Master of science in Computer Science and Engineering
Focus Professional

Programme mnemonic
MA-IRIF
> Focus *Professional* : M-IRIFS

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

Studies level
Master 120 credits

Learning language
english

Schedule
office hours

Studies category / subcategory
Sciences and technics / Sciences and technics

Campus
Plaine and Solbosch

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.

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

> 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.

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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 thaught 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 in blocks 1 or 2) at a foreign university. Credits of successfully completed courses at the foreign university are recognized by the Ecole polytechnique.

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.

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 Professional

Bloc 1 | M-IRIFS | MA-IRIF

Tronc commun / Core courses

ELEC-H417   Communication networks : protocols and architectures | Jean-Michel DRICOT (Coordinator)
5 credits [lecture: 36h, practical work: 24h]   first term   English

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-F405   Introduction to cryptography | Christophe PETIT (Coordinator) and Gilles VAN ASSCHE
5 credits [lecture: 24h, tutorial classes: 24h, project: 30h]   first term   English

INFO-H410   Techniques of artificial intelligence | Hugues BERSINI (Coordinator)
5 credits [lecture: 24h, tutorial classes: 12h]   second term   English

INFO-H417   Database systems architecture | Mahmoud SAKR (Coordinator)
5 credits [lecture: 24h, tutorial classes: 12h, practical work: 24h]   first term   English

INFO-H422   Theory of information coding computing and complexity | Nicolas CERF (Coordinator) and Jérémie ROLAND
5 credits [lecture: 48h, tutorial classes: 12h]   second term   English

INFO-H500   Image acquisition and processing | Olivier DEBEIR (Coordinator)
5 credits [lecture: 24h, practical work: 24h]   first term   English

One course chosen from the following

PROJ-H402
(optional)   Computing project | Mauro BIRATTARI (Coordinator) and Mehrdad TERATANI
5 credits [project: 150h]   academic year   English

PROJ-H417
(optional)   Projet coopération au développement | Antoine NONCLERCQ (Coordinator)
5 credits [project: 150h]   first and second terms   French
Only on selection : see the Development Unit of the Polytechnic School of Brussels (http://polytech.ulb.be/en/international/development-cooperation)

PROJ-H418
(optional)   Hands-on learning: project manager (chef de projet) | Peter BERKE (Coordinator)
5 credits [project: 150h]   first and second terms   French

Elective courses - Block 1

Choisissez 1 module parmi les modules des Electives 1 / Choose 1 complete module among the modules of Electives

An alternative chosen from the four following

Module Computational intelligence and optimization 1

INFO-F422
(optional)   Statistical foundations of machine learning | Gianluca BONTEMPI (Coordinator)
5 credits [lecture: 24h, tutorial classes: 12h, project: 60h]   second term   English

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-H413
(optional)

Heuristic optimisation | Thomas,T STUTZLE (Coordinator)
5 credits [lecture: 24h, tutorial classes: 12h, practical work: 24h]   second term   English

or

Module Data science 1

INFO-H415
(optional)

Advanced databases | 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

or

Module embedded design 1

ELEC-H409
(optional)

Digital architectures and design | Dragomir MILOJEVIC (Coordinator)
5 credits [lecture: 12h, practical work: 36h]   first term   English

ELEC-H410
(optional)

Real-time computer systems | François QUITIN (Coordinator)
5 credits [lecture: 24h, practical work: 36h]   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

or

Module multimedia 1

INFO-H502
(optional)

Virtual Reality | Gauthier LAFRUIT (Coordinator)
5 credits [lecture: 24h, practical work: 24h, project: 12h]   first term   English

INFO-H503
(optional)

GPU computing | Gauthier LAFRUIT (Coordinator) and Jan LEMEIRE
5 credits [lecture: 24h, practical work: 24h, project: 24h]   second term   English

INFO-H516
(optional)

Visual Media Compression | Mehrdad TERATANI (Coordinator) and Gauthier LAFRUIT
5 credits [lecture: 24h, practical work: 24h, personal assignments: 12h]   second term   English

Master of science in Computer Science and Engineering
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Bloc 2 | M-IRIFS | MA-IRIF

Tronc commun / Core courses - Block 2

GEST-S483   **Digital and IT Governance** | Georges ATAYA (Coordinator)
⏱ 5 credits [lecture: 24h]   📅 second term   💬 English

