UCLouvain

DATS2M

2021 - 2022

Master [120] in Data Science : Statistic

At Louvain-la-Neuve - 120 credits - 2 years - Day schedule - In French
Dissertation/Graduation Project : **YES** - Internship : **optional**
Activities in English: **YES** - Activities in other languages : **NO**
Activities on other sites : **optional**
Main study domain : **Sciences**
Organized by: **Faculty of Science (SC)**
Programme acronym: **DATS2M** - Francophone Certification Framework: 7

Table of contents

DATS2M - Introduction

Introduction

Introduction

The digitalization is at the origin of the considerable increase of available data. From then on, most of the actors of the society rely on an analysis of these data to objectify their decision-making and develop their disciplinary axes. From these specific needs, we attend to the emergence of new jobs oriented to "data".

The Master degree in Data Science proposes a training in scientific methods and technological tools to answer societal or scientific questions by processing data that are often massive ("Big Data"). This discipline requires associating a model structured by the problem of interest, with computer sciences, statistics and mathematics to bring a rigorous, quantitative and operational solution to the asked question. An IT infrastructure and algorithms of complex calculations also complement these scientific methods to allow the data structuring and processing.

The fields of application of data sciences are extremely varied: the political and security decision taking, the real time on-line advertising, the e-commerce, the data processing of network, the processing of financial data or industrial production, the biomedical research based on o-mics data or of imaging.

Your profile

You hold an undergraduate diploma or a Master's degree and you have acquired solid skills and the taste for the three pillars of the sciences of the data: the mathematics, the statistics and the computing as well as a curiosity for the fields of application of these disciplines.

You master technical English and are capable of attending class, reading scientific documents, to draft reports and to express you orally in this language. You have general skills and necessary personal qualities to approach a diploma of scientific Master's degree such as of the autonomy, a critical mind, the rigor, a capacity of auto-apprenticeship and to look for or to deal with the information.

A block of additional courses (of maximum 60 credits) is proposed to students having no all these skills.

Your future job

Your diploma of Master's degree in data sciences, statistical orientation, prepares you for positions of "data scientist", "data analyst", "data and analytics manager" or simply "statistician" and prepares to set of responsibility in these domains.

Your programme

The program of Master's degree in Science of the Data of the UCL, declined in two orientations, leans on the following four common pillars:

- Statistical inference and modelling.
- Learning theory, Data mining and visualization of large-dimension data.
- The industrial aspects and the business of data sciences and data analytics.

The "Statistical" orientation offered by the LSBA (Louvain School in statistics, biostatistics and actuarial sciences) proposes, in complement to these four common pillars, a training more specialized in useful statistical methods for data sciences and a strong opening towards the implementation of tools in various fields of application, in management, finance and human sciences.

The École Polytechnique of Leuven (EPL) proposes at the UCL a second orientation in the Master's degree in data sciences, which complements the four common pillars with a training more specialized in "Information technologies" via two options in "Computer systems" and "digital Methods and optimization".

Your parcours

You will develop firstly interdisciplinary fundamental skills, solid and deepened to be capable of approaching a wide spectrum of problems in data science. You will also be able to bring to a successful conclusion projects or of to develop research in the domain.

Your program will offer you opportunities to discover, via projects, internships or applied courses, extremely varied scopes of data sciences: political and security decision-making, the real time online advertising, the e-commerce, the data processing of network, the data processing financiers or of industrial production, the biomedical research based on –omics data or of imaging...

DATS2M - Teaching profile

Learning outcomes

Acquire robust methodological bases in analysis and data processing and apply them in varied domains such as human sciences, engineering, marketing, finance, insurance, or scientific research.

After completing the training, the student will master the fundamental concepts in statistics, algorithmic, data mining, and machine learning that are necessary for the job of «data scientist». He will develop skills in communication and will be capable of analyzing a complex problem, of collaborating in a research project. According to the objectives aimed by the student, several elective modules are proposed: applied data, dated sciences in linguistics, algorithmic and computing, statistics and sampling, dated sciences applied to management.

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

1.

Demonstrate the control of a robust corpus of knowledge in data sciences, allowing him(her) to solve the problems which are a matter of his(her) discipline

1.1

The structures of data and algorithms for the analysis of data.

1.2

The theories of the learning, the data mining and the visualization of large-dimension data.

1.3

The statistical inference, the modelling and statistical computing. The student in the orientation information technologies specializes via compulsory or electives courses.

1.4

The industrial and entrepreneurial aspects of data sciences.

1.5

The computer systems, including parallel computing, the networks and the safety(security).

1.6

Numerical methods and optimization, constrained optimization included, operational research, identification and applied mathematics.

2.

Organize and to lead to its term an initiative of development of a data operating system, fulfilling to complex needs of a customer.

