

Bachelor in Mathematics, option: Data Science**Main Language of Instruction:**Français Anglais Arabe **Campus Where the Program Is Offered:** CST, CLN, CLS, CZB**OBJECTIVES**

Data science operates at the intersection of mathematics and computer science. Our program encompasses a wide range of topics, including programming and data analysis for handling and processing large datasets, as well as mathematical concepts such as probability and statistics for data analysis and interpretation. Additionally, we offer courses in artificial intelligence and machine learning aimed at deriving valuable insights from data to aid decision-making processes.

COMPETENCIES

- Apply diverse mathematical methods to tackle challenges associated with extensive data sets;
- Develop computer programs using appropriate languages for data science to gather, refine, and interpret data;
- Effectively convey data analysis findings through verbal, written, and visual means to audiences with varying technical backgrounds;
- Promote ethical practices in data use and decision-making;
- Instruct and/or organize mathematics and computer science curricula at secondary education levels;
- Undertake advanced studies leading to a master in data science.

PROGRAM REQUIREMENTS

Core courses (144 credits), major elective courses (30 credits), free elective courses (6 credits) (including 32 credits of General Education Courses).

Fundamental Courses (152 Cr.)**Core Courses (144 Cr.)**

Advanced Programming with C++ (6 Cr.), Applied Linear Algebra (6 Cr.), Artificial Intelligence (4 Cr.), Big Data Frameworks (4 Cr.), Calculus I (6 Cr.), Calculus II (6 Cr.), Calculus III (6 Cr.), Computer Programming I (6 Cr.), Computer Programming II (6 Cr.), Data Algorithms and Structures (4 Cr.), Data Mining (6 Cr.), Data Protection (2 Cr.), Data Visualization (6 Cr.), Descriptive Statistics (4 Cr.), Discrete Mathematics (4 Cr.), Ethics for Data science (2 Cr.), Foundations of Data Science (4 Cr.), Introduction to Natural Language Processing (4 Cr.), Introduction to Programming with C++ (4 Cr.), Lab for R (4 Cr.), MATLAB for Data Science (4 Cr.), Matrix Computations (6 Cr.), Probability for Data Science (6 Cr.), Project Management (6 Cr.), Projects in Data Science (6 Cr.), Relational Databases (6 Cr.), Statistical Analysis of Data (6 Cr.), Statistics for Data Science (6 Cr.), Web Application (4 Cr.).

Major Elective Courses (12 Cr.)

Business and Professional Communication (4 Cr.), Internet Programming (4 Cr.), Introduction to Economics (4 Cr.).

Free Elective Courses (6 Cr.)**Arabic course (4 Cr.)**

Two courses to be chosen from the list of Arabic-taught courses (see USJ General Education Courses).

Other courses (2 Cr.)

One course to be chosen from the list of USJ General Education Courses (i.e., sports, etc.)

USJ General Education Courses (32 Cr.)

English (4 Cr.) (Mandatory)

English Level A (4 Cr.)

Arabic (4 Cr.) (Free Electives)

Arabic Language and Culture (2 Cr.)

One course to be chosen from the following:

اللغة العربيّة والإعلام (2 Cr.)

اللغة العربيّة والفنون (2 Cr.)

One course taught in Arabic (2 Cr.)

One course to be chosen from the following:

الاجرات الاساسية الانقاذية ما قبل الاسعاف (2 Cr.)

التعبير الذاتي عبر الموسيقى (2 Cr.)

المسرح والتعرف على الذات (2 Cr.)

Humanities (8 Cr.) (major elective courses)

Ethics (2 Cr.)

Ethics in Data science (2 Cr.)

Religious Studies (2 Cr.)

Les valeurs de l'USJ au quotidien (2 Cr.)

Engagement civique et citoyen (2 Cr.)

One course to be chosen from the following:

المواطنة الفعّالة: الاستراتيجيّة والتقنيّات التقنيّة (2 Cr.)

Le droit dans la vie quotidienne - الحياة اليومية (2 Cr.)

Sustainable development - التنمية المستدامة (2 Cr.)

Other (2 Cr.)

One course to be chosen from the following list:

Origine des concepts scientifiques (2 Cr.)

Journalisme scientifique (2 Cr.)

