analyser le problème à résoudre ou les besoins fonctionnels à rencontrer et formuler le cahier des charges correspondant.
 - 2.2. Formaliser et modéliser le problème et concevoir une ou plusieurs solutions techniques originales répondant à ce cahier des charges.
 - 2.3. Evaluer, justifier et classer les solutions au regard de l'ensemble des critères figurant dans le cahier de charges : efficacité, faisabilité, qualité, pertinence et sécurité.
 - 2.4. Implémenter, tester et valider la solution retenue et en interpréter les résultats.
 - 2.5. Formuler des recommandations pour améliorer le caractère opérationnel de la solution.
3. Organiser et de mener à son terme un travail de recherche pour appréhender une problématique inédite liée à l'exploitation de données selon une méthodologie ou dans un environnement nouveau.
 - 3.1. Se documenter et résumer l'état des connaissances actuelles dans le domaine considéré.
 - 3.2. Proposer une modélisation et/ou un dispositif expérimental permettant de simuler et de tester des hypothèses relatives au problème étudié.
 - 3.3. Mettre en forme un rapport de synthèse visant à décrire la méthodologie avec rigueur et expliciter les potentialités d'innovation théoriques et/ou techniques résultant de ce travail de recherche.
4. Contribuer en équipe à la conduite d'un projet d'exploitation de données et le mener à son terme en tenant compte des objectifs, des ressources allouées et des contraintes qui le caractérisent.
 - 4.1. Cadrer et expliciter les objectifs d'un projet (en y associant des indicateurs de performance) compte tenu des enjeux et des contraintes qui caractérisent l'environnement du projet.
 - 4.2. S'engager collectivement sur un plan de travail, un échéancier et des rôles à tenir.
 - 4.3. Fonctionner dans un environnement pluridisciplinaire, conjointement avec d'autres acteurs porteurs de différents points de vue : gérer des points de désaccord ou des conflits.
 - 4.4. Prendre des décisions en équipe lorsqu'il y a des choix à faire : que ce soit sur les solutions techniques ou sur l'organisation du travail pour faire aboutir le projet.
5. Communiquer efficacement oralement et par écrit en vue de mener à bien les projets qui lui sont confiés dans son environnement de travail (en particulier en anglais).
 - 5.1. Identifier clairement les besoins du « client » ou de l'utilisateur : questionner, écouter et comprendre toutes les dimensions de sa demande et pas seulement les aspects techniques.
 - 5.2. Argumenter et convaincre en s'adaptant au langage de ses interlocuteurs : techniciens, collègues, clients, supérieurs hiérarchiques.
 - 5.3. Communiquer sous forme graphique et schématique ; interpréter un schéma, présenter les résultats d'un travail, structurer des informations.
 - 5.4. Lire, analyser et exploiter des documents techniques (diagrammes, manuels, cahiers de charge...).
 - 5.5. Rédiger des documents écrits en tenant compte des exigences contextuelles et des conventions sociales en la matière.
 - 5.6. Faire un exposé oral convaincant en utilisant les techniques modernes de communication.
6. Faire preuve à la fois de rigueur, d'ouverture, d'esprit critique et d'éthique dans son travail.
 - 6.1. Appliquer les normes en vigueur dans les disciplines de la science des données (terminologie, mesures de qualité, ...).
 - 6.2. Trouver des solutions qui vont au-delà des enjeux strictement techniques, en intégrant les enjeux de dimension éthique d'un projet (y compris la confidentialité des données et la protection de la vie privée) et de développement durable
 - 6.3. Faire preuve d'esprit critique vis-à-vis d'une solution technique pour en vérifier la robustesse et minimiser les risques qu'elle présente au regard du contexte de sa mise en Œuvre.
 - 6.4. S'autoévaluer et développer de manière autonome les connaissances nécessaires pour rester compétent dans son domaine.

Programme structure

The 120-credit programme of the Master's degree in Data Science consists of :

- A core curriculum of at least 53 credits of:
 - Data structures and algorithms for data analysis
 - Machine learning and data mining
 - Statistics
- a specialized 30-credit mandatory courses including the Master Thesis and an industrial seminar,
- at least one major (Numerical Methods and Optimization or Computer Systems),
- elective courses to achieve at least 120 credits.

An additional teaching module may be added to the 120-credit programme for students who do not have all the prerequisites for the Master's degree. These teaching units will be selected with the study advisor.

For a typical programme, this Master's degree will total, whatever the purpose, options and/or elective courses selected, a minimum of 120 credits spread over two annual blocks corresponding to 60 credits each.

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For a programme-type, and regardless of the focus, options/or elective courses selected, this master will carry a minimum of 120 credits divided over two annual units, corresponding to 60 credits each.