INFO-H505   **Cloud Computing** | Dimitrios SACHARIDIS (Coordinator) and Mahmoud SAKR
⏱ 5 credits [lecture: 24h]   📅 second term   💬 English

MEMO-H504   **Mémoire de fin d'études en Informatique** | Dimitrios SACHARIDIS (Coordinator)
⏱ 20 credits [mfe/tfe: 600h]   📅 academic year   💬 French

COURS ELECTIVES/ELECTIVE COURSES - Block 2

Electives 1 and 2

Pour arriver à un total de 60 ECTS, choisissez 35 ECTS de cours parmi les cours d'ELECTIVES 1 pas encore choisi en 1ere année d'étude et les cours d' ELECTIVES 2. Avec l'accord du jury et du titulaire, vous pouvez

aussi choisir maximum 10 ECTS de cours offert dans un autre programme de l' Ecole (y compris les cours des modules transversaux de l'Ecole) et/ou maximum 6 ECTS de cours hors faculté.

Choose, to arrive at a total of 60 credits, 30 credits of courses among the courses of ELECTIVES 1 not chosen in the block 1 of study and the courses of ELECTIVES 2. With the approval of the jury and the lecturer, you may also complete your program by choosing at most 10 credits of courses offered in the other programs of the School (including the courses of the transversal modules of the school) and/or at most 6 credits of courses offered outside of the School.

Up to 35 credits chosen from the following

Module Computational intelligence and optimization 1

INFO-F422
(optional)   **Statistical foundations of machine learning** | Gianluca BONTEMPI (Coordinator)
⏱ 5 credits [lecture: 24h, tutorial classes: 12h, project: 60h]   📅 second term   💬 English

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-H413
(optional)   **Heuristic optimisation** | Thomas,T STUTZLE (Coordinator)
⏱ 5 credits [lecture: 24h, tutorial classes: 12h, practical work: 24h]   📅 second term   💬 English

Module Data science 1

INFO-H415
(optional)   **Advanced databases** | 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

Module Embedded design 1

ELEC-H409
(optional)   **Digital architectures and design** | Dragomir MILOJEVIC (Coordinator)
⏱ 5 credits [lecture: 12h, practical work: 36h]   📅 first term   💬 English

| ELEC-H410 | Real-time computer systems | François QUITIN (Coordinator) |
| (optional) | ⏱ 5 credits [lecture: 24h, practical work: 36h]   📅 second term   💬 English |

Module Multimedia 1

| INFO-H502 | Virtual Reality | Gauthier LAFRUIT (Coordinator) |
| (optional) | ⏱ 5 credits [lecture: 24h, practical work: 24h, project: 12h]   📅 first term   💬 English |

| INFO-H503 | GPU computing | Gauthier LAFRUIT (Coordinator) and Jan LEMEIRE |
| (optional) | ⏱ 5 credits [lecture: 24h, practical work: 24h, project: 24h]   📅 second term   💬 English |

| INFO-H516 | Visual Media Compression | Mehrdad TERATANI (Coordinator) and Gauthier LAFRUIT |
| (optional) | ⏱ 5 credits [lecture: 24h, practical work: 24h, personal assignments: 12h]   📅 second term   💬 English |

Module Computational intelligence and optimization 2

| INFO-F409 | Learning dynamics | Tom LENAERTS (Coordinator) |
| (optional) | ⏱ 5 credits [lecture: 24h, project: 60h]   📅 first term   💬 English |

| INFO-F439 | Advanced Methods in Bioinformatics | Matthieu DEFRANCE (Coordinator) and Wim VRANKEN |
| (optional) | ⏱ 5 credits [lecture: 24h, project: 90h]   📅 second term   💬 English |

| INFO-F524 | Continuous optimization | Bernard FORTZ (Coordinator) and Dimitrios PAPADIMITRIOU |
| (optional) | ⏱ 5 credits [lecture: 24h, project: 60h]   📅 second term   💬 English |

| INFO-F530 | Computer science seminar | Tom LENAERTS (Coordinator), Jérôme De Boeck, Bernard FORTZ, John IACONO and Olivier MARKOWITCH |
| (optional) | ⏱ 5 credits [seminars: 36h, project: 60h]   📅 first and second terms   💬 English |

| INFO-H414 | Swarm Intelligence | Marco DORIGO (Coordinator) and Mauro BIRATTARI |
| (optional) | ⏱ 5 credits [lecture: 12h, practical work: 48h]   📅 second term   💬 English |

| INFO-H512 | Current trends in artificial intelligence | Hugues BERSINI (Coordinator) |
| (optional) | ⏱ 5 credits [lecture: 24h, project: 30h]   📅 second term   💬 English |