2.1

Analyze the problem or solving the functional needs and to formulate the corresponding specifications.

2.2

Formalize and model the problem and design one or several original technical solutions answering these specifications.

2.3

Estimate, justify and classify the solutions with regard to all the criteria appearing in technical specifications: efficiency, feasibility, quality, relevance and security.

2.4

Implement, test and validate the selected solution and interpret the results.

2.5

Formulate recommendations to improve the operational features of the solution.

3.

Organize and lead to his term a research work to comprehend an unsolved problem bound to the exploitation of data according to a new methodology or in a new environment.

3.1

Document and summarize the state of the current knowledge in the considered domain.

3.2

Propose a modelling and/or an experimental plan allowing to simulate and to test hypotheses relative to the studied problem.

3.3

Shape a summary report to describe the methodology with rigor and clarify the theoretical and\or technical potentialities of innovation resulting from this research work.

4.

To contribute in team to the conduct of a project of data exploitation and to lead it to its term by taking into account objectives, assigned resources and constraints that characterize it.

4.1

To center and clarify the objectives of a project (by associating it performance indicators) considering the stakes and the constraints that characterize the environment of the project.

4.2

To be collectively committed on a work plan, a schedule and roles.

4.3

Work in a multidisciplinary environment, together with other actors having various points of view: manage points of disagreement or conflicts.

4.4

To make decisions in team when there are choices: whether it is on the technical solutions or on the organization of the work to run the project successfully.

5.

Communicate effectively orally and in writing to bring to a successful conclusion the projects which are entrusted to him (her) in his (her) working environment (in particular in English).

5.1

Identify clearly the needs for the "customer" or for the user: question, listen and understand all the dimensions of his request and not only the technical aspects.

5.2

Argue and to convince by adapting itself to the language of his (her) interlocutors: technicians, colleagues, customers, managers.

5.3

Communicate under graphic and schematic shape; interpret a plan, present the results of a work, structure information.

5.4

Read, to analyze and to exploit technical documents (diagrams, textbooks, projects specifications).

5.5

Draft written documents by taking into account contextual requirements and social conventions on the subject.

5.6

Make a convincing oral presentation by using the modern techniques of communication.

6.

Show at the same time rigorous, open, critical mind and ethics in its work.

6.1

Apply existing standards in the disciplines of data sciences (terminology, quality measures).

6.2

Find solutions which go beyond the strictly technical issues, by integrating the stakes in ethical dimension of a project (including the data privacy and the protection of the private life) and of sustainable development.

6.3

Show critical mind towards a technical solution to verify the robustness and to minimize the risks that a solution presents with regard to its implementation.

6.4

Make a self-assessment and to develop in an autonomous way the necessary knowledge to remain competent in his (her) domain.

Programme structure

The program of 120 credits of the Master's degree in data science, statistical orientation, consists of:

- A common core syllabus from 52 to 95 credits including courses of
    - statistical modelling,
    - Machine learning and data mining,
    - Computational statistics, structuring of data and algorithmic for data sciences,
    - Philosophy (elective course),
    - Modules to complete if needed, the skills of the student in IT, statistics and mathematics.
- A specialized orientation of 30 credits, including the master thesis and a specific course in the orientation.
- credits for proposed elective courses.
- Maximum 10 credits for courses that are not included in the program, to be made approved by the program committee of the master.

To the program of 120 credits, a module of additional teachings can be added for the student not possessing all the prerequisites of the Master's degree. This module is selected with the advisor of the program.

DATS2M Programme

Detailed programme by subject

CORE COURSES

- O Mandatory
- ⊠ Optional
- △ Not offered in 2021-2022
- ⊘ Not offered in 2021-2022 but offered the following year
- ⊕ Offered in 2021-2022 but not the following year
- △ ⊕ Not offered in 2021-2022 or the following year
- Activity with requisites
- [FR] Teaching language (FR, EN, ES, NL, DE, ...)