[> Tronc commun](#) [en-prog-2020-date2m-ldate220t.html]

[> Professional Focus](#) [en-prog-2020-date2m-ldate200s]

Options courses

- > [Majors in business creation and management](#) [en-prog-2020-date2m-ldate101g.html]
 - > [Major in small and medium sized business creation](#) [en-prog-2020-date2m-lfsa221o.html]
 - > [Major Business risks and opportunities](#) [en-prog-2020-date2m-lfsa220o.html]
- > [Elective courses](#) [en-prog-2020-date2m-ldate104g.html]
 - > [Elective courses available for Master students in Data Sciences Engineering](#) [en-prog-2020-date2m-ldate223o.html]
 - > [Elective courses: transversal skills and contacts with industry](#) [en-prog-2020-date2m-lgbio955o.html]
- > [Majors in data science](#) [en-prog-2020-date2m-ldate105g.html]
 - > [Major in computer systems](#) [en-prog-2020-date2m-ldate220o.html]
 - > [Major in numerical methods and optimization](#) [en-prog-2020-date2m-ldate221o.html]
 - > [Major in Cryptography and information security](#) [en-prog-2020-date2m-lmap234o.html]

DATE2M Detailed programme

Programme by subject

CORE COURSES

- Mandatory
△ Courses not taught during 2020-2021
⊕ Periodic courses taught during 2020-2021
⊗ Optional
⊖ Periodic courses not taught during 2020-2021
■ Activity with requisites

Click on the course title to see detailed informations (objectives, methods, evaluation...)

Year
1 2

o Data structures and algorithms for data analysis

| ● LINGI2172 | Databases | Siegfried Nijssen | 30h+30h | 6 Credits | 2q | x | x |
|-------------|----------------------------|---|------------|-----------|----|---|---|
| ● LINMA2472 | Algorithms in data science | Vincent Blondel Jean-Charles Delvenne (coord.) Gautier Krings (compensates Vincent Blondel) | 30h +22.5h | 5 Credits | 1q | x | x |
| ● LDATA2010 | Information visualisation | John Lee | 30h+30h | 5 Credits | 1q | x | x |

o Machine learning

| | | | | | | | |
|-------------|---|------------------------------|---------|-----------|----|---|---|
| ● LINGI2262 | Machine Learning :classification and evaluation | Pierre Dupont | 30h+30h | 5 Credits | 2q | x | x |
| ● LELEC2870 | Machine learning : regression, deep networks and dimensionality reduction | John Lee Michel Verleysen | 30h+30h | 5 Credits | 1q | x | x |
| ● LSINF2275 | Data mining & decision making | Marco Saerens | 30h+15h | 5 Credits | 2q | x | x |
| ● LINGI2364 | Mining Patterns in Data | Siegfried Nijssen | 30h+15h | 5 Credits | 2q | x | x |
| ● LINGI2261 | Artificial intelligence | Yves Deville | 30h+30h | 6 Credits | 2q | x | x |

o Statistics

| | | | | | | | |
|-------------|-------------------------------------|------------------|----------|-----------|----|---|---|
| ● LSTAT2120 | Linear models | Christian Hafner | 30h+7.5h | 5 Credits | 1q | x | x |
| ● LSTAT2130 | Introduction to Bayesian statistics | Philippe Lambert | 15h+5h | 4 Credits | 2q | x | x |

o Religion courses for students in exact sciences

The students select one course between:

| | | | | | | | |
|-------------|--|-----------------------------------|-----|-----------|---------|---|---|
| ⊗ LTECO2100 | Sociétés, cultures, religions : Biblical readings | Hans Ausloos | 15h | 2 Credits | 1q | x | x |
| ⊗ LTECO2200 | Societies-cultures-religions : Human Questions | Régis Burnet Dominique Martens | 15h | 2 Credits | 1 ou 2q | x | x |
| ⊗ LTECO2300 | Societies, cultures, religions : Ethical questions | Marcela Lobo Bustamante | 15h | 2 Credits | 1q | x | x |

PROFESSIONAL FOCUS

○ Mandatory

△ Courses not taught during 2020-2021

⊕ Periodic courses taught during 2020-2021

⊗ Optional

⊖ Periodic courses not taught during 2020-2021

■ Activity with requisites

Click on the course title to see detailed informations (objectives, methods, evaluation...)