Module DataScience 2

| INFO-H419 | Data warehouses | Esteban ZIMANYI (Coordinator) |
| (optional) | ⏱ 5 credits [lecture: 24h, tutorial classes: 24h, practical work: 12h]   📅 first term   💬 English |

| INFO-H423 | Data Mining | Mahmoud SAKR (Coordinator) |
| (optional) | ⏱ 5 credits [lecture: 24h, tutorial classes: 12h, practical work: 24h]   📅 first term   💬 English |

| INFO-H515 | Big Data: Distributed Data Management and Scalable Analytics | Dimitrios SACHARIDIS (Coordinator) and Gianluca BONTEMPI |
| (optional) | ⏱ 5 credits [lecture: 24h, tutorial classes: 12h, project: 24h]   📅 second term   💬 English |

Module Multimedia 2

| INFO-H501 | Pattern recognition and image analysis | Olivier DEBEIR (Coordinator) and Christine DECAESTECKER |
| (optional) | ⏱ 5 credits [lecture: 36h, practical work: 24h]   📅 second term   💬 English |

| INFO-Y004 | Natural language processing | Paul VAN EECKE |
| (optional) | ⏱ 6 credits [lecture: 26h, tutorial classes: 26h]   📅 first term   💬 English |

| INFO-Y106 | Information visualisation | Beat SIGNER |
| (optional) | ⏱ 6 credits [lecture: 26h, tutorial classes: 26h]   📅 academic year |

Module Algorithms 2

| INFO-F413 | Data structures and algorithms | Jean CARDINAL (Coordinator) |
| (optional) | ⏱ 5 credits [lecture: 24h, tutorial classes: 12h, project: 60h]   📅 first term   💬 English |

| INFO-F420 | Computational geometry | Stefan LANGERMAN F. SWARZBERG (Coordinator) |
| (optional) | ⏱ 5 credits [lecture: 24h, tutorial classes: 12h, project: 60h]   📅 first term   💬 English |

| INFO-F521 | Graph theory | Gwenaël JORET (Coordinator) |
| (optional) | ⏱ 5 credits [lecture: 24h, tutorial classes: 12h, project: 60h]   📅 first 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 Embedded design 2

ELEC-H505
(optional)

Advanced digital architecture | Dragomir MILOJEVIC (Coordinator)

5 credits [lecture: 24h, practical work: 36h]   second term   English

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-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-Y087
(optional)

Declarative programming | WIGGINS Geraint and VAN EECKE Paul

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-Y532
(optional)

Higher order programming | Jens Nicolay (Coordinator)

6 credits [lecture: 26h, tutorial classes: 26h]   first term

Module Entrepreneurship and management 2

GEST-H501
(optional)

Logistics Engineering and Management | Alassane Ballé NDIAYE (Coordinator)

5 credits [lecture: 12h, tutorial classes: 36h]   first term   English

GEST-H502
(optional)

Supply Chain Performance Analytics | Alassane Ballé NDIAYE (Coordinator)

5 credits [lecture: 12h, tutorial classes: 36h, personal assignments: 12h]   second term   English

GEST-S318
(optional)

Introduction to theoretical finance | Laurent GHEERAERT (Coordinator)

5 credits [lecture: 24h, tutorial classes: 24h]   second term   English

GEST-S421
(optional)

Entrepreneurial ecosystems | Judith BEHRENS (Coordinator)

5 credits [lecture: 24h, tutorial classes: 24h]   second term   English

Module Stage/Internship

STAG-H500
(optional)

Internship (3 months) | Frédéric ROBERT (Coordinator)

10 credits [work placement: 300h]   first term   French

Free elective courses

Students have also the opportunity to choose courses among the courses of the 'transversal modules' of the School.