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

				Year 1	Year 2
O Statistical modelling					
O LSTAT2120	Linear models	Christian Hafner	EN [q1] [30h+7.5h] [5 Credits]	x	
O LSTAT2130	Introduction to Bayesian statistics	Philippe Lambert	EN [q2] [15h+5h] [4 Credits]	x	
O LSTAT2150	Nonparametric statistics: smoothings methods	Rainer von Sachs	EN [q1] [15h+5h] [4 Credits]	x	x
O Cours au choix *At least 2 courses among the 5 following.*					
⊠ LSTAT2100	Discrete data analysis.	Anouar El Ghouch	FR [q2] [30h+7.5h] [5 Credits]	x	
⊠ LSTAT2170	Times series	Rainer von Sachs	EN [q2] [22.5h+7.5h] [5 Credits]	x	x
⊠ LSTAT2180	Resampling methods with applications	Eugen Pircalabelu	FR [q1] [15h+5h] [4 Credits]	x	x
⊠ LSTAT2210	Advenced linear models	Lieven Desmet (compensates Catherine Legrand)	FR [q1] [15h+5h] [4 Credits]	x	x
⊠ LSTAT2450	Statistical learning. Estimation, selection and inference	Eugen Pircalabelu	EN [q1] [30h+7.5h] [5 Credits]		x
O Machine learning and Data mining					
O LSTAT2110	Data Analysis	Johan Segers	FR [q1] [30h+7.5h] [5 Credits]	x	
O Cours au choix *Choose at least 2 courses among the 3 following.*					
⊠ LELEC2870	Machine learning : regression, deep networks and dimensionality reduction	John Lee Michel Verleysen	EN [q1] [30h+30h] [5 Credits]	x	x
⊠ LINFO2262	Machine Learning :classification and evaluation	Pierre Dupont	EN [q2] [30h+30h] [6 Credits]		x
⊠ LINFO2275	Data mining & decision making	Marco Saerens	EN [q2] [30h+15h] [5 Credits]	x	x
O Statistical computing, data structures and algorithms for data analysis					
O LSTAT2020	Statistical softwares and basic statistical programming	Céline Bugli	FR [q1] [15h+15h] [3 Credits]	x	
O LSTAT2030	Statistique et data sciences avec R: Programmation avancée	Anouar El Ghouch	FR [q2] [15h+15h] [3 Credits]	x	

				Year 1	2
LDATS2360	Seminar in data management: basic	Céline Bugli	FR [q1] [15h+10h] [5 Credits]	x	x
LINFO2172	Databases	Siegfried Nijssen	EN [q2] [30h+30h] [6 Credits]		x

Cours au choix

LDATS2370	Data Management II : SAS ADVANCED PROGRAMMING	Christophe Kabacinski	FR [q2] [15h+10h] [5 Credits]		x
LINMA2472	Algorithms in data science	Jean-Charles Delvenne (coord.) Gautier Krings (compensates Vincent Blondel)	EN [q1] [30h+22.5h] [5 Credits]		x

Philosophie

Maximum one course among:

LSC2001	Introduction to contemporary philosophy	Peter Verdée	FR [q2] [30h] [2 Credits]	x	x
LSC2220	Philosophy of science	Pieter Thyssen (compensates Alexandre Guay)	EN [q2] [30h] [2 Credits]	x	x
LFILO2003E	Ethics in the Sciences and technics (sem)	Hervé Jeanmart Charles Pence René Rezsohazy	FR [q2] [15h+15h] [2 Credits]	x	x

Activités de base

The student chooses, for a maximum of 10 credits, the courses in the list below for which it did not acquire equivalent skills in its previous formation. This choice is discussed with the advisor of the master and next approved by the restricted jury.

Mathématique - Analyse et algèbre linéaire

Each of the following three modules of two courses allows acquiring similar skills:

Module 1

LINFO1111	Analysis	François Glineur Roland Keunings	FR [q1] [45h+37.5h] [7 Credits]	x	
LINFO1112	Algebra	Christophe Craeye Thomas Peters (compensates Enrico Vitale)	FR [q2] [30h+30h] [5 Credits]	x	

Module 2

LINGE1114	Mathematics I: analysis	Heiner Olbermann	FR [q1] [30h+30h] [5 Credits]	x	
LINGE1121	Mathematics II: algebra and matrix calculus	Tom Claeys	FR [q2] [30h+30h] [5 Credits]	x	

Module 3

LMAT1101	Mathematics 1	Pedro Dos Santos Santana Forte Vaz	FR [q1] [30h+20h] [4 Credits]	x	x
LMAT1102	Mathematics 2	Augusto Ponce	FR [q2] [30h+30h] [4 Credits]	x	x

Probabilités et Statistique

Each of the following four modules of two courses allows acquiring similar skills:

Module 1

LSTAT2012	Probabilités: Concepts de base pour l'analyse statistique	Eugen Pircalabelu	FR [q1] [15h+15h] [3 Credits]	x	
LSTAT2013	Concepts de base en statistique inférentielle	Eugen Pircalabelu	FR [q1] [15h+15h] [3 Credits]	x	

Module 2

LBIR1212	Probabilities and statistics (I)	Patrick Bogaert	FR [q1] [30h+15h] [4 Credits]	x	
LBIR1315	Probability and statistics II	Patrick Bogaert	FR [q1] [22.5h+22.5h] [3 Credits]	x	

