UCLouvain

SINF2M

2024 - 2025

Master [120] in Computer Science

At Louvain-la-Neuve - 120 credits - 2 years - Day schedule - In English
Dissertation/Graduation Project : **YES** - Internship : **optional**
Activities in English: **YES** - Activities in other languages : **optional**
Activities on other sites : **NO**
Main study domain : **Sciences**
Organized by: **Louvain School of Engineering (EPL)**
Programme acronym: **SINF2M** - Francophone Certification Framework: 7

SINF2M -

SINF2M - Teaching profile

Learning outcomes

The computer science developers and designers of tomorrow face two major challenges:

- increasingly complex computer science systems
- ncreasingly varied areas of application

In order to meet these challenges, future diploma holders should

- master real computer science technologies but also keep up with their constant progress
- innovate by integrating in computer systems elements linked to artificial intelligence, software engineering, and security networks
- work as part of multidisciplinary teams that take into account non-technical issues, be open to social sciences and the humanities to help with this task.

This programme is based on research:

UCLouvain is a research university. The computer science research conducted at the institute ICTEAM is internationally recognised. Through the major courses offered in this Master's degree programme, students will be able to take advantage of cutting edge knowledge. In addition to providing fundamental knowledge, this programme is based on the in-depth understanding of concepts and the ability to think abstractly. These tools allow students to quickly adapt to the needs of companies. Moreover, this research may be continued through projects carried out at the doctoral level.

Applying concepts:

The application of concepts is a key part of this Master's degree programme. It is inconceivable that students can master theoretical concepts but not know how to apply them to a concrete problem. Thus, the programme includes a number of projects and studies, a large-scale graduation project and the possibility of completing an internship in a company.

International openness:

English is de facto the most used language in companies and those in the technical field in particular. This Master's degree programme is thus taught in English, which gives our students good speaking and writing skills. By offering a Master's degree in English, this programme demonstrates its international openness. The use of English allows the programme to welcome international students while at the same time immersing them in a French-speaking environment. It also increases the possibility of exchanges and dual diplomas with other (non-Belgian) universities.

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

1.demonstrate mastery of a solid body of knowledge in computer science allowing them to solve problems raised in their field of study

This Master's degree programme aims to provide students with advanced knowledge. A diversity of subjects are offered in the common curriculum and students specialise vria a major:

- security networks
- programming systems
- software engineering
- artificial intelligence
- Data Science and Applied Mathematics
- Business issues

2.organise and carry out the development of a computer system that meets the complex demands of a client

2.1.Analyse a problem to solve or the functional needs to be met and formulate a corresponding specifications note.
2.2.Model a problem and design one or more technical solutions in line with the specifications note.
2.3.Evaluate and classify the solutions in light of all the criteria included in the specifications note: efficiency, feasibility, quality, ergonomics and environmental security.
2.4. Implement and test the chosen solution.
2.5.Come up with recommendations to improve the operational nature of the solution.

3.organise and carry out a study to understand a new problem in the field

3.1. Document and summarize the existing body of knowledge in the area under consideration
3.2. Propose a model and/or an experimental device in order to simulate or test a hypotheses relating to the phenomenon being studied
3.3. Write a cumulative report that explains the potential of the theoretical or technical innovations resulting from the research project

4. contribute as part of a team to the planning and completion of a project while taking into account its objectives, allocated resources, and constraints

4.1. Frame and explain the project's objectives (in terms of performance indicators) while taking into account its issues and constraints
4.2. Collaborate on a work schedule, deadlines and roles
4.3. Work in a multidisciplinary environment with peers holding different points of view; manage any resulting disagreement or conflicts
4.4. Make team decisions and assume the consequences of these decisions (whether they are about technical solutions or the division of labour to complete a project)

5. communicate effectively (orally or in writing) with the goal of carrying out assigned projects in the workplace (in English in particular)

5.1. Identify the needs of the client or the user: question, listen and understand all aspects of their request and not just the technical aspects.
5.2. Present your arguments and adapt to the language of your interlocutors: technicians, colleagues, clients, superiors
5.3. Communicate through graphics and diagrams: interpret a diagram, present project results, structure information
5.4. Read and analyse different technical documents (rules, plans, specification notes)
5.5. Draft documents that take into account contextual requirements and social conventions
5.6. Make a convincing oral presentation using modern communication techniques.

