

Master in Computer science

Focus Professional

The master programme includes three main types of courses: computer science lectures, an introduction to research through the writing of a Master's dissertation, and courses intended to prepare students to enter the job market.

The programme is designed for students who have general skills in computer science, which they can have acquired during the Bachelor in Computer Science at ULB:

- > they are able to gather information and acquire new knowledge autonomously and with scientific rigour, and are able to adopt a critical attitude in this process.
- > they master the main mathematical and formal tools needed in computer science.
- > they can read technical literature in English and engage in a technical conversation in English, as most of the courses in the programme are taught in English (with a few exceptions for electives).
- > They master the main concepts and skills related to programming, programming languages, algorithms, software engineering, operating systems, and fundamental theoretical results in computer science.
- > they are able to design—alone or within a group—a computer application of significant complexity, efficiently using the tools of software engineering.

Students who have not acquired the appropriate background during their Bachelor may, in some cases, have the opportunity to compensate for deficiencies with a tailored curriculum.

Bloc 1 | M-INFOS | MA-INFO

Cours obligatoires

ELEC-H473	Microprocessor architecture Dragomir MILOJEVIC (Coordinator) ⌚ 5 credits [lecture: 24h, practical work: 36h] 📅 second term 🗨 English
INFO-F403	Introduction to language theory and compiling Gilles GEERAERTS (Coordinator) ⌚ 5 credits [lecture: 24h, tutorial classes: 24h, project: 30h] 📅 first term 🗨 English
INFO-F404	Real-Time Operating Systems Joël GOOSSENS (Coordinator) ⌚ 5 credits [lecture: 24h, tutorial classes: 12h, project: 30h] 📅 first term 🗨 English
INFO-F405	Introduction to cryptography Christophe PETIT (Coordinator) and Gilles VAN ASSCHE ⌚ 5 credits [lecture: 24h, tutorial classes: 24h, project: 30h] 📅 first term 🗨 English
INFO-F408	Computability and complexity Jean-François RASKIN (Coordinator) ⌚ 5 credits [lecture: 36h, tutorial classes: 12h, practical work: 12h] 📅 first term 🗨 English
MEMO-F403	Preparatory work for the master thesis Maarten JANSEN (Coordinator) ⌚ 5 credits [personal assignments: 60h] 📅 second term 🗨 English

Options 1

Option - 2 modules complets dans la liste des modules 1.1 à 1.5 à choisir au cours des deux blocs.

A total of 30 credits chosen from the following

Module 1.1. Software and critical systems

INFO-F410 (optional)	Embedded systems design Jean-François RASKIN (Coordinator) ⌚ 5 credits [lecture: 12h, tutorial classes: 12h, project: 60h] 📅 second term 🗨 English
INFO-F412 (optional)	Formal verification of computer systems Jean-François RASKIN (Coordinator) ⌚ 5 credits [lecture: 36h, tutorial classes: 12h] 📅 second term 🗨 English

INFO-F514
(optional)

[Protocols, cryptanalysis and mathematical cryptology](#) | Olivier MARKOWITCH (Coordinator), Liran LERMAN and Christophe PETIT

🕒 5 credits [lecture: 24h] 📅 second term 🗣️ English

Module 1.2. Computational Intelligence

INFO-F409
(optional)

[Learning dynamics](#) | Tom LENAERTS (Coordinator)

🕒 5 credits [lecture: 24h, project: 60h] 📅 first term 🗣️ English

INFO-F422
(optional)

[Statistical foundations of machine learning](#) | Gianluca BONTEMPI (Coordinator)

🕒 5 credits [lecture: 24h, tutorial classes: 12h, project: 60h] 📅 second term 🗣️ English

INFO-H410
(optional)

[Techniques of artificial intelligence](#) | Hugues BERSINI (Coordinator)

🕒 5 credits [lecture: 24h, tutorial classes: 12h] 📅 second term 🗣️ English

Module 1.3. Optimization

INFO-F424
(optional)

[Combinatorial optimization](#) | Bernard FORTZ (Coordinator) and RENAUD CHICOISNE

🕒 5 credits [lecture: 24h, tutorial classes: 12h, practical work: 12h, project: 30h] 📅 second term 🗣️ English