Le monde, l'actualité et moi (2 Cr.)

Social Sciences (6 Cr.) (free elective courses)

Professional Integration and Entrepreneurship (2 Cr.)

One course to be chosen from the following:

Successful Job Hunting (2 Cr.)

Entrepreneurship (2 Cr.)

Work Ready Now (2 Cr.)

Other (4 Cr.)

Two courses to be chosen from the following:

Designing Business Models (2 Cr.)

Time and Money Management (2 Cr.)

Social Leadership (2 Cr.)

Sociology of Emotions (2 Cr.)

Communication Techniques (4 Cr.) (core course)

Business and Professional Communication (4 Cr.)

Quantitative Techniques (6 Cr.) (core course)

Statistics for Data Science (6 Cr.)

SUGGESTED STUDY PLAN

Semester 1

Code	Course Name	Credits
048CA1DL1	Calculus I	6
048CP1DL1	Computer Programming I	6
048DSTD1	Descriptive Statistics	4
048DIMDL1	Discrete Mathematics	4
048FDSDL1	Foundations of Data Science	4
	Free Elective – Arabic	2
	USJ GEC – Humanities	4
	Total	30

Semester 2

Code	Course Name	Credits
048LA1DL2	Applied Linear Algebra	6
048CA2DL2	Calculus II	6
048CP2DL2	Computer Programming II	6
048DAPDL2	Data Protection	2
048ETHDL2	Ethics for Data Science	2
048INPRDL2	Internet Programming	4
	USJ GEC – Arabic	4
	Total	30

Semester 3

Code	Course Name	Credits
048BPCDL3	Business and Professional Communication	4
048CA3DL3	Calculus III	6
048PRCDL3	Introduction to Programming with C++	4
048PRODL3	Probability for Data Science	6
048RDADL3	Relational Databases	6
	USJ GEC – Arabic	2
	USJ GEC – Humanities	2
	Total	30

Semester 4

Code	Course Name	Credits
048APCDL4	Advanced Programming with C++	6
048BDFDL4	Big Data Frameworks	4
048DSADL4	Data Algorithms and Structures	4

o48RLADL4	Lab for R	4
o48MCADL4	Matrix Computations	6
o48STADL4	Statistics for Data Science	6
	Total	30

Semester 5

Code	Course Name	Credits
o48ARIDL4	Artificial Intelligence	4
o48DMIDL5	Data Mining	6
o48DVIDL5	Data Visualization	6
o48ANGLL5	English – Level A	4
o48SADDL5	Statistical analysis of data	6
	USJ GEC – Arabic	2
	USJ GEC – Humanities	2
	Total	30

Semester 6

Code	Course Name	Credits
o48ECODL5	Introduction to Economics	4
o48NLPDL6	Introduction to Natural Language Processing	4
o48MDSDL6	MATLAB for Data Science	4
o48PRMDL6	Project Management	6
o48PDSDL6	Projects in Data Science	6
o48WEBDL6	Web Application	4
	USJ GEC – Social Sciences	2
	Total	30

Course Description

o48APCDL4	Advanced Programming with C++	6 Cr.
------------------	--------------------------------------	--------------

This course thoroughly covers Object-Oriented Programming (OOP) principles using the C++ language. Key topics include: Fundamentals of OOP, Classes and Objects, Constructors and Destructors, Access Modifiers, Inheritance, Polymorphism, Virtual Functions, and Abstract Classes. By course end, students will have a solid grasp of OOP principles and practical proficiency in utilizing C++ for designing efficient, modular, and maintainable software applications.

o48LA1DL2	Applied Linear Algebra	6 Cr.
------------------	-------------------------------	--------------

This course offers a contemporary, foundational exploration of linear algebra alongside a diverse array of practical applications. It adopts a modern perspective, aligning with how linear algebra is utilized in data science and engineering. Topics include: solving systems of linear equations, matrices, linear programming, determinants, vector spaces, inner product spaces, eigenvalues and eigenvectors, linear transformations, and numerical methods.

