

# University of Genoa

## Master's Degree in Computer Science – Class LM-18

### Degree Regulation

#### General Part

*This regulation has been approved by the Degree Programme Board in the meeting held on April 19th 2023 and by the DIBRIS Department Board on May 16th 2023*

#### Cohort 2023-2025

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### **Art. 1 Premise and area of competence**

1. This Regulation, in accordance with the Statute and the University Didactic Regulation (UDR) (general part and special part), disciplines the organizational aspects of the teaching activity of the Master's Degree Programme in Computer Science (Class LM-18), as well as any other subject devolved to it by other legislative and regulatory sources.
2. The Degree Regulation of the Master's Degree Programme in Computer Science is resolved, pursuant to article 25, paragraphs 1 and 4 of the University Didactic Regulations, general part, by the Degree Program Board (DPB) of Computer Science to the majority of the members. After this, it is submitted for the approval of the Board of the reference Department (and of the Boards of possible associated Departments), after consultation with the School of Mathematical, Physical and Natural Sciences, with the prior favourable opinion of the Joint Committee of the School and the Department, if provided. DPB resolutions can also be taken in "online mode", pursuant to the above-mentioned regulations and, in particular, to the Article 14 "Online Meetings" of the current General Regulations of the University (in force from 19/12/2018)
3. For what is not explicitly provided by these regulations, please refer to the University Didactic Regulations, the University Regulations for Students, the Degree Programme Table and the Degree programme web page.

### **Art. 2 Admission requirements and procedures for verifying individual preparation (UDR, Art. 17)**

1. Admission to the Master's Degree Programme in Computer Science is subject to the possession of a) specific curricular requirements, b) adequate personal preparation and c) knowledge of English language.
2. With reference to the curricular requirements, students must have obtained at least 180 ECTS, 90 of which in the Disciplinary scientific area INF/01, ING-INF/03, ING-INF/04, ING-INF/05, ING-INF/06, FIS/01, FIS/02, FIS/03, FIS/07, MAT/01, MAT/02, MAT/03, MAT/05, MAT/06, MAT/07, MAT/08, MAT/09, SECS-S/01 e/o SECS-S/02. In the case of degrees obtained abroad, it will be verified that the commitment necessary to obtain the degree is not less than 180 ECTS, of which at least 90 are dedicated to training activities within the above-listed scientific-disciplinary fields.
3. With reference to the assessment of individual preparation, admission is subject to the passing of a test, in mathematics and computer science, by interview, to which a preliminary quiz can be added. The interview, and possibly the quiz, will focus on the basic knowledge needed to follow the studies profitably.
4. With reference to the knowledge of the English language at the B2 level, admission is subject to the submission of a valid B2 (or higher) language certificate or to a verification by interview.
5. For applicants from non-EU countries, with foreign residence and having a diploma not issued by an EU country, the application procedure takes place on an online portal, annually published on institutional web sites and on the Degree Programme web site, according to a timetable and deadlines established annually and duly communicated to students.
6. Each year, the DPB appoints a working group to verify the possession of the curricular requirements, the individual preparation and the knowledge of English and to inform the concerned student.

7. Referring to the Programme Table for the cohort of this document, the Master's Degree in Computer Science is recognized as incompatible for simultaneous enrolment with any LM-18 Master's Degree and with the following Master's Degree of the University of Genoa:
  - Master's Degree in Computer Engineering, class LM-32
8. For other degree programmes belonging to different classes, including those of other universities, the compatibility analysis will be carried out as follows (DM 930/2022 and subsequent ministerial clarifications). Initially, the basic and characterizing scientific disciplinary sectors of the two courses of study are considered. If the credits in common are more than 40, the two courses are incompatible for simultaneous enrolment. If from the previous analysis it appears that the credits in common are less than 40, the analysis of the learning outcomes and of further available information on the content of each teaching unit will be carried out to highlight common topics covered in courses characterized by different scientific disciplinary sectors. If even after this analysis the credits in common are less than 40, the two courses are declared compatible for simultaneous enrolment. In the event of the presence of more than one curriculum, the calculation will be made in the least favourable case, i.e. the one characterized by the greatest number of common credits.