INFO-F524
(optional)

[Continuous optimization](#) | Bernard FORTZ (Coordinator) and Dimitrios PAPADIMITRIOU

🕒 5 credits [lecture: 24h, project: 60h] 📅 second term 🗣️ English

INFO-H413
(optional)

[Heuristic optimisation](#) | Thomas, T STUTZLE (Coordinator)

🕒 5 credits [lecture: 24h, tutorial classes: 12h, practical work: 24h] 📅 second term 🗣️ English

Module 1.4. Algorithms

INFO-F413
(optional)

[Data structures and algorithms](#) | Jean CARDINAL (Coordinator)

🕒 5 credits [lecture: 24h, tutorial classes: 12h, project: 60h] 📅 first term 🗣️ English

INFO-F420
(optional)

[Computational geometry](#) | Stefan LANGERMAN F. SWARZBERG (Coordinator)

🕒 5 credits [lecture: 24h, tutorial classes: 12h, project: 60h] 📅 first term 🗣️ English

INFO-F521
(optional)

[Graph theory](#) | Gwenaël JORET (Coordinator)

🕒 5 credits [lecture: 24h, tutorial classes: 12h, project: 60h] 📅 first term 🗣️ English

Module 1.5. Web and information systems

INFO-H415
(optional)

[Advanced databases](#) | Esteban ZIMANYI (Coordinator)

🕒 5 credits [lecture: 24h, tutorial classes: 24h, practical work: 12h] 📅 first term 🗣️ English

INFO-H417
(optional)

[Database systems architecture](#) | Mahmoud SAKR (Coordinator)

🕒 5 credits [lecture: 24h, tutorial classes: 12h, practical work: 24h] 📅 first term 🗣️ English

INFO-H515
(optional)

[Big Data: Distributed Data Management and Scalable Analytics](#) | Dimitrios SACHARIDIS (Coordinator) and Gianluca BONTEMPI




🕒 5 credits [lecture: 24h, tutorial classes: 12h, project: 24h] 📅 second term 🗣️ English

Master in Computer science

Focus Professional

Bloc 2 | M-INFOS | MA-INFO

Cours obligatoires

- INFO-F530 **Computer science seminar** | Tom LENAERTS (Coordinator), Jérôme De Boeck, Bernard FORTZ, John IACONO and Olivier MARKOWITCH
 5 credits [seminars: 36h, project: 60h]  first and second terms  English
- MEMO-F524 **Masters thesis** | Jean-François RASKIN (Coordinator)
 20 credits [mfe/tfe: 240h]  first and second terms







An alternative chosen from the two following

Options 1







35 ECTS à choisir dans les options 1 dont minimum 2 modules complets au cours des 2 blocs. (60 crédits sur l'ensemble du cycle)

Up to 60 credits chosen from the following







Module 1.1 Software and critical systems

- INFO-F410 (optional) **Embedded systems design** | Jean-François RASKIN (Coordinator)
 5 credits [lecture: 12h, tutorial classes: 12h, project: 60h]  second term  English
- INFO-F412 (optional) **Formal verification of computer systems** | Jean-François RASKIN (Coordinator)
 5 credits [lecture: 36h, tutorial classes: 12h]  second term  English
- INFO-F514 (optional) **Protocols, cryptanalysis and mathematical cryptology** | Olivier MARKOWITCH (Coordinator), Liran LERMAN and Christophe PETIT
 5 credits [lecture: 24h]  second term  English

Module 1.2 Computational Intelligence

- INFO-F409 (optional) **Learning dynamics** | Tom LENAERTS (Coordinator)
 5 credits [lecture: 24h, project: 60h]  first term  English
- INFO-F422 (optional) **Statistical foundations of machine learning** | Gianluca BONTEMPI (Coordinator)
 5 credits [lecture: 24h, tutorial classes: 12h, project: 60h]  second term  English
- INFO-H410 (optional) **Techniques of artificial intelligence** | Hugues BERSINI (Coordinator)
 5 credits [lecture: 24h, tutorial classes: 12h]  second term  English