6. Demonstrate rigor, openness and critical thinking as well as a sense of ethics in your work

6.1. Rigorously apply the standards of your discipline (terminology, measurement units, quality standards and security)
6.2. Find solutions that go beyond strictly technical issues by considering sustainable development and the socio-economic ethics of a project
6.3. Demonstrate critical awareness of a technical solution in order to verify its robustness and minimize the risks that may occur during implementation.
6.4. Evaluate oneself and independently develop necessary skills to remain knowledgeable in the field.

Programme structure

The program consists of four parts:

- a common core (30 credits), including a final thesis (25 credits).
- a specialized focus, compulsory training (30 credits).
- one or more options allowing students to specialize in a field of IT (20-40 credits).
- elective courses (20-40 credits).

The graduation project is normally carried out in the last year. However, students may, depending on their training, conduct other courses in either the first or second year so long as they have completed the prerequisite courses. This is especially the case for students who have completed a portion of their studies abroad. The yearly allocation of course activities found in the detailed programme description is for information purposes only.

In general, this Master’s degree will consist of a minimum of 120 credits spread over two years with 60 credits taken per year (regardless of the focus, major or elective courses selected).

				Year 1	2
LINFO2992	Graduation project/End of studies project *The graduation project can be written and presented in French or English, in consultation with the supervisor. It may be accessible to exchange students by prior agreement between the supervisors and/or the two universities.*		EN [q1+q2] [] [25 Credits]	x	x
LEPL2020	Professional integration work *The modules of LEPL2020 course are organized over the two annual blocks of the master's degree. It is strongly recommended that students take them from year 1, but they will only be able to register for the course at the earliest the year in which they present their final graduation project.* *Students who have other professional integration activities in their personal programme, or who can demonstrate an equivalent activity could be exempted from this course. This equivalence is at the discretion of the examination board. Another activity should then be chosen to reach the number of ECTS required for their graduation.*		EN [q1+q2] [30h+15h] [2 Credits] Δ *> French-friendly*	x	x

Computer science seminars

Students may choose 3 credits among
The student shall select 3 credits from amongst

LINFO2349	Networking and security seminar	Etienne Riviere Ramin Sadre	EN [q1] [30h] [3 Credits] *> French-friendly*		x
LINFO2359	Software engineering and programming systems seminar	Eduard Baranov Charles-Henry Bertrand Van Ouytsel	EN [q1] [30h] [3 Credits] *> French-friendly*		x
LINFO2369	Artificial intelligence and machine learning seminar	Siegfried Nijssen Eric Piette	EN [q1] [30h] [3 Credits] *> French-friendly*		x

PROFESSIONAL FOCUS [30.0]

- Mandatory
- Optional
- Not offered in 2024-2025
- Not offered in 2024-2025 but offered the following year
- Offered in 2024-2025 but not the following year
- Not offered in 2024-2025 or the following year
- Activity with requisites
- Open to incoming exchange students
- Not open to incoming exchange students
- [FR] Teaching language (FR, EN, ES, NL, DE, ...)

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

Content:

Computer science courses

				Year 1	Year 2
LINFO2132	Languages and translators	Ramin Sadre	EN [q2] [30h+30h] [6 Credits] > *French-friendly*	x	x
LINFO2172	Databases		EN [q2] [30h+30h] [6 Credits] > *French-friendly*	x	x
LINFO2241	Architecture and performance of computer systems	Tom Barbette	EN [q1] [30h+30h] [6 Credits] > *French-friendly*	x	x
LINFO2262	Machine Learning :classification and evaluation	Pierre Dupont	EN [q2] [30h+30h] [6 Credits] > *French-friendly*	x	x
LINFO2255	Software engineering project	Benoît Duhoux	EN [q1] [30h+30h] [6 Credits] > *French-friendly*	x	