### Art. 3 Curricula (UDR, Art. 19)

1. The Master's Degree Programme is divided into two curricula: **Data Science and Engineering**, focused on the management, analysis and visualization of large amounts of digital data for artificial intelligence, data analysis or visual computing, and **Software Security & Engineering**, focused on the development of innovative and high-quality software systems, through cutting-edge technologies, safety assessment and standardized processes.
2. The **Data Science and Engineering** curriculum is divided into three distinct tracks: a) **Artificial Intelligence**, focused on advanced machine learning, speech and natural language vision and processing; b) **Data Analytics**, related to structured data analysis, from Internet of Things technology acquisition to large-scale data management, data warehousing and data visualization; c) **Visual Computing**, focused on computer graphics, augmented reality and geometric modelling. The **Software Security & Engineering** curriculum is divided into two tracks: a) **Software Security**, focused on data protection and privacy, forensic computer science, malware analysis and secure programming; b) **Software Engineering**, focused on software system design, project management and advanced data management.

### Art. 4 Training activities (UDR, Art. 19)

1. The tables in the annex describe the training activities of the Degree Programme for the cohort 2023-2025; some activities are mandatory for a certain curriculum or track, others elective. The activity plan is divided by years: for each activity, a reference year is specified, i.e. the year in which it should be included in the study plan of a full-time student.
2. For each academic year, the Degree Programme Table specifies which activities are offered by the programme to cover the choices of students, without prejudice to the freedom of students to choose other activities offered at the University, or other affiliated locations, consistent with the training project and in compliance with any prerequisites.

3. The above-mentioned tables specify, for each training activity, the curriculum and the track in which it is offered, the language of instruction (English), the learning objectives, the ECTS, the possible articulation in modules, the duration in hours of activities in presence, the hours allocated to the individual study and any pre-requisites. Regardless of the student's choices within the proposed activities, the annual amount of hours dedicated to personal study or other individual training activities is more than 50%.

#### **Art. 5 Study Plan (UDR, Art. 19)**

1. The study plan is submitted by the student, who inserts the teaching activities he/she intends to attend, following what is reported in the Degree Programme Table. Courses already included in the study plans submitted in previous years for which the examination has not yet been taken do not need to be re-inserted.
2. Each year students can change the study plan, also the ones related to previous academic years, limited to exams not yet taken. It is not possible to take exams related to activities not included in the study plan.
3. Study plans are reviewed by DPB, which can accept or reject them; if a change request is rejected, the last approved study plan remains valid. Study plans that follow the Degree Programme Table are automatically approved by the DPB ("Standard Study Plans"). Study plans that differ from the Degree Programme Table ("Individual study plans") will be submitted to the opinion of the DPB, which will examine their consistency, deciding whether to accept them or ask for them to be amended.
4. In order to include in the study plan an activity planned for the second year, all activities foreseen for the first year must be included in the plan.
5. A study plan which does not comply with the Degree Programme Table, but conforms to the didactic system, is subject to approval by both the DPB and the Department Board. Study plans different from the didactic system cannot be approved.
6. Study plans are presented or modified in the manner and terms established by the School of Mathematical, Physical and Natural Sciences.

#### **Art. 6 Attendance and teaching methods (UDR, Art. 22)**

1. The training activities of the degree Programme are carried out mostly according to conventional methods: lectures and laboratory activities in presence, even if the support of tools for distance training is provided.
2. The attendance to the training activities is strongly recommended.
3. All training activities of the Degree Programme are carried out in English.
4. The classes calendar is divided into two teaching periods: the first semester extends between September and December and the second between February and May. The semesters and the schedule of the training activities are published in dedicated web pages. The classes timetable guarantees the possibility to attend the tracks listed in the current year Degree Programme Table.