Year

1 2

o Contenu:

Students select 30 credits among:

| | | | | | | | |
|-------------|--|---|-----|------------|-----------|---|---|
| ○ LDATE2990 | Master thesis in data analytics | | | 27 Credits | | | x |
| ⊗ LINGI2399 | Industrial seminar in computer science | Yves Deville Bernard Geubelle | 30h | 3 Credits | 2q | x | x |
| ⊗ LINGI2369 | Artificial intelligence and machine learning seminar | Pierre Dupont Siegfried Nijssen | 30h | 3 Credits | 1q | x | x |
| ⊗ LINMA2120 | Applied mathematics seminar | Pierre-Antoine Absil Frédéric Crevecoeur Jean-Charles Delvenne François Glineur Julien Hendrickx Laurent Jacques (coord.) Raphaël Jungers Yurii Nesterov Anthony Papavasiliou | 30h | 3 Credits | 1 + 2q | x | x |
| ⊗ LSTAT2390 | Applied statistics workshops | Catherine Legrand Christian Ritter | 15h | 3 Credits | 1 + 2q | x | x |

OPTIONS

The student completes his program to reach at least 60 technical credits (in the Masters EPL or with a STAT acronym) not including the Master thesis and the eventual complements taken by some students who would lack basic knowledge. It is not compulsory to validate an option.

Majors in business creation and management

- > Major in small and medium sized business creation [en-prog-2020-date2m-lfsa221o]
- > Major Business risks and opportunities [en-prog-2020-date2m-lfsa220o]

Elective courses

- > Elective courses available for Master students in Data Sciences Engineering [en-prog-2020-date2m-ldati223o]
- > Elective courses: transversal skills and contacts with industry [en-prog-2020-date2m-lgbio955o]

Majors in data science

- > Major in computer systems [en-prog-2020-date2m-ldati220o]
- > Major in numerical methods and optimization [en-prog-2020-date2m-ldati221o]
- > Major in Cryptography and information security [en-prog-2020-date2m-lmap234o]

MAJOR IN SMALL AND MEDIUM SIZED BUSINESS CREATION

In keeping with most of the EPL Masters' degrees, the goal of this major is to familiarize the student with the specifics of entrepreneurship and business development in order to develop the necessary abilities, knowledge and tools to create a business. It is a truly interdisciplinary initiative where students from different faculties are brought together in cross-disciplinary teams to create an entrepreneurial project.

The Interdisciplinary program in entrepreneurship (CPME) is spread over two years and is integrated into more than 30 Masters (9 faculties). The program includes a collective and interdisciplinary master thesis focused on an entrepreneurial project (start-up or spin-off) and realized in teams of 3 to 4 students from 3 to 4 different faculties. The access is reserved for a small number of students by a selection procedure. Additional information may be found at www.uclouvain.be/cpme.

This major is not available in English and may not be taken at the same time as the major "Business risks and opportunities".

● Mandatory

△ Courses not taught during 2020-2021

⊕ Periodic courses taught during 2020-2021

⊗ Optional

⊖ Periodic courses not taught during 2020-2021

■ Activity with requisites

Click on the course title to see detailed informations (objectives, methods, evaluation...)

De 20 à 25 CREDITS parmi

Year

1 2

Contenu:

Required courses for the major in small and medium sized businesses

| | | | | | | | |
|-------------|---|--------------------------------|---------|-----------|----|---|---|
| ● LCPME2001 | Entrepreneurship Theory (in French) | Frank Janssen | 30h+20h | 5 Credits | 1q | x | |
| ● LCPME2002 | Managerial, legal and economic aspects of the creation of a company (in French) | Yves De Cordt Marine Falize | 30h+15h | 5 Credits | 1q | x | x |
| ● LCPME2003 | Business plan of the creation of a company (in French) <i>Les séances du cours LCPME2003 sont réparties sur les deux blocs annuels du master. L'étudiant doit les suivre dès le bloc annuel 1, mais ne pourra inscrire le cours que dans son programme de bloc annuel 2.</i> | Frank Janssen | 30h+15h | 5 Credits | 2q | | x |
| ● LCPME2004 | Advanced seminar on Entrepreneurship (in French) | Frank Janssen | 30h+15h | 5 Credits | 2q | x | x |

⊗ Prerequisite CPME courses

Student who have not taken management courses during their previous studies must enroll in LCPME2000.

| | | | | | | | |
|-------------|---|-----------------------------------|---------|-----------|----|---|--|
| ● LCPME2000 | Venture creation financement and management I | Yves De Rongé Olivier Giacomin | 30h+15h | 5 Credits | 1q | x | |
|-------------|---|-----------------------------------|---------|-----------|----|---|--|

MAJOR BUSINESS RISKS AND OPPORTUNITIES

● Mandatory

△ Courses not taught during 2020-2021

⊕ Periodic courses taught during 2020-2021

⊗ Optional

⊖ Periodic courses not taught during 2020-2021

■ Activity with requisites

Click on the course title to see detailed informations (objectives, methods, evaluation...)

This Major is not available in English and cannot be taken simultaneously with the Major "Major in small and medium sized business creation".

