



MA-IRIF | M-IRIFB | 2024-2025

Master of science in Computer Science and Engineering

Focus Big Data Management and Analytics (Erasmus Mundus)

The 2024-2025 programme is subject to change. It is provided for information purposes only.

Programme mnemonic

MA-IRIF

> Focus *Big Data Management and Analytics (Erasmus Mundus)*: M-IRIFB

Exists also in

> Focus *Professional*: M-IRIFS

Studies level

Master 120 credits

Learning language

english

Schedule

office hours

Studies category / subcategory

Sciences and technics / Sciences and technics

Campus

Plaine and Solbosch

- > As Engineers they are capable of applying a multidisciplinary corpus of knowledge from the exact and engineering sciences to resolve challenging multidisciplinary technical problems (e.g., those involving physics, chemistry, mechanics, electronics, ...).
- > As Computer Scientists they are capable of mobilizing a domain-specific body of knowledge in Computer Science and exhibit competences in Computational Thinking to develop new computing systems and to advance the field of computer science itself.

The exposure to the multi-disciplinary corpus of knowledge and the associated problem-solving mindset is developed majoritarily in the Bachelor years. The specialization in Computer Science is majoritarily developed in the Master years.

Due to this multi-disciplinarity, the graduates Master of Science and Engineering in Computer Science at ULB is comfortable with the modeling and approaches to problem solving in a variety of disciplines, not limited to the computational thinking methodology of Computer Science. Given the growing application domain of computing across a wide range of disciplines, the Master Ingénieur Civil en Informatique is capable of bridging the gap between specialized scientific domains and application areas and computing.

Graduates of the program Master of Science in Engineering: Computer Science at ULB are both Engineers and Computer Scientists:

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Programme objectives

The Master in Computer Science and Engineering program provides top quality scientific training in information technology. The aim is to train engineers capable of designing, implementing, correcting and maintaining complex computer-based systems through a thorough understanding of the underlying algorithmical, software, and hardware aspects. The skills developed focus not only on the essential concepts of modern information technology but also on the technical characteristics associated with the training for civil engineering. The project-directed training in particular helps students to develop practical skills in this field.

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Programme's added value

This Master combines the multi-faceted skills set of civil engineers with expertise in computer and information technology. Due to his multi-faceted civil engineering background, the Master in Computer Science and Engineering is a privileged participant in multi-disciplinary projects who understands the technological issues and industrial constraints of the field in which the computer-based solutions are to be implemented, and can therefore ensure optimal solutions.

Teaching methods

The program is taught entirely in English.

The program uses multiple teaching methods, from classical lectures to project-based learning. About half of the program is devoted to exercise sessions and computer labs. Since computer science is by definition a discipline that requires the development of practical expertise, many courses involve project work. During these projects, the student develops, among other competencies, the practical and proactive reflexes required in the professional life as a master in computer science and engineering.

To allow students to gain professional experience, students are offered the possibility to realize an internship of 12 weeks in an enterprise or research centre abroad. The internship has to be done between start of July and end of October, between BLOCK 1 and BLOCK 2.

Succeed in your studies

Choose

The information and guidance counsellors at the InFOR-études [<https://www.ulb.be/en/studies-info-desk-1>] service will help you choose your studies throughout the year.

Succeed

Take part in preparatory courses [<https://www.ulb.be/en/studies-info-desk-1>] or get help to succeed [<https://www.ulb.be/en/studies-info-desk-1>], before or during your studies.

Get help

Apply for financial aid, look for accommodation or a student job, get support [<https://www.ulb.be/fr/aides-services-et-accompagnement/aid-services-and-support-1>] for your specific needs.

International/Openness

The Master of computer science and engineering offered at the Ecole Polytechnique de Bruxelles is co-organized with the

computer science department of the Faculty of Sciences of the ULB and the computer science department of the Vrije Universiteit Brussel (VUB). This collaboration allows in-depth expertise in the array of computer science topics mentioned above.

The Ecole polytechnique encourages students to participate in the Erasmus mobility program. This optional program allows students to spend a semester or an entire year (either in blocks 1 or 2) at a foreign university. Credits of successfully completed courses at the foreign university are recognized by the Ecole polytechnique.