**Art. 7 Examination and other profit exams (UDR, Art. 20 and 22)**

1. For each teaching activity, the assessment of the student's individual performance takes place through a final examination, or through other forms specified in the following paragraphs. The examination methods are indicated in the teaching unit's information table published on the Degree programme official web page.
2. For the purposes of this Article, the teaching units shall be distinguished from other training activities. For the teaching units, the final examination can be carried out in one or more of the following ways: written exam, oral exam, individual laboratory exam. Alternative forms of assessment are: guided workshops with mandatory attendance, realization of projects, writing of essays, realisation and presentation of seminars. Such alternative forms replace one or more tests of the final examination and take place one or more times during the year. Guided workshops, projects, essays, seminars can be held during the period of lectures, and are complementary to the final examination tests. The final examination, on the other hand, cannot take place during the lesson period but only during the periods expressly dedicated. The appointed professor may derogate from this rule only in the case of students who, in the current academic year, have not included training activities in their study plan.
3. For other training activities, not included among those considered in the previous paragraphs, two types of assessment are possible: "pass", in which case the corresponding ECTS do not contribute to the calculation of the final average, or mark out of thirty, with evaluation assigned to a commission designated by the DPB.
4. For students with disabilities and students with Specific Learning Disorders, the assessment procedures comply with the UDR.
5. The calendar of profit exams is established within the ministerial date for the following academic year and is published on the web pages of the University related with the Degree Programme. The calendar of any intermediate assessment test is established by the DPB and communicated to the students at the beginning in due time.

**Art. 8 Recognition of credits (UDR, Art. 18)**

1. The previous career of students wanting to enrol in the Degree Programme is assessed on a case-by-case basis taking into account the content and the study load. In case of recognition, a number of ECTS is awarded, not necessarily identical to those originally attributed. The exact correspondence with the training activities foreseen in the Degree Programme is not required, but the overall consistency of the recognized activities must be compliant with the training objectives of the Degree Programme, also by providing a personalised study plan.
2. Each student enrolled in the Degree Programme, who has been awarded ECTS on the basis of the previous career assessment, is assigned a reference cohort and the expected duration of his or her studies.
3. With regards to the professional knowledge and skills individually certified in accordance with the current regulations, as well as other knowledge and skills acquired in post-graduate training activities to the design and implementation of which the University has taken part, the maximum number of recognizable credits is 12.

**Art. 9 Mobility and studies abroad (UDR, Art. 23)**

1. Students may carry out periods of study abroad, on the basis of agreements with foreign universities. Students are informed about these opportunities through special calls for applications managed by the University.
2. In order to apply for Erasmus calls, students must have acquired at least 18 ECTS if applying for mobility in the first year and at least 72 ECTS if applying for mobility in the second year.
3. The conversion of the marks obtained abroad in the framework of Erasmus+ programmes will take place according to criteria approved annually by the DPB and published on the Degree Programme and School of MFN Sciences websites. In order to encourage mobility within Erasmus+ programmes, a bonus of up to 3 ECTS may be awarded for credits acquired abroad for students who have obtained at least 30 ECTS during mobility.
4. Considering the specificity of the curriculum offered, the DPB will consider for approval only Learning Agreements for periods abroad starting from the second year.

**Art. 10 Final Examination (UDR, Art. 21)**

1. To be admitted to the Master's Degree Final Examination, students must have obtained all the foreseen credits, except those related to the final examination itself, within the deadlines set by the School of MFN Sciences and published on the dedicated website.
2. The Master's Degree final Examination consists in the discussion in English language of an activity carried out by the student under the guidance of one or more supervisors, of which at least one must be a member of the DPB and teacher of a teaching unit offered by the Degree Programme, and the control of a co-supervisor.
3. The activity consists in: (i) carrying out independently a significant project, of theoretical, computational, or experimental value; (ii) producing a clear and effective document in English describing the project and the results obtained.
4. The final examination mark is calculated as follows: a) a mark out of thirty is awarded to the carried out activity; b) a basic score is calculated, obtained from the average - weighted on the credits - of the teaching units examination marks and the mark assigned to the carried out activity; the mark 30 with honors counts 31; b) the score is converted to a score out of 110; c) to this base score, an increment is added in the range [0,4] also on the basis of a short presentation, in which the ability to make accessible the results obtained is an element of evaluation; d) if the score achieved is higher or equal to 110/110, the degree commission may grant the honors.