Module 3

LINGE1113	Probability	Johan Segers	FR [q2] [30h+15h] [4 Credits]	x	
LINGE1214	Further Statistics	Christian Hafner	FR [q1] [30h+15h] [4 Credits]	x	

Module 4

				Year 1	2
○ LMAT1271	Calculation of probability and statistical analysis	Rainer von Sachs	FR [q2] [30h+30h] [6 Credits]	x	

⊠ Programmation et informatique

The student must acquire the skills bound to these three courses:

⊠ LINFO1101	Introduction to programming	Kim Mens Siegfried Nijssen Charles Pecheur	FR [q1] [30h+30h] [5 Credits]	x	
⊠ LEPL1402	Informatics 2	Sébastien Jodogne Ramin Sadre Pierre Schaus	FR [q1] [30h+30h] [5 Credits]	x	
⊠ LEPL1509	Project 4 (in informatics)	Marc Lainez (compensates Yves Deville)	FR [q2] [30h+22.5h] [5 Credits]	x	

⊠ Other pre-requisite activities

The teaching units below may be added to the student's program if they are admitted on a case-by-case basis. The choice of these units will be made in consultation with the study advisor.

⊠ LSTAT2011	Éléments de mathématiques pour la statistique	Catherine Legrand	FR [q1] [15h+15h] [3 Credits]	x	
⊠ LMAFY1101	Data exploration and introduction to statiscal inference	Anouar El Ghouch	FR [q2] [30h+30h] [5 Credits]	x	
⊠ LPSP1209	Statistics, inference on one or two variables	Aurélie Bertrand (compensates Eugen Pircalabelu) Aurélie Bertrand (compensates Bernadette Govaerts)	FR [q1] [22.5h+15h] [4 Credits]	x	
⊠ LPSP1306	Statistics: descriptive analysis and GLM multivariate data modeling	Nathalie Lefèvre Cédric Taverne	FR [q2] [30h+15h] [4 Credits]	x	
⊠ LINGE1222	Multivariate Statistical Analysis	Nathan Uyttendaele (compensates Johan Segers)	FR [q2] [30h+15h] [4 Credits]	x	
⊠ LANGL1330	English intermediate level - 1st part	Stéphanie Brabant Jean-Luc Delghust Aurélie Deneumoustier Fanny Desterbecq Charlotte Diaz Marie Duelz Jérémie Dupal Ilenia Gallo Adrien Kefer (compensates Laura Lievens) Sandrine Mulkers (coord.) Marc Piwnik (coord.) Nevin Serbest Françoise Stas Anne-Julie Toubeau	EN [q1 or q2] [20h] [3 Credits]	x	

PROFESSIONAL FOCUS [30.0]

- Mandatory
- Optional
- Not offered in 2021-2022
- Not offered in 2021-2022 but offered the following year
- Offered in 2021-2022 but not the following year
- Not offered in 2021-2022 or the following year
- Activity with requisites
- [FR] Teaching language (FR, EN, ES, NL, DE, ...)

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

Content:

				Year 1	Year 2
LDATS2840	Master thesis in data analytics		FR [q1 or q2] [] [20 Credits]		x
LDATS2350	Data Mining	Robin Van Oirbeek	EN [q2] [15h+15h] [5 Credits]	x	

Optionnal course

Choose 1 course among the 2 following.

LDATA2010	Information visualisation	John Lee	EN [q1] [30h+30h] [5 Credits]		x
LINFO2364	Mining Patterns in Data	Siegfried Nijssen	EN [q2] [30h+15h] [5 Credits]		x

OPTIONS

The student completes his program with elective courses reported in the list below. With the agreement of the restricted jury, the student can also complete his program by other courses that he would consider relevant and taught at the UCLouvain. The student may include a maximum of 5 language course credits in his or her program, provided that the level is appropriate and consistent with the student's and the program's profile.

> Data in action *[en-prog-2021-dats2m-ldats210o]*
> Data sciences en linguistique et Text Mining *[en-prog-2021-dats2m-ldats211o]*
> Algorithme, informatique, optimisation, recherche opérationnelle *[en-prog-2021-dats2m-ldats220o]*
> Stage *[en-prog-2021-dats2m-ldats240o]*
> Data Sciences appliquées à la gestion *[en-prog-2021-dats2m-ldats250o]*
> Optional courses *[en-prog-2021-dats2m-lsc100o]*

DATA IN ACTION

- Mandatory
- Optional
- Not offered in 2021-2022
- Not offered in 2021-2022 but offered the following year
- Offered in 2021-2022 but not the following year
- Not offered in 2021-2022 or the following year
- Activity with requisites
- [FR] Teaching language (FR, EN, ES, NL, DE, ...)