OPTIONS EN SCIENCES INFORMATIQUES

MAJOR IN ARTIFICIAL INTELLIGENCE: BIG DATA, OPTIMIZATION AND ALGORITHMS

Students completing the major in Artificial Intelligence: big data, optimization and algorithms will be able to:

- Identify and implement methods and techniques that allow software to solve complex problems that when solved by humans require “intelligence”,
- Understand and put to good use methods and techniques relating to artificial intelligence such as automatic reasoning, research and heuristics, acquisition and representation of knowledge, automatic learning, problems associated with overcoming constraints,
- Identify applications and its methods and tools; understand a particular category of applications and its related techniques, for example robotics, computer vision, planning, data mining, computational linguistics and bioinformatics, big data processing,
- Formalise and structure a body of complex knowledge and use a systematic and rigorous approach to develop quality “intelligence” systems.

Mandatory
Optional
Not offered in 2024-2025
Not offered in 2024-2025 but offered the following year
Offered in 2024-2025 but not the following year
Not offered in 2024-2025 or the following year
Activity with requisites
Open to incoming exchange students
Not open to incoming exchange students
[FR] Teaching language (FR, EN, ES, NL, DE, ...)

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

From 20 to 30credit(s)

Year
1 2

Content:

Required courses in Artificial Intelligence: big data, optimization and algortihms

LINFO2263	Computational Linguistics	

				Year 1	2
⊠ LINMA2472	Algorithms in data science	Jean-Charles Delvenne (coord.) Benoît Legat (compensates Vincent Blondel)	EN [q1] [30h+22.5h] [5 Credits] *> French-friendly*	x	x
⊠ LINFO2275	Data mining & decision making	Marco Saerens	EN [q2] [30h+15h] [5 Credits] *> French-friendly*	x	x
⊠ LINFO2381	Health Informatics	Sébastien Jodogne	EN [q2] [30h+30h] [5 Credits] *> French-friendly*	x	x

OPTION IN DATA SCIENCE AND APPLIED MATHEMATICS

Students completing the major “Data science and Applied Mathematics” must be able to:

- Understand engineering fields requiring synergy between applied mathematics and computer science such as algorithms, scientific calculations, modelling computer systems, optimisation, machine learning or data mining;
- Understand and put to good use algorithms and techniques used in data science;

				Year 1	Year 2
⊠ LMECA2170	Numerical Geometry	Vincent Legat Jean-François Remacle	EN [q1] [30h+30h] [5 Credits] *> French-friendly*	x	x

OPTION EN CYBERSECURITY

Students who have completed the "Cybersecurity and Information Technology" track should be able to:

• Understand areas of engineering that require synergy between computer security, networks, and systems, such as cryptography, data protection, application security, security architecture, or programming,

• Comprehend and appropriately apply methods and techniques related to cybersecurity, including prevention, detection, and response to cyber threats,

• Identify and implement security practices and standards to protect the infrastructure, systems, and data of organizations,

• Apply their knowledge to real-life scenarios through projects.

- Mandatory
- Optional
- Not offered in 2024-2025
- Not offered in 2024-2025 but offered the following year
- Offered in 2024-2025 but not the following year
- Not offered in 2024-2025 or the following year
- Activity with requisites
- Open to incoming exchange students
- Not open to incoming exchange students
- [FR] Teaching language (FR, EN, ES, NL, DE, ...)