De 17 à 20 CREDITS parmi

Year

1 2

o Contenu:

| | | | | | | | |
|------------|--|--|---------|-----------|----|---|---|
| ● LFSA1290 | Introduction to financial and accounting management | Philippe Grégoire | 30h+15h | 4 Credits | 2q | x | x |
| ● LFSA2140 | Elements of law for industry and research | Vincent Cassiers Werner Derijcke Bénédicte Inghels | 30h | 3 Credits | 1q | x | x |
| ● LFSA2210 | Organisation and human resources | John Cultiaux Eline Jammaers | 30h | 3 Credits | 2q | x | x |
| ● LFSA2230 | Introduction to management and to business economics | Benoît Gailly | 30h+15h | 4 Credits | 2q | x | x |
| ● LFSA2245 | Environment and business | Jean-Pierre Tack | 30h | 3 Credits | 1q | x | x |

o One course between

De 3 à 5 CREDITS parmi

| | | | | | | | |
|-------------|---|-----------------------------------|-----|-----------|----|---|---|
| ⊗ LFSA2202 | Ethics and ICT | Axel Gosseries Olivier Pereira | 30h | 3 Credits | 2q | x | x |
| ⊗ LLSMS2280 | Business Ethics and Compliance Management | Carlos Desmet | 30h | 5 Credits | 1q | x | x |

⊗ Alternative to the major in business risks and opportunities for computer science students

Computer science students who have already taken courses in this field while pursuing their Bachelor's degree may choose between 16-20 credits from the courses offered in the management minor for computer sciences.

ELECTIVE COURSES AVAILABLE FOR MASTER STUDENTS IN DATA SCIENCES ENGINEERING

● Mandatory

△ Courses not taught during 2020-2021

⊕ Periodic courses taught during 2020-2021

⊗ Optional

⊖ Periodic courses not taught during 2020-2021

■ Activity with requisites

Click on the course title to see detailed informations (objectives, methods, evaluation...)

The elective courses being recommended and available for Master students in Data Sciences Engineering are listed here above, in the majors and other lists of elective courses. However, a student can further suggest other courses that would be relevant for his/her personal curriculum, pending that this is compliant with the rules for setting up a personal Master program.

Year

1 2

o Contenu:

⊗ Statistics

| | | | | | | | |
|-------------|--|---------------------------------------|--------|-----------|--------|---|---|
| ⊗ LSTAT2200 | Survey and Sampling | Marie-Paule Kestemont | 15h+5h | 4 Credits | 2q | x | x |
| ⊗ LSTAT2380 | Statistical consulting | Christian Ritter | 30h | 5 Credits | 1 + 2q | x | x |
| ⊗ LSTAT2390 | Applied statistics workshops | Catherine Legrand Christian Ritter | 15h | 3 Credits | 1 + 2q | x | x |
| ⊗ LSTAT2150 | Nonparametric statistics: smoothings methods | Rainer von Sachs | 15h+5h | 4 Credits | 1q | x | x |

⊗ Machine learning, vision and artificial intelligence

| | | | | | | | |
|-------------|--|--|---------|-----------|----|---|---|
| ⊗ LELEC2885 | Image processing and computer vision | Christophe De Vleeschouwer (coord.) Laurent Jacques | 30h+30h | 5 Credits | 1q | x | x |
| ⊗ LGBIO2010 | Bioinformatics | Pierre Dupont | 30h+30h | 5 Credits | 1q | x | x |
| ⊗ LINGI2263 | Computational Linguistics | Pierre Dupont Pierre Dupont (compensates Cédric Fairon) Cédric Fairon | 30h+15h | 5 Credits | 1q | x | x |
| ⊗ LINGI2348 | Information theory and coding | Jérôme Louveaux Benoît Macq Olivier Pereira | 30h+15h | 5 Credits | 2q | x | x |
| ⊗ LINGI2369 | Artificial intelligence and machine learning seminar | Pierre Dupont Siegfried Nijssen | 30h | 3 Credits | 1q | x | x |

⊗ Data structures and algorithms for data analysis

| | | | | | | | |
|-------------|---|---|---------|-----------|----|---|---|
| ⊗ LSINF2345 | Languages and algorithms for distributed Applications | Peter Van Roy | 30h+15h | 5 Credits | 1q | x | x |
| ⊗ LELEC2770 | Privacy Enhancing technology | Olivier Pereira (coord.) François-Xavier Standaert | 30h+30h | 5 Credits | 1q | x | x |

ELECTIVE COURSES: TRANSVERSAL SKILLS AND CONTACTS WITH INDUSTRY

● Mandatory

△ Courses not taught during 2020-2021

⊕ Periodic courses taught during 2020-2021

⊗ Optional

⊖ Periodic courses not taught during 2020-2021

■ Activity with requisites

Click on the course title to see detailed informations (objectives, methods, evaluation...)