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

Content:

				Year 1	Year 2
LDATS2310	Data science for insurance and finance	Donatien Hainaut	EN [q1] [15h] [3 Credits]		x
LSTAT2200	Survey and Sampling	Marie-Paule Kestemont	FR [q2] [15h+5h] [4 Credits]	x	x
LSTAT2320	Design of experiment.	Patrick Bogaert Bernadette Govaerts	FR [q2] [22.5h+7.5h] [5 Credits]	x	x

				Year 1	Year 2
⊠ LSTAT2340	Statistical Analyses of ¿omics Data	Céline Bugli Bernadette Govaerts	FR [q2] [15h] [4 Credits]		x
⊠ LSTAT2380	Statistical consulting	Christian Ritter	EN [q1+q2] [30h] [5 Credits]		x
⊠ LSTAT2390	Applied statistics workshops	Catherine Legrand Christian Ritter	EN [q1+q2] [15h] [3 Credits]		x

DATA SCIENCES EN LINGUISTIQUE ET TEXT MINING

- O Mandatory
- ⊠ Optional
- △ Not offered in 2021-2022
- ⊘ Not offered in 2021-2022 but offered the following year
- ⊕ Offered in 2021-2022 but not the following year
- △ ⊕ Not offered in 2021-2022 or the following year
- Activity with requisites
- [FR] Teaching language (FR, EN, ES, NL, DE, ...)

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

o *Content:*

				Year 1	Year 2
⊠ LINFO2263	Computational Linguistics	Pierre Dupont	EN [q1] [30h+15h] [5 Credits]		x
⊠ LFIAL2620	Natural language processing	Cédrick Fairon	FR [q1] [22.5h] [5 Credits]	x	x
⊠ LFIAL2630	Introduction to automatic text processing	Cédrick Fairon	FR [q2] [22.5h] [5 Credits]	x	x

ALGORITHME, INFORMATIQUE, OPTIMISATION, RECHERCHE OPÉRATIONNELLE

- O Mandatory
- ⊠ Optional
- △ Not offered in 2021-2022
- ⊘ Not offered in 2021-2022 but offered the following year
- ⊕ Offered in 2021-2022 but not the following year
- △ ⊕ Not offered in 2021-2022 or the following year
- Activity with requisites
- [FR] Teaching language (FR, EN, ES, NL, DE, ...)

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

o *Content:*

⊠ Cours au choix

Maximum one course among the two courses (As they are bachelor course, the amount of credits is reduced to 5)

				Year 1	Year 2
⊠ LINFO1113	Numerical algorithmic	Loïc Quertenmont	FR [q1] [30h+30h] [6 Credits]	x	
⊠ LINFO1114	Discrete mathematics	Marco Saerens	FR [q2] [30h+15h] [5 Credits]	x	
⊠ LINFO1252	Informatic Systems	Etienne Riviere	FR [q1] [30h+30h] [5 Credits]	x	x
⊠ LINFO2266	Advanced Algorithms for Optimization	Pierre Schaus	EN [q1] [30h+15h] [5 Credits]	x	x
⊠ LINFO2145	Cloud Computing	Etienne Riviere	EN [q1] [30h+15h] [5 Credits]		x

STAGE

- Mandatory
- Optional
- Not offered in 2021-2022
- Not offered in 2021-2022 but offered the following year
- Offered in 2021-2022 but not the following year
- Not offered in 2021-2022 or the following year
- Activity with requisites
- [FR] Teaching language (FR, EN, ES, NL, DE, ...)

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

1 internship maximum, chosen among the two following (optional):

Content:

				Year 1	Year 2
LDATS2940	Stage en science des données		FR [q1 or q2] [] [10 Credits]		x
LDATS2945	Stage en science des données en lien avec le mémoire		FR [q1 or q2] [] [5 Credits]		x

DATA SCIENCES APPLIQUÉES À LA GESTION

- Mandatory
- Optional
- Not offered in 2021-2022
- Not offered in 2021-2022 but offered the following year
- Offered in 2021-2022 but not the following year
- Not offered in 2021-2022 or the following year
- Activity with requisites
- [FR] Teaching language (FR, EN, ES, NL, DE, ...)

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

The following courses are taught on two-month periods and the first three ones are taught on the Campus of UCL Mons. Thus, we ask to students to check that this choice is compatible with their schedule, before inscription.

Content:

				Year 1	Year 2
MLSMM2152	New Technologies & Emerging Practices	Bart Jourquin	FR [q1] [30h] [5 Credits]	x	x
MLSMM2153	Web Mining	François Fouss	EN [q1] [30h] [5 Credits]	x	x
MLSMM2156	Recommender Systems	Corentin Vande Kerckhove	FR [q2] [30h] [5 Credits]	x	x
LLSMS2030	Supply Chain Management (in English)	Pierre Semal	EN [q1] [30h] [5 Credits]		x

OPTIONAL COURSES

- Mandatory
- Optional
- Not offered in 2021-2022
- Not offered in 2021-2022 but offered the following year
- Offered in 2021-2022 but not the following year
- Not offered in 2021-2022 or the following year
- Activity with requisites
- [FR] Teaching language (FR, EN, ES, NL, DE, ...)