048ARIDL4	Artificial Intelligence	4 Cr.
<p>This course will cover the foundational concepts and techniques used in building intelligent computer systems. Topics include intelligent agents, problem-solving algorithms, game design, reasoning and decision-making under uncertainty, machine learning, logic, knowledge representation, and planning.</p>		
048BDFDL4	Big Data Frameworks	4 Cr.
<p>This course aims to delve into the world of BIG DATA by comprehensively understanding its technical components and aspects. Through the study of top frameworks and databases, participants will engage in learning and practical application across multiple scenarios.</p>		
048BPCDL3	Business and Professional Communication	4 Cr.
<p>This course equips students with fundamental communication skills across written, verbal, and non-verbal domains, essential for success in professional settings. It is structured into two sections. The first section focuses on crafting visually engaging presentations, while the second section hones academic and professional communication skills. Through theoretical insights and practical strategies, students learn to navigate diverse communication scenarios, tailoring their approach to both individuals and larger audiences. Emphasis is placed on leveraging various communication tools effectively within different contexts. Through interactive sessions, students develop their abilities as communicators and public speakers, empowering them to influence peers and excel in academic and professional pursuits.</p>		
048CA1DL1	Calculus I	6 Cr.
<p>This course aims to equip students with proficiency in fundamental calculus computations. By the course's end, students will be able to compute limits, derivatives, and integrals, analyze functions using these concepts, and effectively apply calculus techniques to solve real-world problems across diverse fields such as physics, biology, business, and economics.</p>		
048CA2DL2	Calculus II	6 Cr.
<p>Upon completion of this course, students will master various advanced calculus topics, including modeling and problem-solving using sequences and series, exploring discrete structures crucial for data science, utilizing MATLAB programming for computations involving sequences, series, parametric, and polar curves, approximating functions via Taylor and Maclaurin expansions, evaluating limits, continuity, and differentiability of multivariable functions, identifying local and absolute extrema of surfaces, analyzing parametric equations, converting between Cartesian and polar coordinates, and studying 3-D geometric figures.</p>		
048CA3DL3	Calculus III	6 Cr.
<p>This course delves into advanced calculus principles, focusing on partial derivatives, multiple integrals, line integrals, and second-order differential equations. The curriculum emphasizes both theoretical comprehension and practical application across various disciplines.</p>		
048CITBL1	المواطنة الفعّالة: الاستراتيجيّة والتقنيّات والتقيّات Citoyenneté	2 Cr.
<p>This course is tailored for STEM students, aiming to provide them with an opportunity to explore citizenship and various civic practices both in Lebanon and globally.</p>		
048CP1DL1	Computer Programming I	6 Cr.
<p>This course introduces students to algorithms and programming through pseudocode and Python. By the end, students will be able to design algorithms, convert pseudocode to Python, and debug Python programs effectively.</p>		

048CP2DL2	Computer Programming II	6 Cr.
------------------	--------------------------------	--------------

In this course, students learn to develop programs of varying complexity using Python. Upon completion, students will proficiently write Python programs for mathematical problem-solving, select suitable data structures, and utilize Python libraries for data analysis.

048DSADL4	Data Algorithms and Structures	4 Cr.
------------------	---------------------------------------	--------------

This course introduces fundamental concepts of data structures and algorithms using the C++ programming language. Topics include pointers, recursion, algorithmic complexity, sorting methods, linked lists, stacks, queues, and binary trees.

048DMIDL5	Data Mining	6 Cr.
------------------	--------------------	--------------

This course provides an in-depth exploration of key data mining concepts and techniques, enabling students to extract valuable insights from data. Topics covered include data preprocessing, association rules, classification methods, clustering, and support vector machines, with emphasis on both theoretical understanding and practical implementation.

048DAPDL2	Data Protection	2 Cr.
------------------	------------------------	--------------

This course aims to instill good practices of personal data protection for Data Science students. Upon completion, students will: grasp key terminology in data protection, understand their roles and obligations under the General Data Protection Regulation (GDPR) and the Data Protection Act (DPA) 1998, identify data protection principles applicable to all organizations, discern lawful grounds for processing personal data, appreciate the significance of risk management, and acquire various techniques for safeguarding personal data.

048DVIDL5	Data Visualization	6 Cr.
------------------	---------------------------	--------------

This course introduces students to fundamental principles and techniques of data visualization. Through hands-on exercises and projects, students will learn to create effective visualizations using various chart types and visualization tools.