The student selects between 3 and 22 credits (max 27 if the student selects the internship) in this list below or in the courses of the major "business risks and opportunities". An alternative is to select the Major in small and medium sized business creation.

Year

1 2

o Contenu:**o Transversal skills and contacts with industry**

The student selects minimum 3 credits among the courses of the Majors "business risks and opportunities" and "small and medium sized business creation" and courses of professional integration activity specific to the program.

⊗ Internship

| | | | | | | | |
|------------|--------------------|--------------------|-----|------------|-----------|---|---|
| ⊗ LFSA2995 | Company Internship | Jean-Pierre Raskin | 30h | 10 Credits | 1 + 2q | X | X |
|------------|--------------------|--------------------|-----|------------|-----------|---|---|

⊗ Communication

Students may select max. 8 credits of languages courses or group dynamics :
Max=8 CREDITS parmi

⊗ Languages

Students may select from any language course offered at the ILV. Special attention is placed on the following seminars in professional development:

| | | | | | | | |
|-------------|---|--|-----|-----------|------------|---|---|
| ⊗ LALLE2500 | Professional development seminar German | Caroline Klein (coord.) | 30h | 3 Credits | 1 + 2q | X | X |
| ⊗ LALLE2501 | Professional development seminar-German | Caroline Klein (coord.) | 30h | 5 Credits | 1 + 2q | X | X |
| ⊗ LESPA2600 | Vocational Induction Seminar - Spanish (B2.2/C1) | Paula Lorente Fernandez (coord.) | 30h | 3 Credits | 1q | X | X |
| ⊗ LESPA2601 | Vocational Induction Seminar - Spanish (B2.2/C1) | Paula Lorente Fernandez (coord.) | 30h | 5 Credits | 1q | X | X |
| ⊗ LNEER2500 | Seminar of Entry to professional life in Dutch - Intermediate level | Isabelle Demeulenaere (coord.) Marie-Laurence Lambrecht | 30h | 3 Credits | 1 ou 2q | X | X |
| ⊗ LNEER2600 | Seminar of entry to professional life in Dutch - Upper-Intermediate level | Isabelle Demeulenaere (coord.) | 30h | 3 Credits | 1 ou 2q | X | X |

⊗ Group dynamics

| | | | | | | | |
|------------|----------------------------|--|---------|-----------|----|---|---|
| ⊗ LEPL2351 | Dynamique des groupes - Q1 | Christine Jacqmot Claude Oestges Benoît Raucent Vincent Wertz | 15h+30h | 3 Credits | 1q | X | X |
| ⊗ LEPL2352 | Dynamique des groupes - Q2 | Christine Jacqmot Claude Oestges Benoît Raucent Vincent Wertz | 15h+30h | 3 Credits | 2q | X | X |

⊗ Other non-disciplinary courses

The student may further select maximum 8 credits in other disciplines.

MAJOR IN COMPUTER SYSTEMS

● Mandatory

△ Courses not taught during 2020-2021

⊕ Periodic courses taught during 2020-2021

⊗ Optional

⊖ Periodic courses not taught during 2020-2021

■ Activity with requisites

Click on the course title to see detailed informations (objectives, methods, evaluation...)

Min=16 credits parmi

Year

1 2

o Contenu:**o Compulsory courses :**

| | | | | | | | |
|-------------|--|-----------------|---------|-----------|----|---|---|
| ● LINGI2145 | Cloud Computing | Etienne Riviere | 30h+15h | 5 Credits | 1q | x | x |
| ● LINGI2241 | Architecture and performance of computer systems | Ramin Sadre | 30h+30h | 6 Credits | 1q | x | x |

o Elective courses (15 credits)

| | | | | | | | |
|-------------|--|--------------------------------|---------|-----------|----|---|---|
| ⊗ LINGI2347 | Computer system security | Ramin Sadre | 30h+15h | 5 Credits | 2q | x | x |
| ⊗ LINGI2143 | Concurrent systems : models and analysis | Charles Pecheur | 30h+15h | 5 Credits | 1q | x | x |
| ⊗ LINGI2349 | Networking and security seminar | Etienne Riviere Ramin Sadre | 30h | 3 Credits | 1q | x | x |
| ⊗ LINGI2146 | Mobile and Embedded Computing | Ramin Sadre | 30h+15h | 5 Credits | 2q | x | x |
| ⊗ LINGI2355 | Multicore programming | Etienne Riviere | 30h+15h | 5 Credits | 2q | x | x |

MAJOR IN NUMERICAL METHODS AND OPTIMIZATION

● Mandatory

△ Courses not taught during 2020-2021

⊕ Periodic courses taught during 2020-2021

⊗ Optional

⊖ Periodic courses not taught during 2020-2021

■ Activity with requisites

Click on the course title to see detailed informations (objectives, methods, evaluation...)