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

These credits are not counted within the 120 required credits.

Year
1 2

Content:

⊠ LSST1001	IngénieuxSud	Stéphanie Merle Jean-Pierre Raskin (coord.)	FR [q1+q2] [15h+45h] [5 Credits]	x	x
⊠ LSST1002M	Information and critical thinking - MOOC	Myriam De Kesel Jean-François Rees	FR [q2] [30h+15h] [3 Credits]	x	x

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.

To access to this Master's degree, the student has to master a minimum of preliminary skills in mathematics, programming, algorithmic and probability-statistics. If it is not the case, additional teachings must be added to his program. He can nevertheless include a maximum of 10 of these credits in the prerequisite module planned in the common-core syllabus of the Master's degree.

Students who do not have a B1 level in English (level obtained at UCLouvain) must take the LANGL1330 (https://uclouvain.be/en-cours-langl1330) English course. A dispensatory test is organized at the beginning of the academic year.

The student is invited to meet the program advisor to decide which courses should be followed. The restricted jury must next approve his program.

- Mandatory
- ⊠ Optional
- △ Not offered in 2021-2022
- ⊘ Not offered in 2021-2022 but offered the following year
- ⊕ Offered in 2021-2022 but not the following year
- △ ⊕ Not offered in 2021-2022 or the following year
- Activity with requisites
- [FR] Teaching language (FR, EN, ES, NL, DE, ...)

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

⊠ Mathématique - Analyse et algèbre linéaire

Each of the following three modules allows acquiring similar skills:

⊠ Module 1

LINFO1111	Analysis	François Glineur Roland Keunings	FR [q1] [45h+37.5h] [7 Credits]
LINFO1112	Algebra	Christophe Craeye Thomas Peters (compensates Enrico Vitale)	FR [q2] [30h+30h] [5 Credits]

⊠ Module 2

LINGE1114	Mathematics I: analysis	Heiner Olbermann	FR [q1] [30h+30h] [5 Credits]
LINGE1121	Mathematics II: algebra and matrix calculus	Tom Claeys	FR [q2] [30h+30h] [5 Credits]

⊠ Module 3

LMAT1101	Mathematics 1	Pedro Dos Santos Santana Forte Vaz	FR [q1] [30h+20h] [4 Credits]
LMAT1102	Mathematics 2	Augusto Ponce	FR [q2] [30h+30h] [4 Credits]

⊠ Probabilités et Statistique

Each of the following four modules allows acquiring similar skills:

⊠ Module 1

LSTAT2012	Probabilités: Concepts de base pour l'analyse statistique	Eugen Pircalabelu	FR [q1] [15h+15h] [3 Credits]
LSTAT2013	Concepts de base en statistique inférentielle	Eugen Pircalabelu	FR [q1] [15h+15h] [3 Credits]

Module 2

LBIR1212	Probabilities and statistics (I)	Patrick Bogaert	FR [q1] [30h+15h] [4 Credits]
LBIR1315	Probability and statistics II	Patrick Bogaert	FR [q1] [22.5h+22.5h] [3 Credits]

Module 3

LINGE1113	Probability	Johan Segers	FR [q2] [30h+15h] [4 Credits]
LINGE1214	Further Statistics	Christian Hafner	FR [q1] [30h+15h] [4 Credits]

Module 4

LMAT1271	Calculation of probability and statistical analysis	Rainer von Sachs	FR [q2] [30h+30h] [6 Credits]

Programmation et informatique

The student must acquire the skills related to these three courses:

LINFO1101	Introduction to programming	Kim Mens Siegfried Nijssen Charles Pecheur	FR [q1] [30h+30h] [5 Credits]
LEPL1402	Informatics 2	Sébastien Jodogne Ramin Sadre Pierre Schaus	FR [q1] [30h+30h] [5 Credits]
LEPL1509	Project 4 (in informatics)	Marc Lainez (compensates Yves Deville)	FR [q2] [30h+22.5h] [5 Credits]

Other pre-requisite activities

The teaching units below may be added to the student's program if they are admitted on a case-by-case basis. The choice of these units will be made in consultation with the study advisor.