Module 1.3 Optimization

- INFO-F424 (optional) **Combinatorial optimization** | Bernard FORTZ (Coordinator) and RENAUD CHICOISNE
 5 credits [lecture: 24h, tutorial classes: 12h, practical work: 12h, project: 30h]  second term  English
- INFO-F524 (optional) **Continuous optimization** | Bernard FORTZ (Coordinator) and Dimitrios PAPADIMITRIOU
 5 credits [lecture: 24h, project: 60h]  second term  English
- INFO-H413 (optional) **Heuristic optimisation** | Thomas, T STUTZLE (Coordinator)
 5 credits [lecture: 24h, tutorial classes: 12h, practical work: 24h]  second term  English

Module 1.4 Algorithms

- INFO-F413 (optional) [Data structures and algorithms](#) | Jean CARDINAL (Coordinator)
⌚ 5 credits [lecture: 24h, tutorial classes: 12h, project: 60h] 📅 first term 🗣 English
- INFO-F420 (optional) [Computational geometry](#) | Stefan LANGERMAN F. SWARZBERG (Coordinator)
⌚ 5 credits [lecture: 24h, tutorial classes: 12h, project: 60h] 📅 first term 🗣 English
- INFO-F521 (optional) [Graph theory](#) | Gwenaël JORET (Coordinator)
⌚ 5 credits [lecture: 24h, tutorial classes: 12h, project: 60h] 📅 first term 🗣 English

Module 1.5 Web and Information Systems

- INFO-H415 (optional) [Advanced databases](#) | Esteban ZIMANYI (Coordinator)
⌚ 5 credits [lecture: 24h, tutorial classes: 24h, practical work: 12h] 📅 first term 🗣 English
- INFO-H417 (optional) [Database systems architecture](#) | Mahmoud SAKR (Coordinator)
⌚ 5 credits [lecture: 24h, tutorial classes: 12h, practical work: 24h] 📅 first term 🗣 English
- INFO-H515 (optional) [Big Data: Distributed Data Management and Scalable Analytics](#) | Dimitrios SACHARIDIS (Coordinator) and Gianluca BONTEMPI
⌚ 5 credits [lecture: 24h, tutorial classes: 12h, project: 24h] 📅 second term 🗣 English

Module 2.1 Software and critical systems

- INFO-Y082 (optional) [Distributed and mobile programming paradigms](#) | Elisa GONZALEZ BOIX
⌚ 6 credits [lecture: 26h, tutorial classes: 26h, project: 30h] 📅 first term 🗣 English
- INFO-Y085 (optional) [Functional programming](#) | Wolfgang DE MEUTER (Coordinator)
⌚ 6 credits [lecture: 26h, tutorial classes: 26h] 📅 second term 🗣 English
- INFO-Y099 (optional) [Multicore programming](#) | SWALLENS Janwillem
⌚ 6 credits [lecture: 26h, tutorial classes: 26h] 📅 second term 🗣 English
- INFO-Y1001 (optional) [Practical Parallel Program](#) | Jan LEMEIRE
⌚ 3 credits [lecture: 12h, project: 30h] 📅 first term 🗣 French
- INFO-Y1002 (optional) [GPU computing](#) | Jan LEMEIRE
⌚ 5 credits [lecture: 12h, project: 45h] 📅 second term 🗣 French
- INFO-Y110 (optional) [Higher Order Programming](#) | Nicolas JENS
⌚ 6 credits [lecture: 26h, tutorial classes: 26h] 📅 first term

Module 2.2 Computational Intelligence

- INFO-F439 (optional) [Advanced Methods in Bioinformatics](#) | Matthieu DEFRANCE (Coordinator) and Wim VRANKEN
⌚ 5 credits [lecture: 24h, project: 90h] 📅 second term 🗣 English
- INFO-H414 (optional) [Swarm Intelligence](#) | Marco DORIGO (Coordinator) and Mauro BIRATTARI
⌚ 5 credits [lecture: 12h, practical work: 48h] 📅 second term 🗣 English
- INFO-H515 (optional) [Big Data: Distributed Data Management and Scalable Analytics](#) | Dimitrios SACHARIDIS (Coordinator) and Gianluca BONTEMPI
⌚ 5 credits [lecture: 24h, tutorial classes: 12h, project: 24h] 📅 second term 🗣 English
- INFO-Y004 (optional) [Natural language processing](#) | Paul VAN EECKE
⌚ 6 credits [lecture: 26h, tutorial classes: 26h] 📅 first term 🗣 English
- INFO-Y087 (optional) [Declarative programming](#) | WIGGINS Geraint and VAN EECKE Paul
⌚ 6 credits [lecture: 26h, tutorial classes: 26h] 📅 second term 🗣 English