Min=15 credits parmi

Year

1 2

o Contenu:**o Compulsory courses**

| | | | | | | | |
|-------------|------------------------------------|------------------|---------------|-----------|----|---|---|
| ● LINMA2471 | Optimization models and methods II | François Glineur | 30h +22.5h | 5 Credits | 1q | x | x |
| ● LINMA2380 | Matrix computations | Raphaël Jungers | 30h +22.5h | 5 Credits | 1q | x | x |

o One course between

| | | | | | | | |
|-------------|--------------------------------------|---|---------------|-----------|------|---|---|
| ⊗ LINGI2266 | Advanced Algorithms for Optimization | Pierre Schaus | 30h+15h | 5 Credits | 1q △ | x | x |
| ⊗ LINMA2450 | Combinatorial optimization | Jean-Charles Delvenne Julien Hendrickx | 30h +22.5h | 5 Credits | 1q | x | x |

⊗ Elective courses

| | | | | | | | |
|-------------|--|---|---------------|-----------|-----------|---|---|
| ⊗ LINMA2470 | Stochastic modelling | Philippe Chevalier | 30h +22.5h | 5 Credits | 2q | x | x |
| ⊗ LINMA2491 | Operational Research | El-Houssaine Aghezzaf (compensates Anthony Papavasiliou) Anthony Papavasiliou | 30h +22.5h | 5 Credits | 2q | x | x |
| ⊗ LINMA2171 | Numerical Analysis : Approximation, Interpolation, Integration | Pierre-Antoine Absil | 30h +22.5h | 5 Credits | 1q | x | x |
| ⊗ LINMA2875 | System Identification | Julien Hendrickx | 30h+30h | 5 Credits | 2q | x | x |
| ⊗ LINGI2365 | Constraint programming | Yves Deville Pierre Schaus Pierre Schaus (compensates Yves Deville) | 30h+15h | 5 Credits | 2q | x | x |
| ⊗ LINMA2460 | Optimization : Nonlinear programming | Yurii Nesterov | 30h +22.5h | 5 Credits | 2q | x | x |
| ⊗ LINMA2120 | Applied mathematics seminar | Pierre-Antoine Absil Frédéric Crevecoeur Jean-Charles Delvenne François Glineur Julien Hendrickx Laurent Jacques (coord.) Raphaël Jungers Yurii Nesterov Anthony Papavasiliou | 30h | 5 Credits | 1 + 2q | x | x |

MAJOR IN CRYPTOGRAPHY AND INFORMATION SECURITY

As with the Master's degree engineering programmes in electricity, computer sciences and applied mathematics, this major provides students with the knowledge of fundamental algorithms and mathematics in order to better understand information security as well as the design and implementation of solutions for problems related to electronic circuits and information systems.

● Mandatory

△ Courses not taught during 2020-2021

⊕ Periodic courses taught during 2020-2021

⊗ Optional

⊖ Periodic courses not taught during 2020-2021

■ Activity with requisites

Click on the course title to see detailed informations (objectives, methods, evaluation...)

The student shall select
De 15 à 30 CREDITS parmi

Year

1 2

o Contenu:**⊗ Elective courses**

In order to validate this option INFO and MAP students have to take at least 20 credits and the ELEC, DATE and DATI students have to take at least 15 credits among:

| | | | | | | | |
|-------------|--|---|---------|-----------|----|---|---|
| ⊗ LELEC2760 | Secure electronic circuits and systems | François-Xavier Standaert | 30h+30h | 5 Credits | 2q | x | x |
| ⊗ LINGI2144 | Secured systems engineering | Axel Legay | 30h+15h | 5 Credits | 2q | x | x |
| ⊗ LINGI2347 | Computer system security | Ramin Sadre | 30h+15h | 5 Credits | 2q | x | x |
| ⊗ LINGI2348 | Information theory and coding | Jérôme Louveaux Benoît Macq Olivier Pereira | 30h+15h | 5 Credits | 2q | x | x |
| ⊗ LMAT2440 | Number theory | Olivier Pereira Jean-Pierre Tignol | 30h+15h | 5 Credits | 1q | x | x |
| ⊗ LMAT2450 | Cryptography | Olivier Pereira | 30h+15h | 5 Credits | 1q | x | x |
| ⊗ LELEC2770 | Privacy Enhancing technology | Olivier Pereira (coord.) François-Xavier Standaert | 30h+30h | 5 Credits | 1q | x | x |

Course prerequisites

A document entitled [en-prerequis-2020-date2m.pdf](#) specifies the activities (course units - CU) with one or more pre-requisite(s) within the study programme, that is the CU whose learning outcomes must have been certified and for which the credits must have been granted by the jury before the student is authorised to sign up for that activity.