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

Students shall select 20 to 30 credits among:

Content:

Students shall select 20 to 30 credits among:

Required courses in Cybersecurity

				Year 1	Year 2
LINFO2347	Computer system security	Ramin Sadre	EN [q2] [30h+15h] [5 Credits] > *French-friendly*	x	x
LINFO2145	Cloud Computing	Etienne Riviere	EN [q1] [30h+15h] [5 Credits] > *French-friendly*	x	x
LINFO2144	Secured systems engineering	Charles-Henry Bertrand Van Ouytsel Gaëtan Cassiers	EN [q2] [30h+15h] [5 Credits] > *French-friendly*	x	x
LELEC2770	Privacy Enhancing technology	Olivier Pereira François-Xavier Standaert	EN [q1] [30h+30h] [5 Credits] > *French-friendly*	x	x

Elective courses in Cybersecurity

				Year 1	Year 2
LINFO2143	Concurrent systems : models and analysis	Charles Pecheur	EN [q1] [30h+15h] [5 Credits] > *French-friendly*	x	x
LMAT2450	Cryptography	Olivier Pereira	EN [q1] [30h+15h] [5 Credits] > *French-friendly*	x	x
LINFO2142	Computer networks: configuration and management	Olivier Bonaventure	EN [q1] [30h+30h] [5 Credits] > *French-friendly*	x	x
LINFO2146	Mobile and Embedded Computing	Ramin Sadre	EN [q2] [30h+15h] [5 Credits] > *French-friendly*	x	x
LINFO2345	Languages and algorithms for distributed Applications	Peter Van Roy	EN [q1] [30h+15h] [5 Credits] > *French-friendly*	x	x
LELEC2348	Information theory and coding	Jérôme Louveaux Benoît Macq Olivier Pereira	EN [q2] [30h+15h] [5 Credits] > *French-friendly*	x	x

OPTION NETWORKS AND SYSTEMS

Students who have completed the “Networks and Systems" track should be able to:

- Understand and explain different devices and protocols used in computer and cellular networks;
- Design, configure and manage computer networks while taking into account application needs;
- Understand the operation of IoT and cellular networks;
- Explain the problems that affect cellular and IoT networks and develop solutions to cope with them;
- Understand how to optimise applications to efficiently use parallel cores;
- Understand, implement and use lock-free data structures;
- Understand the interactions between real-time operating systems and hardware;
- Design and implement applications running on embedded systems

O Mandatory
⊠ Optional
△ Not offered in 2024-2025
⊘ Not offered in 2024-2025 but offered the following year
⊕ Offered in 2024-2025 but not the following year

OPTION EN INFORMATIQUE MÉDICALE

Year
1 2

Open Source Project

- Mandatory
- Optional
- Not offered in 2024-2025
- Not offered in 2024-2025 but offered the following year
- Offered in 2024-2025 but not the following year
- Not offered in 2024-2025 or the following year
- Activity with requisites
- Open to incoming exchange students
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Click on the course title to see detailed informations (objectives, methods, evaluation...)

Year 1 2

Content:

LINFO2401	Open Source strategy for software development	Lionel Dricot	EN [q1] [30h+15h] [5 Credits] > French-friendly	x	x
LINFO2402	Open Source Project		EN [q1+q2] [0h] [5 Credits] > French-friendly	x	x

OPTIONS ET COURS AU CHOIX EN CONNAISSANCES SOCIO-ÉCONOMIQUES

BUSINESS RISKS AND OPPORTUNITIES

- Mandatory
- Optional
- Not offered in 2024-2025
- Not offered in 2024-2025 but offered the following year
- Offered in 2024-2025 but not the following year
- Not offered in 2024-2025 or the following year
- Activity with requisites
- Open to incoming exchange students
- Not open to incoming exchange students
- [FR] Teaching language (FR, EN, ES, NL, DE, ...)

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

Les étudiant·es doivent réussir au moins 15 crédits pour valider l'option. Cette option ne peut être prise simultanément avec l'option « Formation interdisciplinaire en création d'entreprise - CPME ».

Year 1 2

Content:

LEPL2211

Year
1 2

COURS AU CHOIX EN CONNAISSANCES SOCIO-ÉCONOMIQUES

- Mandatory
- Optional
- Not offered in 2024-2025
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- Activity with requisites
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- [FR] Teaching language (FR, EN, ES, NL, DE, ...)