**Art. 11 Guidance services and tutoring (UDR, Art. 24)**

1. The DPB, in collaboration with the School of MFN Sciences, relying on a dedicated commission, organizes and participates in activities and initiatives to encourage the conscious choice of university studies, the continuity of the educational path, the access to the world of work.
2. The School of MFN Sciences, in collaboration with the DPB, which relies on a specific working group, organizes and manages a tutoring service for welcoming and supporting the students,

in order to prevent dispersion and delay in studies and to promote a fruitful active participation in university life in all its forms.

3. Specific forms of guidance and mentoring are provided for students with disabilities and students with Specific Learning Disorders.

#### **Art. 12 Verification of credits obsolescence**

1. ECTS credits acquired within the framework of the Degree Programme may be subject to an obsolescence check after 6 years.
2. If the DPB recognizes the obsolescence of even a single part of the corresponding educational content, the DPB itself establishes the supplementary tests that must be taken by the student, defining the topics and the methods of verification. Once the required tests have been passed, the DPB validates the credits acquired with a resolution.

## Special Part

Curriculum	Academic Year	Course Code	Course Name	ECTS	SSD (Disciplinary Scientific Area)	Type	Area	Language	Learning Objectives	Hours dedicated to assisted teaching activities	Hours dedicated to personal study
SOFTWARE SECURITY & ENGINEERING - SOFTWARE ENGINEERING	1	86798	MACHINE LEARNING AND DATA ANALYSIS	6	ING-INF/05	CORE	Computer Science	English	Students will be provided with advanced skills related to machine learning and data analysis. Students will learn insights on machine learning and data analysis methodologies and a series of real world applications.	48	102
SOFTWARE SECURITY & ENGINEERING - SOFTWARE SECURITY	1	86798	MACHINE LEARNING AND DATA ANALYSIS	6	ING-INF/05	CORE	Computer Science	English	Students will be provided with advanced skills related to machine learning and data analysis. Students will learn insights on machine learning and data analysis methodologies and a series of real world applications.	48	102
SOFTWARE SECURITY & ENGINEERING - SOFTWARE ENGINEERING	1	86800	VIRTUALIZATION AND CLOUD COMPUTING	6	ING-INF/05	CORE	Computer Science	English	The course provides the foundations of the main virtualization technologies at the state of the art. In detail, the course focuses on several types of virtualization, like Storage-level, OS-level, Application-level, and Enterprise-level virtualization. The course is mostly practical, with the aim to teach the student how to deal with current virtualization technologies to build actual virtualized architectures.	48	102



SOFTWARE SECURITY & ENGINEERING - SOFTWARE SECURITY	1	86800	VIRTUALIZATION AND CLOUD COMPUTING	6	ING-INF/05	CORE	Computer Science	English	The course provides the foundations of the main virtualization technologies at the state of the art. In detail, the course focuses on several types of virtualization, like Storage-level, OS-level, Application-level, and Enterprise-level virtualization. The course is mostly practical, with the aim to teach the student how to deal with current virtualization technologies to build actual virtualized architectures.	48	102
DATA SCIENCE & ENGINEERING - ARTIFICIAL INTELLIGENCE	1	90498	MACHINE LEARNING	9	INF/01	CORE	Computer Science	English	Learning how to use classical supervised and unsupervised machine learning algorithms by grasping the underlying computational and modeling issues.	72	153
DATA SCIENCE & ENGINEERING - DATA ANALYTICS	1	90498	MACHINE LEARNING	9	INF/01	CORE	Computer Science	English	Learning how to use classical supervised and unsupervised machine learning algorithms by grasping the underlying computational and modeling issues.	72	153
DATA SCIENCE & ENGINEERING - VISUAL COMPUTING	1	90498	MACHINE LEARNING	9	INF/01	CORE	Computer Science	English	Learning how to use classical supervised and unsupervised machine learning algorithms by grasping the underlying computational and modeling issues.	72	153