These activities are identified in the study programme: their title is followed by a yellow square.

As the prerequisites are a requirement of enrolment, there are none within a year of a course.

The prerequisites are defined for the CUs for different years and therefore influence the order in which the student can enrol in the programme's CUs.

In addition, when the panel validates a student's individual programme at the beginning of the year, it ensures the consistency of the individual programme:

- It can change a prerequisite into a corequisite within a single year (to allow studies to be continued with an adequate annual load);
- It can require the student to combine enrolment in two separate CUs it considers necessary for educational purposes.

For more information, please consult [regulation of studies and exams](#).

The programme's courses and learning outcomes

For each UCLouvain training programme, a [reference framework of learning outcomes](#) specifies the competences expected of every graduate on completion of the programme. You can see the contribution of each teaching unit to the programme's reference framework of learning outcomes in the document "*In which teaching units are the competences and learning outcomes in the programme's reference framework developed and mastered by the student?*"

The document is available by clicking [this link](#) after being authenticated with your UCLouvain account.

DATE2M - Information

Admission

General and specific admission requirements for this program must be satisfied at the time of enrolling at the university.

In the event of the divergence between the different linguistic versions of the present conditions, the French version shall prevail.

SUMMARY

- > [Specific Admission Requirements](#)
- > [University Bachelors](#)
- > [Non university Bachelors](#)
- > [Holders of a 2nd cycle University degree](#)
- > [Holders of a non-University 2nd cycle degree](#)
- > [Adults taking up their university training](#)
- > [Access on the file](#)
- > [Admission and Enrolment Procedures for general registration](#)

Specific Admission Requirements

This programme is taught in English with no prerequisite in French. The student is supposed to have at least a B2 level in the European Framework of Reference. A certificate is required for the holders of a non-Belgian degree, see [selection criteria](#) of the personalized access.

University Bachelors

| Diploma | Special Requirements | Access | Remarks |
|---|--|----------------------|--|
| UCLouvain Bachelors | | | |
| Bachelor in Engineering | | direct_access | Students who have neither major nor minor in the field of their civil engineering Master's degree may have an adapted programme. |
| Others Bachelors of the French speaking Community of Belgium | | | |
| Bachelor in Engineering | | direct_access | Students with a Bachelor's degree in engineering sciences who have not taken the equivalent of a Minor in the field of their civil engineering master degree may have an adapted master programme. |
| Bachelors of the Dutch speaking Community of Belgium | | | |
| Bachelor in Engineering | | access_with_training | Students who have no specialisation in the field of their civil engineering master degree may have an adapted master programme with up to 60 additional credits. |
| Foreign Bachelors | | | |
| Bachelor in Engineering | For others institutions | on_the_file | See "Personalized access" |
| Bachelor in Engineering | Bachelor degree of Cluster Institution | direct_access | Students with a Bachelor's degree in engineering sciences who have not taken the equivalent of a minor in the field of their civil engineering master degree may have an adapted master programme. |

Non university Bachelors

> Find out more about [links](#) to the university

Holders of a 2nd cycle University degree

| Diploma | Special Requirements | Access | Remarks |
|--------------------|----------------------|--------|---------|
| "Licenciés" | | | |

Masters

| | |
|------------------------|---------------|
| Master ingénieur civil | direct_access |
|------------------------|---------------|

Holders of a non-University 2nd cycle degree

Adults taking up their university training

> See the website [Valorisation des acquis de l'expérience](#)

It is possible to gain admission to all masters courses via the validation of professional experience procedure.

Access on the file

Reminder : all Masters (apart from Advanced Masters) are also accessible on file.

The first step of the admission procedure requires to submit an application online : <https://uclouvain.be/en/study/inscriptions/futurs-etudiants.html>.

[Selection criteria are summarized here](#) (contact : epl-admission@uclouvain.be).

Admission and Enrolment Procedures for general registration

Supplementary classes

To access this Master, students must have a good command of certain subjects. If this is not the case, they must add supplementary classes at the beginning of their Master's programme in order to obtain the prerequisites for these studies.

○ Mandatory

△ Courses not taught during 2020-2021

⊕ Periodic courses taught during 2020-2021

⊗ Optional

⊖ Periodic courses not taught during 2020-2021

■ Activity with requisites

Click on the course title to see detailed informations (objectives, methods, evaluation...)