Module 2.3 Optimization

Module 2.4 Algorithms

- INFO-F440 (optional) [Algorithms for big data](#) | John IACONO (Coordinator)
⌚ 5 credits [lecture: 24h, tutorial classes: 12h, project: 60h] 📅 second term 🗣 English

INFO-H514
(optional)

Quantum information and computation | Nicolas CERF (Coordinator), Ognyan Oreshkov and Jérémie ROLAND
⌚ 5 credits [lecture: 24h, tutorial classes: 24h] 📅 first term 🗨 English

Module 2.5 Web and Information Systems

INFO-H419
(optional)

Data warehouses | Esteban ZIMANYI (Coordinator)
⌚ 5 credits [lecture: 24h, tutorial classes: 24h, practical work: 12h] 📅 first term 🗨 English

INFO-H420
(optional)

Management of Data Science and Business Workflows | Dimitrios SACHARIDIS (Coordinator)
⌚ 5 credits [lecture: 24h, tutorial classes: 36h] 📅 first term 🗨 English

INFO-H509
(optional)

Geo-Spatial and web technologies | Mahmoud SAKR (Coordinator)
⌚ 5 credits [lecture: 24h, tutorial classes: 12h, practical work: 24h] 📅 second term 🗨 English

INFO-Y528
(optional)

Information visualisation
⌚ 6 credits [lecture: 26h, tutorial classes: 26h] 📅 second term 🗨 English

Module 2.6 Internship

GEST-S483
(optional)

Digital and IT Governance | Georges ATAYA (Coordinator)
⌚ 5 credits [lecture: 24h] 📅 second term 🗨 English

TRAN-F501
(optional)

Internship | Gianluca BONTEMPI (Coordinator) and Maarten JANSEN
⌚ 15 credits [project: 200h] 📅 first term 🗨 English

or

Variante Master ORO - Université de Nantes

Students attending one or two semesters at the University of Nantes in the framework of the double diploma register to the 30 or 60 ECTS corresponding to their stay in Nantes in Block 2.

INFO-Y515
(optional)

Large Scale Optimisation
⌚ 3 credits [lecture: 13h, tutorial classes: 13h] 📅 academic year

INFO-Y516
(optional)

Discrete Constraint Programming
⌚ 3 credits [lecture: 13h, tutorial classes: 13h] 📅 academic year

INFO-Y517
(optional)

Global Optimization
⌚ 3 credits [lecture: 13h, tutorial classes: 13h] 📅 academic year

INFO-Y518
(optional)

Black-box Optimization
⌚ 3 credits [lecture: 13h, tutorial classes: 13h] 📅 academic year

INFO-Y519
(optional)

Multi-Objective Optimization
⌚ 3 credits [lecture: 13h, tutorial classes: 13h] 📅 academic year

INFO-Y520
(optional)

Cloud Artificial Intelligence Services
⌚ 3 credits [lecture: 13h, tutorial classes: 13h] 📅 academic year 🗨 English

INFO-Y521
(optional)

Transportation and Logistics
⌚ 3 credits [lecture: 13h, tutorial classes: 13h] 📅 academic year

INFO-Y522
(optional)

Planning and Scheduling
⌚ 3 credits [lecture: 13h, tutorial classes: 13h] 📅 academic year

INFO-Y523
(optional)

Bioinfomatics
⌚ 3 credits [lecture: 13h, tutorial classes: 13h] 📅 academic year

INFO-Y524
(optional)

OR Special Topic II
⌚ 2 credits [lecture: 13h, tutorial classes: 13h] 📅 academic year

INFO-Y525
(optional)

Conferences
⌚ 1 credit [tutorial classes: 26h] 📅 academic year

INFO-Y526
(optional)

Master Thesis (track research)

🕒 20 credits 📅 academic year

INFO-Y527
(optional)

Internship (track application)

🕒 10 credits 📅 academic year