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Job opportunities

Masters in Computer Science and Engineering find jobs in many different sectors, such as:

- > sectors where the main activity consists of the transmission of information (i.e., the telecommunication and computer networking sector);
- > sectors where the main activity concerns the treatment of information (banks, insurances, general administration);
- > the manufacturing industry, where there is an ever-growing demand for automation and computer assistance, not only at the management level (e.g., Business Intelligence) but also on the level of production processes (with a strong trend of integration of the two);
- > in sectors that develop new activities with the aid of computer technology (multimedia, bio-informatics, ...);
- > in research centers

Computer and information-related technologies have known an exponential growth in the past few decades. As expert in this area, the Master in Computer Science and Engineering is hence ideally positioned within this sector. In addition, due to his multi-faceted civil engineering background, the Master in Computer Science and Engineering is a privileged participant in many multi-disciplinary projects.

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Contacts

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 <https://polytech.ulb.be/fr/les-etudes/masters/informatique>





Jury President

Johan GYSELINCK

Jury Secretary

Simon-Pierre GORZA



Master of science in Computer Science and Engineering

Focus Big Data Management and Analytics (Erasmus Mundus)

The 120 ECTS program covers a wide array of computer science topics including the following.

- > "Computational Intelligence", which enables the development of adaptive mechanisms capable of intelligent behavior in complex and dynamic environments.
- > "Software and critical system design" which covers the fundamental concepts of computer science and its practical applications, especially in the development of software applications.
- > "Web and Information Systems", which covers the management of digital information, both in structured form as in traditional databases and in semi-structured form on the web. It also covers business intelligence, and the development of applications on the Web.
- > "3D Graphics and Image Processing", which addresses the technologies related to the acquisition, processing and synthesis of multimedia data.
- > "Optimization and Algorithms", which covers the design of advanced algorithms and operations research, with a focus on optimization methods, on network applications and on computational geometry.
- > "Computer Engineering", which concerns the integrated development of hardware and software.
- > "Entrepreneurship and Management", which concerns computer-science specific issues such as the governance of enterprise IT, but also broader topics such as leadership, finance, and entrepreneurship.

By means of a total of 75 ECTS of required courses, the master program ensures a solid foundation in all of the wide array of Computer Science topics mentioned above. The student can complement her or his program in the topic(s) that she/he is most interested in (for a total of 45 ECTS of elective courses). With the approval of the jury, the student can also complement her/his program by other courses available at the ULB.

In particular, the structure of the program is as follows

MASTER BLOCK 1

- > COMMON, REQUIRED COURSES (45 ECTS)
- > 1 COMPLETE MODULE (15 ECTS) OF ELECTIVE COURSES, CHOSEN AMONG:
 - > MODULE 1.1 COMPUTATIONAL INTELLIGENCE AND OPTIMIZATION
 - > MODULE 1.2 SOFTWARE AND CRITICAL SYSTEMS DESIGN
 - > MODULE 1.3 WEB AND INFORMATION SYSTEMS

MASTER BLOCK 2

- > COMMON, REQUIRED COURSES (30 ECTS)
- > 30 ECTS OF ELECTIVE COURSES, TO BE CHOSEN AMONG THE COURSES OF THE FOLLOWING MODULES (and the courses of modules 1.1-1.3 not chosen in Block 1)
 - > MODULE 2.1 STAGE/INTERNSHIP
 - > MODULE 2.2 COMPUTER ENGINEERING
 - > MODULE 2.3 ENTREPRENEURSHIP AND MANAGEMENT
 - > MODULE 2.4 COMPUTATIONAL INTELLIGENCE
 - > MODULE 2.5 WEB & INFORMATION SYSTEMS
 - > MODULE 2.6 3D GRAPHICS AND IMAGE PROCESSING
 - > MODULE 2.7 ALGORITHMS
 - > MODULE 2.8 OPTIMIZATION
 - > MODULE 2.9 SOFTWARE AND CRITICAL SYSTEMS