English : LANG-H500

Engineering and society : PROJ-H421 - GEST-H509 - BIME-G5505 - PHYS-F517

Sustainability : GEST-S492 - ENVI-F405 - CHIM-H504 - ENVI-F452 - ENVI-F454 - ELEC-Y514

Finance, accounting, management, marketing, logistics and quality : GEST-S101 - GEST-S318 - GEST-S421 - GEST-Y501 GEST-H501 - GEST-H502

Participation to a summer school : EDUC-H601

Free elective courses

Up to six credits chosen from the following

BIME-G5505
(optional)

Interfaculty and interdisciplinary program in Healthcare Innovation | Hilde STEVENS (Coordinator)
🕐 5 credits [lecture: 40h, tutorial classes: 20h] 📅 second term 💬 English

CHIM-H504
(optional)

Engineering aspects of circular economy | Prakash VENKATESAN (Coordinator)
🕐 5 credits [lecture: 24h, practical work: 36h] 📅 second term 💬 English

DROI-C5174
(optional)

Approche interdisciplinaire du droit de la propriété intellectuelle/Interdisciplinary Approach to In | Julien CABAY (Coordinator)
🕐 5 credits [lecture: 24h] 📅 first term 💬 English/French

EDUC-H601
(optional)

Summer School | Johan GYSELINCK (Coordinator)
🕐 5 credits [personal assignments: 5h] 📅 academic year 💬 English

ELEC-Y514
(optional)

Sustainability : an interdisciplinary Approach | Cathy MACHARIS (Coordinator) and Waldo Galle
🕐 6 credits [lecture: 36h, practical work: 24h] 📅 academic year 💬 English

ENVI-F405
(optional)

Climat: sciences et politiques | Frank PATTYN (Coordinator) and Louise Knops
🕐 5 credits [lecture: 40h] 📅 second term 💬 French

ENVI-F452
(optional)

Environmental impact analysis and management | Wouter ACHTEN (Coordinator)
🕐 5 credits [lecture: 24h, practical work: 12h, project: 24h] 📅 first term 💬 English/French

ENVI-F454
(optional)

Energie: Société et environnement | Michel HUART (Coordinator) and Nadine MATTIELLI
🕐 5 credits [lecture: 30h, practical work: 12h, project: 24h] 📅 first term 💬 French

GEST-H501
(optional)

Logistics Engineering and Management | Alassane Ballé NDIAYE (Coordinator)
🕐 5 credits [lecture: 12h, tutorial classes: 36h] 📅 first term 💬 English

GEST-H502
(optional)

Supply Chain Performance Analytics | Alassane Ballé NDIAYE (Coordinator)
🕐 5 credits [lecture: 12h, tutorial classes: 36h, personal assignments: 12h] 📅 second term 💬 English

GEST-H509
(optional)

📅 unknown term

GEST-S101
(optional)

Comptabilité financière | Gilles GEVERS (Coordinator) and Laurent GHEERAERT
🕐 5 credits [lecture: 36h, tutorial classes: 8h] 📅 second term 💬 French

GEST-S318
(optional)

Introduction to theoretical finance | Laurent GHEERAERT (Coordinator)
🕐 5 credits [lecture: 24h, tutorial classes: 24h] 📅 second term 💬 English

GEST-S421
(optional)

Entrepreneurial ecosystems | Judith BEHRENS (Coordinator)
🕐 5 credits [lecture: 24h, tutorial classes: 24h] 📅 second term 💬 English

GEST-S492
(optional)

Energy policy, sustainability & management | Adel EL Gammal (Coordinator), Julien BLONDEAU and Michel HUART
🕐 5 credits [lecture: 36h, seminars: 24h] 📅 first term 💬 English

GEST-Y501
(optional)

Business Management and Entrepreneurship | Marc GOLDCHSTEIN (Coordinator)
🕐 3 credits [lecture: 33h] 📅 first term 💬 English

LANG-H500
(optional)

English for professional purposes | Alexander CORNFORD (Coordinator) and Matthew LANGSLEY
🕐 5 credits [tutorial classes: 48h, personal assignments: 12h] 📅 first and second terms 💬 English

PHYS-F517
(optional)

How To Make (almost) Any Experiment Using Digital Fabrication | Denis TERWAGNE (Coordinator)
🕐 5 credits [lecture: 24h, practical work: 24h] 📅 first term 💬 French

PROJ-H421
(optional)

Projet polydaire: expériences didactiques innovantes pour le secondaire | Simon-Pierre GORZA (Coordinator)
🕐 5 credits [project: 150h] 📅 academic year 💬 French