DATA SCIENCE & ENGINEERING - ARTIFICIAL INTELLIGENCE	1	90520	DIGITAL SIGNAL & IMAGE PROCESSING	9	INF/01	CORE	Computer Science	English	Acquiring the basic tools for the analysis of 1D and 2D signals in both the space and frequency domains	72	153
DATA SCIENCE & ENGINEERING - VISUAL COMPUTING	1	90520	DIGITAL SIGNAL & IMAGE PROCESSING	9	INF/01	CORE	Computer Science	English	Acquiring the basic tools for the analysis of 1D and 2D signals in both the space and frequency domains	72	153
DATA SCIENCE & ENGINEERING - DATA ANALYTICS	1	90524	INTERNET OF THINGS	9	INF/01	CORE	Computer Science	English	Learning methods, protocols, architectures, and platforms for the development of distributed and mobile applications for the Internet of Things, including machine to machine protocols, distributed algorithms for fault tolerance and replication, service oriented architectures platforms, embedded operating systems, real time and streaming data, geolocation, and collaborative framework.	56	169
SOFTWARE SECURITY & ENGINEERING - SOFTWARE ENGINEERING	1	90524	INTERNET OF THINGS	9	INF/01	CORE	Computer Science	English	Learning methods, protocols, architectures, and platforms for the development of distributed and mobile applications for the Internet of Things, including machine to machine protocols, distributed algorithms for fault tolerance and replication, service oriented architectures platforms, embedded operating systems, real time and streaming data, geolocation, and collaborative framework.	56	169

SOFTWARE SECURITY & ENGINEERING - SOFTWARE SECURITY	1	90524	INTERNET OF THINGS	9	INF/01	CORE	Computer Science	English	Learning methods, protocols, architectures, and platforms for the development of distributed and mobile applications for the Internet of Things, including machine to machine protocols, distributed algorithms for fault tolerance and replication, service oriented architectures platforms, embedded operating systems, real time and streaming data, geolocation, and collaborative framework.	56	169
DATA SCIENCE & ENGINEERING - DATA ANALYTICS	1	90530	NETWORK ANALYSIS	6	INF/01	RELATED OR SUPPLEMENTARY	Related or supplementary learning activity	English	Learning algorithms and techniques for large scale graph analytics, including centrality measures, connected components, graph clustering, graph properties for random, small-world, and scale free graphs, graph metrics for robustness and resiliency, and graph algorithms for reference problems.	40	110
SOFTWARE SECURITY & ENGINEERING - SOFTWARE SECURITY	1	90538	DATA PROTECTION & PRIVACY	9	ING-INF/05	CORE	Computer Science	English	Learning the theoretical and practical bases of the anonymization of personal data, with a special reference to state-of-the-art techniques for the anonymization of multidimensional data, graphs, time series, longitudinal and transactional data, as well as some legal bases on the protection of personal data.	56	169

DATA SCIENCE & ENGINEERING - ARTIFICIAL INTELLIGENCE	1	90539	COMPUTATIONAL VISION	6	INF/01	RELATED OR SUPPLEMENTARY	Related or supplementary learning activity	English	Learning how to represent image content adaptively by means of shallow or deep computational models and biologically-inspired hierarchical models, and how to tackle image classification and categorization problems.	40	110
DATA SCIENCE & ENGINEERING - VISUAL COMPUTING	1	90539	COMPUTATIONAL VISION	6	INF/01	RELATED OR SUPPLEMENTARY	Related or supplementary learning activity	English	Learning how to represent image content adaptively by means of shallow or deep computational models and biologically-inspired hierarchical models, and how to tackle image classification and categorization problems.	40	110
DATA SCIENCE & ENGINEERING - ARTIFICIAL INTELLIGENCE	1	90549	ADDITIONAL USEFUL KNOWLEDGE	3		OTHER ACTIVITIES	Other work-oriented knowledge	English	Acquiring additional useful knowledge on elements of enterprise culture, skill activities, basics of program management, as well as on personal interests related to the Master degree topics through research seminar attendance.	0	75
DATA SCIENCE & ENGINEERING - DATA ANALYTICS	1	90549	ADDITIONAL USEFUL KNOWLEDGE	3		OTHER ACTIVITIES	Other work-oriented knowledge	English	Acquiring additional useful knowledge on elements of enterprise culture, skill activities, basics of program management, as well as on personal interests related to the Master degree topics through research seminar attendance.	0	75
DATA SCIENCE & ENGINEERING - VISUAL COMPUTING	1	90549	ADDITIONAL USEFUL KNOWLEDGE	3		OTHER ACTIVITIES	Other work-oriented knowledge	English	Acquiring additional useful knowledge on elements of enterprise culture, skill activities, basics of program management, as well as on personal interests related to the Master degree topics through research seminar attendance.	0	75