048DSTDL1	Descriptive Statistics	4 Cr.
------------------	-------------------------------	--------------

This course aims to equip students with essential statistical concepts for data science applications. Students will apply these concepts practically in data collection, analysis, and interpretation. By the end of the course, students will be able to calculate measures of central tendency and dispersion and interpret their significance, organize data into frequency tables and visually represent them using various graphs, and use descriptive and deductive statistical methods to examine the relationship between two numerical variables (e.g., linear regression) and analyze correlation.

048DIMDL1	Discrete Mathematics	4 Cr.
------------------	-----------------------------	--------------

This course focuses on the following objectives:

- Introduce mathematical logic concepts for analyzing propositions and proving theorems;
- Demonstrate proficiency in writing and evaluating proofs, with examples of various proof techniques;
- Apply sets to solve real-world problems and utilize set operations algebraically;
- Explore functions as relations and their properties;
- Understand and apply the Quotient-Remainder Theorem (Division Algorithm) and construct divisibility arguments;
- Apply the Euclidean Algorithm.

048DBMML6	Designing Business Models	2 Cr.
<p>This course explores the fundamentals of designing business models, offering insights into how businesses operate and addressing key challenges. Through immersive business case studies, students gain practical experience in understanding the dynamics behind various industries.</p>		
048ANGLL5	English - Level A	4 Cr.
<p>The English for Specific Purposes (ESP) course focuses on enhancing students' language proficiency, particularly in written and oral scientific communication. It covers academic paper writing, clear presentation of scientific data, and active engagement in English academic discussions.</p>		
048ENTML6	Entrepreneurship	2 Cr.
<p>This course equips students with the skills necessary to cultivate an entrepreneurial mindset in their everyday lives. It covers idea generation, growth strategies, and creating social value. The curriculum includes theoretical lectures, interactive discussions, group projects, and hands-on exercises. Students will learn to initiate their ventures, innovate products, and make a positive impact on society.</p>		
048ETHDL2	Ethics for Data Science	2 Cr.
<p>This course examines the ethical considerations and responsibilities inherent in data science. Students will explore diverse ethical frameworks, analyze real-world case studies, and participate in discussions to develop a comprehensive understanding of ethical decision-making within the context of data science.</p>		
048FSDSL1	Foundations of Data Science	4 Cr.
<p>This course aims to introduce students to the essential tools and concepts of data science. Upon successful completion, students will understand data science terminology, experiment with data science tools for analytics, big data, etc., and get acquainted with the concept of No-SQL databases. To achieve these learning objectives, coursework will include exercises and resources through which students will engage in hands-on problem-solving activities.</p>		
048INPRDL2	Internet Programming	4 Cr.
<p>This course is tailored for beginners seeking to grasp the fundamentals of web development using HTML and CSS. Students will learn to create basic web page layouts, format text, incorporate images, links, and lists using HTML tags, and apply styles and layouts using CSS. By the course's end, students will possess the foundational skills necessary to develop simple web pages.</p>		
048ECODL5	Introduction to Economics	4 Cr.
<p>This course lays the groundwork in microeconomic and macroeconomic principles, aiming to grasp contemporary economic behaviors. Employing economic models and graphical tools, it illustrates how supply, demand, and macroeconomic aggregates shape economic outcomes.</p>		
048NLPDL6	Introduction to Natural Language Processing	4 Cr.
<p>This course offers a comprehensive understanding and practical skills in handling human language data through Natural Language Processing (NLP) techniques.</p>		
048PRCDL3	Introduction to Programming with C++	4 Cr.
<p>This course initiates students into C++ programming fundamentals. Covering variables, control structures, functions, and arrays, it emphasizes practical application via hands-on coding exercises. By the end of this course, students should achieve proficiency in writing simple C++ programs, understanding syntax, debugging code, utilizing variables and operators, employing conditional statements and loops, designing and employing functions, manipulating arrays including multidimensional ones, and basic string operations.</p>		