LSTAT2011	Éléments de mathématiques pour la statistique	Catherine Legrand	FR [q1] [15h+15h] [3 Credits]
LMAFY1101	Data exploration and introduction to statiscal inference	Anouar El Ghouch	FR [q2] [30h+30h] [5 Credits]
LPSP1209	Statistics, inference on one or two variables	Aurélie Bertrand (compensates Eugen Pircalabelu) Aurélie Bertrand (compensates Bernadette Govaerts)	FR [q1] [22.5h+15h] [4 Credits]
LPSP1306	Statistics: descriptive analysis and GLM multivariate data modeling	Nathalie Lefèvre Cédric Taverne	FR [q2] [30h+15h] [4 Credits]
LINGE1222	Multivariate Statistical Analysis	Nathan Uyttendaele (compensates Johan Segers)	FR [q2] [30h+15h] [4 Credits]
LANGL1330	English intermediate level - 1st part	Stéphanie Brabant Jean-Luc Delghust Aurélie Deneumoustier Fanny Desterbecq Charlotte Diaz Marie Duelz Jérémie Dupal Ilenia Gallo Adrien Kefer (compensates Laura Lievens) Sandrine Mulkers (coord.) Marc Piwnik (coord.) Nevin Serbest Françoise Stas Anne-Julie Toubeau	EN [q1 or q2] [20h] [3 Credits]

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.

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.

DATS2M - Information

Access Requirements

Master course admission requirements are defined by the French Community of Belgium Decree of 7 November 2013 defining the hiher education landscape and the academic organisation of courses.

General and specific admission requirements for this programme 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 access requirements

In addition to the access conditions described below, candidates will have to provide proof of a sufficient command of the French language (level B1 of the CEFR, Common European Framework of Reference for Languages).

Students who wish to be admitted on the basis of a dossier (see tables below) are invited to consult the criteria for the evaluation of application.

University Bachelors

Diploma	Special Requirements	Access	Remarks
UCLouvain Bachelors			
Bachelor : Business Engineering Bachelor in Engineering Bachelor in Computer Science Bachelor in Mathematics Bachelor in Physics		Direct access	
Other Bachelor	with Titre inconnu:mininfo or Minor in Statistics, Actuarial Sciences and Data Sciences.	Direct access	In some cases, the UCLouvain Enrolment Office, after reviewing their online enrolment or re-enrolment application, will ask the students concerned to provide an enrolment authorisation from the faculty/ school.
Bachelor in Economics and Management Bachelor in Bioengineering		Access with additional training	Straight access, but the program is completed with an additional training of maximum 10C
Other Bachelor	if no minor in computer sciences / statistics and data sciences	Access based on application	
Others Bachelors of the French speaking Community of Belgium			
Engineer in management Engineering, orientation « civil engineer » Computer sciences Mathematical sciences Physical sciences		Direct access	

Bachelor in economics or management Engineering orientation bio-engineering	Access with additional training	Straight access, but the program is completed with an additional training of maximum 10C
Other Bachelor	Access based on application	
Bachelors of the Dutch speaking Community of Belgium		
Bachelor in de ingenieurswetenschappen Bachelor of Engineering Technology Bachelor in de informatica Bachelor in de wiskunde Bachelor in de fysica Bachelor in de economische wetenschappen Bachelor in de bio-ingenieurswetenschappen	Access based on application	
Foreign Bachelors		
All degree	Access based on application	

Non university Bachelors

> Find out more about links to the university

Diploma	Access	Remarks
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"			
Masters			
Master degree from the French community of Belgium: Civil engineer Computer sciences Engineer in management Actuarial sciences Mathematical sciences Statistics Biostatistics Physical sciences		Direct access	Subject to the acceptance of the file by the jury, a student can be exempted from maximum 60 credits of activity and possibly realize the Master's degree in sciences of the data in a single year.
Other master degrees		Access based on application	Subject to the acceptance of the file by the jury, a student can be exempted from maximum 60 credits of activity and possibly

realize the Master's degree in sciences of the data in a single year

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 required qualifications. However, validation of prior experience does not automatically apply to all courses. Find out more about Validation of priori experience.

Access based on application

Admission on the basis of a submitted dossier may be granted either directly or on the condition of completing additional coursework of a maximum of 60 ECTS credits, or refused.

Foreign students who have succeeded an university education (minimum 3 years) with strong quantitative connotation and who have obtained at least 70% (or 14/20) of average for all successful university years in their home university, without fail in mathematics/ statistics/probability, have the possibility to apply for admission to the master's program in Data Science (120 ECTS).

Students who wish to be admitted on the basis of a dossier are invited to consult the criteria for the evaluation of application.

Admission and Enrolment Procedures for general registration

Teaching method

By its professional vocation, the teaching is completed by numerous practical class having for objective the implementation of methods of analysis on real data. On the other hand, the student also has the possibility of including in his program, a company internship to develop the methodological aspects of the report there. Certain projects will also require working in multidisciplinary teams, what contributes to the development of a stimulating and friendly spirit of collaboration among the students of the program.