DATA SCIENCE & ENGINEERING - DATA ANALYTICS	1	101798	DATA WAREHOUSING	9	INF/01	CORE	Computer Science	English	Learning the theoretical, methodological, and technological fundamentals of data management and analysis in decision support systems, with a specific reference to data warehousing architectural and design issues, as well as key elements of data integration and governance, data quality and cleaning, ExtractionTransformation-Loading processes, conceptual, logical, and physical design of data warehouses, storage architectures and scalable parallel processing, use of data warehouses for business reporting and online analytical processing.	72	153
DATA SCIENCE & ENGINEERING - ARTIFICIAL INTELLIGENCE	1	101804	DEEP LEARNING	9	INF/01	CORE	Computer Science	English	Learning how to use deep learning algorithms, including classical approaches and very recent networks, by grasping the underlying computational and modeling issues.	56	169
DATA SCIENCE & ENGINEERING - VISUAL COMPUTING	1	101804	DEEP LEARNING	9	INF/01	CORE	Computer Science	English	Learning how to use deep learning algorithms, including classical approaches and very recent networks, by grasping the underlying computational and modeling issues.	56	169
SOFTWARE SECURITY & ENGINEERING - SOFTWARE ENGINEERING	1	101805	MOBILE DEVELOPMENT	6	INF/01	RELATED OR SUPPLEMENTARY	Related or supplementary learning activity	English	Learning the design and development of mobile applications by using state of the practice IDEs, frameworks, languages, and technologies.	40	110

SOFTWARE SECURITY & ENGINEERING - SOFTWARE SECURITY	1	101805	MOBILE DEVELOPMENT	6	INF/01	RELATED OR SUPPLEMENTARY	Related or supplementary learning activity	English	Learning the design and development of mobile applications by using state of the practice IDEs, frameworks, languages, and technologies.	40	110
SOFTWARE SECURITY & ENGINEERING - SOFTWARE ENGINEERING	1	101806	IT PROJECT MANAGEMENT	6	INF/01	RELATED OR SUPPLEMENTARY	Related or supplementary learning activity	English	Learning the fundamental concepts, roles, and responsibilities of IT project management and develop skills for effective project management and leadership.	48	102
SOFTWARE SECURITY & ENGINEERING - SOFTWARE ENGINEERING	1	101807	SOFTWARE SYSTEMS DESIGN AND MODELLING	9	INF/01	CORE	Computer Science	English	Learning through practical experience the basic conceptual tools for the design and modelling of software systems, and acquiring communication skills and lifelong learning capabilities.	56	169
SOFTWARE SECURITY & ENGINEERING - SOFTWARE ENGINEERING	1	101808	FUNCTIONAL AND SECURITY TESTING TECHNIQUES	6	INF/01	CORE	Computer Science	English	Learning the fundamentals in functional and security testing of software systems, with special emphasis on challenges posed by Web and Mobile applications, and getting acquainted with automated tools used to practice testing techniques.	48	102
SOFTWARE SECURITY & ENGINEERING - SOFTWARE SECURITY	1	101808	FUNCTIONAL AND SECURITY TESTING TECHNIQUES	6	INF/01	CORE	Computer Science	English	Learning the fundamentals in functional and security testing of software systems, with special emphasis on challenges posed by Web and Mobile applications, and getting acquainted with automated tools used to practice testing techniques.	48	102