048JSCPL1	Journalisme scientifique	2 Cr.
<p>This course covers fundamental techniques and principles of journalistic writing. By the course's conclusion, students will proficiently employ these techniques, evaluate the suitability of scientific information for general press publication, and effectively craft both journalistic news pieces and scientific press articles.</p>		
048RLADL4	Lab for R	4 Cr.
<p>This course aims to equip students with practical skills in using the R programming language for statistical analysis, data visualization, and manipulation. Through hands-on exercises and real-world examples, participants will gain a thorough understanding of R's functionalities.</p>		
048DVQCL1	Le droit dans la vie quotidienne - القانون في الحياة اليومية	2 Cr.
<p>This course aims to introduce students to fundamental legal concepts in a clear and approachable manner, particularly designed for science students who may find the subject daunting. The objective is to empower these students to grasp contemporary legal issues, understand their fundamental rights and responsibilities as citizens, and contextualize their national legal framework within the scope of international law. Through practical examples, the course equips students with the skills to locate and interpret legal texts, articles of law, and international conventions. Additionally, it emphasizes the importance of respecting the etymology of words and legal terminology.</p>		
048MAMPL1	Le monde, l'actualité et moi	2 Cr.
<p>This course prompts students to reflect on prevalent issues dominating headlines locally and globally, fostering critical thinking and the articulation of viewpoints. Amidst Lebanon's current health, economic, social, and political crises, students analyze impactful news stories, honing their ability to form informed opinions.</p>		
048VUQBL1	Les valeurs de l'USJ au quotidien	2 Cr.
<p>This course aims to instill in students the core values of Saint Joseph University of Beirut (USJ), empowering them to apply these values in their personal, interpersonal, and professional spheres. By critically examining the principles outlined in the USJ Charter, students are equipped to navigate contemporary challenges and understand their ethical obligations on a global scale, contributing positively towards societal advancement.</p>		
048MDSDL6	MATLAB for Data Science	4 Cr.
<p>This course equips students with essential skills to utilize MATLAB's powerful numerical computation capabilities for data manipulation, analysis, machine learning, and model deployment in data science. Through hands-on exercises, practical examples, and real-world projects, students will learn to access, preprocess, and visualize data, construct machine learning models, and deploy them in enterprise systems using MATLAB. Additionally, ethical considerations and emerging trends in data science are explored to ensure students develop a holistic understanding of the subject.</p>		
048MCADL4	Matrix Computations	6 Cr.
<p>This course offers a comprehensive understanding of numerical linear algebra, with a focus on practical applications for computational scientists and engineers. Topics include fast transforms, parallel LU decomposition, discrete Poisson solvers, pseudospectra, structured linear equation problems, structured eigenvalue problems, large-scale singular value decomposition (SVD) methods, and polynomial eigenvalue problems.</p>		
048OCSC1	Origine des concepts scientifiques	2 Cr.
<p>This course aims to provide students with a reflective analysis of the historical development of scientific disciplines and the evolution of scientific concepts. Through this exploration, critical thinking skills will be cultivated, specifically in understanding the interconnections between epistemology, the philosophy of science, and scientific history. Additionally, the course will delve into various epistemological perspectives that have shaped the formation of scientific knowledge. These insights are essential for comprehending contemporary scientific concepts across disciplines such as science, chemistry, physics, and mathematics. Ultimately, an epistemological examination of scientific theory construction informs both science education and the approach of scientific researchers.</p>		

o48PRODL3	Probability for Data Science	6 Cr.
------------------	-------------------------------------	--------------

This course focuses on equipping students with the techniques necessary to analyze and interpret random phenomena. It begins with a study of enumerative combinatorics, essential for probability calculations, followed by an exploration of independent events. Students then delve into random variables and various probability laws including Bernoulli, binomial, Poisson, geometric, hypergeometric, uniform, Gaussian, and exponential distributions. The course concludes with an introduction to the weak law of large numbers and the central limit theorem, laying the groundwork for further studies in statistics.

o48PRMDL6	Project Management	6 Cr.
------------------	---------------------------	--------------

This course offers a comprehensive overview of project management principles and practices. Through a combination of theoretical learning and practical exercises, students will gain the necessary skills to successfully initiate, plan, execute, monitor, and close projects across diverse industries. Case studies and group discussions further enhance understanding and application of project management concepts.

o48PDSDL6	Projects in Data Science	6 Cr.
------------------	---------------------------------	--------------

This project-based course allows students to apply their acquired knowledge in practical settings. It involves utilizing statistical analysis, programming in R, and either scripting (Python) or compiled (C++) languages to process real-world data. Students will culminate their work with a detailed written report outlining their project's execution and findings.