The majority of the courses distributed by the teachers are accompanied by an intranet site on the platform "moodle". These sites propose tools of e-learning and serve as forum to the students.

Certain specialized modules are taught by professors coming from the industry.

Finally, the program includes compulsory courses in English and in French. Thus, the student must be capable of attending class in both languages. The report can be made in English and the student can also individual ask to take his examinations in English. The choice of English aims at favoring international attraction of this training and at perfecting the skills of our own local students. Opportunities will be offered to students who do not know French and wish for a complete cycle in English.

Evaluation

The evaluation methods comply with the regulations concerning studies and exams (https://uclouvain.be/fr/decouvrir/rgee.html). More detailed explanation of the modalities specific to each learning unit are available on their description sheets under the heading "Learning outcomes evaluation method".

Assessment methods are in accordance with the regulation of studies and examinations. More information about the modalities appropriate to every credit is available in their descriptive index card, in the column "Assessment mode of learning outcomes of students".

Every EU of the program contains an oral examination or a written examination often completed by a project completed by a report, taken into account in the assessment. The (optional) internship and the master thesis each involve the writing of a document being the object of an oral defense in front of a jury.

The total mark is an average of marks for each course, weighted by their respective credits.

If a student registered to an examination in January was not able to attend for duly justified reasons of force majeure, he can ask to the foreman of jury for the authorization to present the examination in June. The foreman of jury judges the relevance of the request and, if the professor of the course agrees, the student can retake the examination in June.

Mobility and/or Internationalisation outlook

The program of Master's degree in science of the data (statistical orientation) being new, no program of systematic exchange with foreign universities is set up.

The students who wish to gain an experience abroad within a company or an outside body during their program can:

- Do an internship in a private company (in Belgium or abroad).
- Prepare a master thesis in collaboration with a company (in Belgium or abroad).
- Participate to a program with a university that has a partnership with the UCL, for bilateral exchange of students.

The students wishing to participate in a program of international exchange are invited to get in touch with the person responsible for these within the Faculty of Science or with the person of contact within the School of statistics, biostatistics and actuarial sciences (LSBA).

Detailed Information on: https://uclouvain.be/fr/facultes/sc/programmes-d-echange-d-etudiants.html (https://uclouvain.be/fr/facultes/sc/programmes-d-echange-d-etudiants.html).

Possible trainings at the end of the programme

After having obtained the Master's degree in data sciences (statistical orientation) a student who has chosen adequate elective courses, can realize in one year a Master's degree in biostatistics, a Master's degree in statistics or a Master's degree in data sciences (orientation information technology). The interested student is invited to contact the program advisor of the envisaged Master's degrees.

Accessible Doctoral programs :

The Master's degree in data science (statistical orientation) allows to register for the doctoral program in statistics if the following conditions are fulfilled:

- The success of the master program with distinction,
- The availability of a supervisor or a co-supervisor at the School of statistics, biostatistics and actuarial sciences (LSBA) ready to guide the student in his work of thesis,
- The acceptance of the application by the Doctoral Commission of the Domain (CDD).

Certificates

The LSBA also proposes diverse programs of continuous training (certified or not), as the university certificate in statistics and data sciences which allows to follow 15 to 30 credits of courses according to the interest or professional needs for the participant.

The SMCS also propose complementary trainings (not certified) in statistics and statistical software. (https://uclouvain.be/fr/chercher/smcs (https://uclouvain.be/fr/chercher/smcs))

Contacts

Curriculum Management

Entity

Structure entity	SST/SC/LSBA
Denomination	(LSBA)
Faculty	Faculty of Science (SC)
Sector	Sciences and Technology (SST)
Acronym	LSBA
Postal address	Voie du Roman Pays 20 - bte L1.04.01 1348 Louvain-la-Neuve Tel: +32 (0) 10 47 43 14 - Fax: +32 (0) 10 47 30 32
Website	https://uclouvain.be/fr/facultes/sc/lsba

Academic supervisor: Donatien Hainaut (https://uclouvain.be/repertoires/donatien.hainaut)

Jury

- Foreman of the jury: Christian Hafner (https://uclouvain.be/repertoires/christian.hafner)
- Secretary of the jury: Rainer von Sachs (https://uclouvain.be/repertoires/rainer.vonsachs)

Useful Contact(s)

- Study advisor: Donatien Hainaut (https://uclouvain.be/repertoires/donatien.hainaut)
- Secretary of The Louvain School of Statistics, Biostatistics and Actuarial Sciences: Sophie Malali (https://uclouvain.be/repertoires/sophie.malali)