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

Year

				Year 1	2
⊠ LESPA2600	Vocational Induction Seminar - Spanish (B2.2/C1)	Paula Lorente Fernandez (coord.)	ES [q1] [30h] [3 Credits]	x	x
⊠ LESPA2601	Vocational Induction Seminar - Spanish (B2.2/C1)	Paula Lorente Fernandez (coord.)	ES [q1] [45h] [5 Credits]	x	x
⊠ LNEER2500	Seminar of Entry to professional life in Dutch - Intermediate level	Isabelle Demeulenaere (coord.)	NL [q1 or q2] [30h] [3 Credits]	x	x
⊠ LNEER2600	Seminar of entry to professional life in Dutch - Upper-Intermediate level	Isabelle Demeulenaere (coord.) Dag Houdmont	NL [q1 or q2] [30h] [3 Credits]	x	x

⊠ Group dynamics

⊠ LEPL2351	Become a tutor	Jean-Charles Delvenne (coord.) Delphine Ducarme Thomas Pardoen Benoît Raucent	FR [q1] [15h+30h] [3 Credits]	x	x
⊠ LEPL2352	Become a tutor	Jean-Charles Delvenne (coord.) Delphine Ducarme Thomas Pardoen Thomas Pardoen (compensates Benoît Raucent)	FR [q2] [15h+30h] [3 Credits]	x	x

⊠ Autres UEs hors-EPL

L'étudiant·e peut choisir maximum 8 crédits de cours hors EPL, considérés comme non-disciplinaires par la commission de programme.

Cours alternatifs Calculabilité, logique et complexité

L'étudiant·e choisit un cours parmi:

LINFO1123	Calculability, Logic and Complexity	Yves Deville	FR [q2] [30h+30h] [5 Credits]
LSINC1123	Calculability, Logic and Complexity	Maxime Parmentier (compensates Yves Deville)	FR [q2] [30h+30h] [5 Credits]

Course prerequisites

There are no prerequisites between course units (CUs) for this programme, i.e. the programme activity (course unit, CU) whose learning outcomes are to be certified and the corresponding credits awarded by the jury before registration in another CU.

The programme's courses and learning outcomes

For each UCLouvain training programme, a reference framework of learning outcomes specifies the the skills expected of every graduate on completion of the programme. Course unit descriptions specify targeted learning outcomes, as well as the unit's contribution to reference framework of learning outcomes.

SINF2M - Information

Access Requirements

BA en informatique de gestion - crédits supplémentaires entre 30 et 60 BA en informatique et systèmes, orientation informatique industrielle - crédits supplémentaires entre 30 et 60 BA en informatique et systèmes, orientation réseaux et télécommunications - crédits supplémentaires entre 30 et 60 BA en informatique et systèmes, orientation sécurité des systèmes - crédits supplémentaires entre 30 et 60 BA en informatique et systèmes, orientation technologie de l'informatique - crédits supplémentaires entre 30 et 60 BA en informatique, orientation développement d'applications - crédits supplémentaires entre 30 et 60 BA en informatique, orientation informatique industrielle - crédits supplémentaires entre 30 et 60 BA en informatique, orientation réseaux et télécommunications - crédits supplémentaires entre 30 et 60 BA en informatique, orientation sécurité des systèmes - crédits supplémentaires entre 30 et 60 BA en informatique, orientation technologies de l'informatique - crédits supplémentaires entre 30 et 60	Les enseignements supplémentaires éventuels peuvent être consultés dans le module complémentaire.	Type court

Holders of a 2nd cycle University degree

Diploma	Special Requirements	Access	Remarks
"Licenciés"			
"Licencié en informatique"		-	
Masters			
Master in computer science		-	

Holders of a non-University 2nd cycle degree

Access based on validation of professional experience

> It is possible, under certain conditions, to use one's personal and professional experience to enter a university course without having

The Master’s degree in computer science may be followed by a doctoral programme in engineering sciences.

Most of the UCLouvain Master’s degree programmes (generally 60) are open to UCLouvain Master’s degree diploma holders. For example:

Different Master’s degree programmes (60) in management (automatic admission based on written application): see this list

The Master’s degree (60) in information and communication at Louvain-la-Neuve or the Master’s degree (60) in information and communication at Mons.