DATA SCIENCE & ENGINEERING - ARTIFICIAL INTELLIGENCE	1	101809	DISTRIBUTED COMPUTING	9	INF/01	CORE	Computer Science	English	Learning the fundamental design principles for distributed systems and getting more in-depth knowledge of a few chosen architectures relative to the students' curriculum; getting familiarity with the concepts of reliability, availability, and fault tolerance.	72	153
DATA SCIENCE & ENGINEERING - DATA ANALYTICS	1	101809	DISTRIBUTED COMPUTING	9	INF/01	CORE	Computer Science	English	Learning the fundamental design principles for distributed systems and getting more in-depth knowledge of a few chosen architectures relative to the students' curriculum; getting familiarity with the concepts of reliability, availability, and fault tolerance.	72	153
DATA SCIENCE & ENGINEERING - VISUAL COMPUTING	1	101809	DISTRIBUTED COMPUTING	9	INF/01	CORE	Computer Science	English	Learning the fundamental design principles for distributed systems and getting more in-depth knowledge of a few chosen architectures relative to the students' curriculum; getting familiarity with the concepts of reliability, availability, and fault tolerance.	72	153
SOFTWARE SECURITY & ENGINEERING - SOFTWARE ENGINEERING	1	101809	DISTRIBUTED COMPUTING	6	INF/01	CORE	Computer Science	English	Learning the fundamental design principles for distributed systems and getting more in-depth knowledge of a few chosen architectures relative to the students' curriculum; getting familiarity with the concepts of reliability, availability, and fault tolerance.	48	102
SOFTWARE SECURITY & ENGINEERING - SOFTWARE SECURITY	1	101809	DISTRIBUTED COMPUTING	6	INF/01	CORE	Computer Science	English	Learning the fundamental design principles for distributed systems and getting more in-depth knowledge of a few chosen	48	102

									architectures relative to the students' curriculum; getting familiarity with the concepts of reliability, availability, and fault tolerance.		
SOFTWARE SECURITY & ENGINEERING - SOFTWARE SECURITY	1	101812	DIGITAL FORENSICS	6	INF/01	RELATED OR SUPPLEMENTARY	Related or supplementary learning activity	English	Learning how to conduct digital investigations, following the standard process involving identification, acquisition, storage, and analysis of digital evidence.	40	102
DATA SCIENCE & ENGINEERING - ARTIFICIAL INTELLIGENCE	1	108871	AUGMENTED REALITY	6	INF/01	RELATED OR SUPPLEMENTARY	Related or supplementary learning activity	English	Learning the theoretical and methodological fundamentals of Augmented Reality, from the concepts of 3D Computational Vision to model the real-world world, to the synthesis of the virtual environments, and their fusion.	40	110
DATA SCIENCE & ENGINEERING - DATA ANALYTICS	1	108871	AUGMENTED REALITY	6	INF/01	RELATED OR SUPPLEMENTARY	Related or supplementary learning activity	English	Learning the theoretical and methodological fundamentals of Augmented Reality, from the concepts of 3D Computational Vision to model the real-world world, to the synthesis of the virtual environments, and their fusion.	40	110
DATA SCIENCE & ENGINEERING - VISUAL COMPUTING	1	109186	COMPUTER GRAPHICS	6	INF/01	RELATED OR SUPPLEMENTARY	Related or supplementary learning activity		Learning the theoretical and methodological fundamentals of Computer Graphics	40	110



DATA SCIENCE & ENGINEERING - DATA ANALYTICS	2	61884	ADVANCED DATA MANAGEMENT	9	INF/01	CORE	Computer Science	English	Learning the theoretical, methodological, and technological fundamentals of data management for advanced data processing architectures, with a specific reference to large-scale distributed environments, like key elements of NoSQL and stream-based systems as well as basic issues in parallel and distributed query processing, multi-query processing, and high-throughput transactional systems.	56	169
SOFTWARE SECURITY & ENGINEERING - SOFTWARE ENGINEERING	2	61884	ADVANCED DATA MANAGEMENT	9	INF/01	CORE	Computer Science	English	Learning the theoretical, methodological, and technological fundamentals of data management for advanced data processing architectures, with a specific reference to large-scale distributed environments, like key elements of NoSQL and stream-based systems as well as basic issues in parallel and distributed query processing, multi-query processing, and high-throughput transactional systems.	56	169