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MASTER BLOCK 2

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Bloc 1 | M-IRIFB | MA-IRIF

Business intelligence fundamentals - ULB - Block 1

INFO-H415	Advanced databases Esteban ZIMANYI (Coordinator) ⌚ 5 credits [lecture: 24h, tutorial classes: 24h, practical work: 12h] 📅 first term 🗨 English
INFO-H417	Database systems architecture Mahmoud SAKR (Coordinator) ⌚ 5 credits [lecture: 24h, tutorial classes: 12h, practical work: 24h] 📅 first term 🗨 English
INFO-H419	Data warehouses Esteban ZIMANYI (Coordinator) ⌚ 5 credits [lecture: 24h, tutorial classes: 24h, practical work: 12h] 📅 first term 🗨 English
INFO-H420	Management of Data Science and Business Workflows Dimitrios SACHARIDIS (Coordinator) ⌚ 5 credits [lecture: 24h, tutorial classes: 36h] 📅 first term 🗨 English
INFO-H423	Data Mining Mahmoud SAKR (Coordinator) ⌚ 5 credits [lecture: 24h, tutorial classes: 12h, practical work: 24h] 📅 first term 🗨 English
LANG-H400	Humanities ⌚ 5 credits [tutorial classes: 48h] 📅 first term 🗨 French

Big data fundamentals - UPC - Block 1

ETHI-Y400	Humanities : Debates on Ethics of Big Data ⌚ 2 credits 📅 second term 🗨 English
INFO-Y405	Big Data Management ⌚ 6 credits 📅 second term 🗨 English
INFO-Y406	Semantic Data Management ⌚ 6 credits 📅 second term 🗨 English
INFO-Y408	Big Data Seminar ⌚ 2 credits 📅 second term 🗨 English
INFO-Y508	Viability of business projects ⌚ 6 credits 📅 second term 🗨 English



INFO-Y586

Machine Learning

🕒 6 credits 📅 second term 🗨 English

LANG-Y402

Humanities : Foreign Language

🕒 2 credits 📅 second term 🗨 English

European business intelligence and Big data summer school (summer) - Block 1

Students will attend the summer school organised annually by one partner institution. Presented by learning researchers in the field, it provides students with theoretical and practical skills in the domain. Industrial presentations will allow participants to understand the current product offer.



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Choice of module - Block 2

Business Process Analytics - TU/E (NL)

ETHI-Y500 **Responsible Data Challenge**
5 credits first term English

INFO-Y543 **Advanced Process Mining**
5 credits first term English

INFO-Y544 **Foundations of Process Mining**
5 credits first term English

INFO-Y546 **Longitudinal Data Analysis**
5 credits first term French

INFO-Y547 **Seminar Process Analytics**
5 credits first term English

INFO-Y548 **Applications of Data Science for Software Engineering**
5 credits [lecture: 36h] first term English

Decision Support and Data Analytics - Centrale Supélec (FR)

INFO-Y565 **Decision Modeling**
5 credits first term French

INFO-Y566 **Advanced Machine Learning**
5 credits first term French

INFO-Y567 **Visual Analytics**
5 credits first term French

INFO-Y568 **Massive Graph Management & Analytics**
5 credits first term French

INFO-Y569 **Big Data Research Project**
5 credits [lecture: 24h] first term French

INFO-Y570 **Law and Intellectual Property**
2.5 credits first term French

LANG-Y505 **French Language and European Culture**
2.5 credits [lecture: 24h] first term French

Statistics and Deep Learning for Data Analytics - uniPD (IT)

INFO-Y583 **Statistical Learning**
6 credits [lecture: 36h] first term French

INFO-Y584 **Deep Learning and Human Data Analytics**
6 credits [lecture: 36h] first term French

INFO-Y585 **Time-Series Analysis for Business Economic and Financial Data**
6 credits [lecture: 36h] first term French

Choose 2 of the following 3 courses

Two courses chosen from the following

- | | |
|-------------------------|---|
| INFO-Y580
(optional) | Law and data
⌚ 6 credits [lecture: 36h] 📅 first term 🗨 French |
| INFO-Y581
(optional) | Stochastic methods
⌚ 6 credits [lecture: 36h] 📅 first term 🗨 French |
| INFO-Y582
(optional) | Biological Data
⌚ 6 credits [lecture: 36h] 📅 first term 🗨 French |

Master's thesis - Block 2

(In main or associated partner)

- | | |
|-----------|---|
| MEMO-H511 | Thesis
⌚ 30 credits 📅 academic year 🗨 English |
|-----------|---|