⊗ Mathématique - Analyse et algèbre linéaire

L'étudiant choisit un des modules suivants :

⊗ Module 1

| | | | | | |
|-------------|--------------------------|-------------------------------------|-----------|-----------|----|
| ○ LINFO1111 | Analysis | François Glineur Roland Keunings | 45h+37.5h | 7 Credits | 1q |
| ○ LINFO1112 | Algebra | Christophe Craeye Thomas Peters | 30h+30h | 5 Credits | 2q |

⊗ Module 2

| | | | | | |
|-------------|---|------------------|---------|-----------|----|
| ○ LINGE1114 | Mathematics I: analysis | Heiner Olbermann | 30h+30h | 5 Credits | 1q |
| ○ LINGE1121 | Mathematics II: algebra and matrix calculus | Tom Claeys | 30h+30h | 5 Credits | 2q |

○ Probabilités et statistique

L'étudiant choisit un des modules suivants :

⊗ Module 1

| | | | | | |
|------------|--|-----------------|-------------|-----------|----|
| ○ LBIR1315 | Probability and statistics II | Patrick Bogaert | 22.5h+22.5h | 3 Credits | 1q |
| ○ LBIR1212 | Probabilities and statistics (I) | Patrick Bogaert | 30h+15h | 4 Credits | 1q |

⊗ Module 2

| | | | | | |
|------------|--|--|---------|-----------|----|
| ○ LEPL1108 | Mathématiques discrètes et probabilité | Jean-Charles Delvenne Olivier Pereira | 30h+30h | 5 Credits | 1q |
| ○ LEPL1109 | Statistics and data sciences | Donatien Hainaut Laurent Jacques | 30h+30h | 5 Credits | 1q |

○ Programmation et informatique

| | | | | | |
|-------------|--|--|---------|-----------|----|
| ○ LINFO1101 | Introduction à la programmation | Kim Mens Siegfried Nijssen Charles Pecheur | 30h+30h | 5 Credits | 1q |
| ○ LINFO1104 | Paradigmes de programmation et concurrence | Peter Van Roy | 30h+30h | 5 Credits | 2q |
| ○ LEPL1402 | Informatique 2 | Ramin Sadre Pierre Schaus | 30h+30h | 5 Credits | 1q |

○ Un cours parmi :

| | | | | | |
|-------------|---|---|-----------|-----------|----|
| ⊗ LINMA2111 | Discrete mathematics II : Algorithms and complexity | Vincent Blondel Jean-Charles Delvenne Jean-Charles Delvenne (compensates Vincent Blondel) | 30h+22.5h | 5 Credits | 1q |
|-------------|---|---|-----------|-----------|----|

| | | | | | |
|-------------|--|---|---------|-----------|----|
| ⊗ LINFO1121 | Algorithmique et structures de données | Guillaume Derval (compensates Pierre Schaus) Pierre Schaus | 30h+30h | 5 Credits | 1q |
|-------------|--|---|---------|-----------|----|

⊗ **Systemes informatiques :**

| | | | | | |
|-------------|------------------------|---------------------|---------|-----------|----|
| ○ LINFO1341 | Réseaux informatiques | Olivier Bonaventure | 30h+30h | 5 Credits | 2q |
| ○ LINFO1252 | Systemes informatiques | Etienne Riviere | 30h+30h | 5 Credits | 1q |

⊗ **Méthodes numériques et optimisation :**

| | | | | | |
|-------------|-----------------------------------|------------------|-----------|-----------|----|
| ○ LINMA1702 | Optimization models and methods I | François Glineur | 30h+22.5h | 5 Credits | 2q |
|-------------|-----------------------------------|------------------|-----------|-----------|----|

○ **Un cours parmi :**

| | | | | | |
|-------------|-------------------------|------------------|---------|-----------|----|
| ○ LEPL1104 | Méthodes numériques | Vincent Legat | 30h+30h | 5 Credits | 2q |
| ○ LINFO1113 | Algorithmique numérique | Loïc Quertenmont | 30h+30h | 6 Credits | 1q |

⊗ **Other EU to be determined with the Study Advisor**

Depending on his / her previous academic background, the student (in consultation with the study advisor) can add other UEs in order to acquire the necessary prerequisites for the program.

Evaluation

The evaluation methods comply with the [regulations concerning studies and exams](#). More detailed explanation of the modalities specific to each learning unit are available on their description sheets under the heading "Learning outcomes evaluation method".

Contacts

Curriculum Management

Entity

Structure entity

Denomination

Faculty

Sector

Acronym

Postal address

SST/EPL/DATA

(DATA)

Louvain School of Engineering (EPL)

Sciences and Technology (SST)

DATA

Rue Archimède 1 - bte L6.11.01

1348 Louvain-la-Neuve

Academic supervisor: [Jean-Charles Delvenne](#)

Jury

- Président: [Jean-Didier Legat](#)
- Secrétaire du Jury: [Siegfried Nijssen](#)

Useful Contact(s)

- Secrétariat: [Pascale Premereur](#)