o48RDADL3	Relational Databases	6 Cr.
------------------	-----------------------------	--------------

This course offers a comprehensive introduction to relational database systems, covering fundamental concepts and practical applications. Through a blend of theory and hands-on exercises, students will learn to design, create, query, and manage relational databases effectively. Topics include data modeling, SQL query language, normalization techniques, database administration, and data quality assurance. Advanced subjects such as object-oriented databases, data warehousing, and database technology integration are also explored.

o48SADDL5	Statistical Analysis of Data	6 Cr.
------------------	-------------------------------------	--------------

This course provides a thorough introduction to statistical analysis techniques for data interpretation and decision-making, emphasizing practical applications with the R statistical software. Students will develop skills in data analysis, interpretation, various statistical tests, and advanced techniques for multivariate data analysis.

o48STADL4	Statistics for Data Science	6 Cr.
------------------	------------------------------------	--------------

This course aims to equip Data Science students with a solid understanding of statistical concepts, including sampling, estimation using confidence intervals, hypothesis testing, regression, correlation analysis, Goodness-of-fit tests, and independence Chi-square tests.

o48LEABL1	Social Leadership	2 Cr.
------------------	--------------------------	--------------

Social leadership emphasizes the emotional and empathetic approach of leaders who prioritize connection, collaboration, and communication. These leaders understand the importance of building strong relationships within their teams and fostering a positive work environment. Being a social leader entails nurturing trust, care, and respect among team members, creating an open atmosphere conducive to idea-sharing in an ever-changing work climate. Unlike formal leaders who rely solely on position or title, social leaders utilize emotional intelligence and interpersonal skills to influence others, enhancing effectiveness in today's workplace where meaning and purpose are valued by employees. After completing this course, students will be able to:

- Recognize the values and principles of Social Leadership;
- Develop essential skills for effective social leadership;
- Define their purpose and guide their team accordingly;
- Understand the 9 core principles of the NET Model;
- Assess strengths and areas for improvement.

048EMIPL2	Sociology of Emotions	2 Cr.
------------------	------------------------------	--------------

This course introduces students to sociological theories regarding emotions. It examines how emotions influence both individual and collective decision-making processes, and evaluates social interactions from an emotional perspective.

048SJHPL2	Successful Job Hunting	2 Cr.
------------------	-------------------------------	--------------

This course aims to familiarize students with the expectations of professional life, covering both personal growth and technical skills. It includes:

- Crafting effective responses to job offers (via application emails, cover letters, and CVs);
- Mastering job interview techniques (including dress code, body language, self-presentation, and best practices);
- Efficient job search strategies (creating a strong LinkedIn profile, leveraging social media platforms like X, posting
- CVs on job portals such as Monster and Bayt, and utilizing institutional, company, hospital, and industry websites for job searches).

048SSDCL1	Sustainable Development - التنمية المستدامة	2 Cr.
------------------	--	--------------

The purpose of this course is to familiarize students with the interconnections among different sectors of human activity, emphasizing sustainable development and the UN's Sustainable Development Goals (SDGs). Additionally, it aims to clarify the roles of both public and private entities in achieving these goals.

048TMMML2	Time and Money Management	2 Cr.
------------------	----------------------------------	--------------

This course is designed to help undergraduates enhance their productivity through informed decision-making. It provides students with a comprehensive understanding of investment opportunities across various industries, including the stock market, life insurance, private banking, and retail banking.

048WEBDL6	Web Application	4 Cr.
------------------	------------------------	--------------

This course aims to provide students with the necessary knowledge and skills to create dynamic web applications specifically for data science tasks.

048WRNBL2	Work Ready Now	2 Cr.
------------------	-----------------------	--------------

This course aims to equip students with essential soft skills and practical work experiences to excel in professional environments. Through active engagement and hands-on learning, students will develop and refine crucial skills, fostering the self-confidence needed to pursue, secure, and excel in roles aligned with their career aspirations. Work-based learning activities will prepare them for internships and entry-level positions, while digital assignments will reinforce these skills in practical contexts. Additionally, students will build a comprehensive career portfolio throughout the course, serving as a valuable tool in their transition from student to employee.