DATA SCIENCE & ENGINEERING - VISUAL COMPUTING	2	80412	GEOMETRIC MODELING	6	INF/01	CORE	Computer Science	English	Learning theoretical foundations, techniques and methodologies for the representation and manipulation of solid objects, 2D and 3D scalar surfaces and fields, and related computational techniques. Learning computational techniques for resolving geometric problems (computational geometry and geometry processing). Reference applications: computer graphics, scientific visualization, CAD systems, geographic information systems, virtual reality.	40	110
DATA SCIENCE & ENGINEERING - ARTIFICIAL INTELLIGENCE	2	90529	DATA VISUALIZATION	6	INF/01	CORE	Computer Science	English	Learning basic principles from vision and human perception. Learning principles, methods, and techniques for effective visual analysis of data, including techniques for visualizing spatial, non-spatial, and temporal data.	40	110
DATA SCIENCE & ENGINEERING - DATA ANALYTICS	2	90529	DATA VISUALIZATION	6	INF/01	CORE	Computer Science	English	Learning basic principles from vision and human perception. Learning principles, methods, and techniques for effective visual analysis of data, including techniques for visualizing spatial, non-spatial, and temporal data.	40	110

DATA SCIENCE & ENGINEERING - VISUAL COMPUTING	2	90529	DATA VISUALIZATION	6	INF/01	CORE	Computer Science	English	Learning basic principles from vision and human perception. Learning principles, methods, and techniques for effective visual analysis of data, including techniques for visualizing spatial, non-spatial, and temporal data.	40	110
DATA SCIENCE & ENGINEERING - ARTIFICIAL INTELLIGENCE	2	90535	HIGH PERFORMANCE COMPUTING	9	INF/01	CORE	Computer Science	English	Learning the main aspects of modern, heterogeneous high-performance computing systems (pipeline/superscalar processors, shared-memory/message-passing multiprocessors, vector processors, GPUs) and basic programming skills for high-performance computing (cache optimization, vectorization, optimizations OpenMP, MPI, CUDA).	56	169
DATA SCIENCE & ENGINEERING - VISUAL COMPUTING	2	90535	HIGH PERFORMANCE COMPUTING	9	INF/01	CORE	Computer Science	English	Learning the main aspects of modern, heterogeneous high-performance computing systems (pipeline/superscalar processors, shared-memory/message-passing multiprocessors, vector processors, GPUs) and basic programming skills for high-performance computing (cache optimization, vectorization, optimizations OpenMP, MPI, CUDA).	56	169
DATA SCIENCE & ENGINEERING - ARTIFICIAL INTELLIGENCE	2	90537	FINAL DISSERTATION	30		FINAL EXAMINATION	For the final Examination	FINAL EXAMINATION	Being able to carry out autonomously a conspicuous project which could be of theoretical, computational, or experimental flavour. Being able to clearly describe the	0	750

									project and the obtained results in a written document.		
DATA SCIENCE & ENGINEERING - DATA ANALYTICS	2	90537	FINAL DISSERTATION	30		FINAL EXAMINATION	For the final Examination	English	Being able to carry out autonomously a conspicuous project which could be of theoretical, computational, or experimental flavour. Being able to clearly describe the project and the obtained results in a written document.	0	750
DATA SCIENCE & ENGINEERING - VISUAL COMPUTING	2	90537	FINAL DISSERTATION	30		FINAL EXAMINATION	For the final Examination	English	Being able to carry out autonomously a conspicuous project which could be of theoretical, computational, or experimental flavour. Being able to clearly describe the project and the obtained results in a written document.	0	750
SOFTWARE SECURITY & ENGINEERING - SOFTWARE ENGINEERING	2	90537	FINAL DISSERTATION	29		FINAL EXAMINATION	For the final Examination	English	Being able to carry out autonomously a conspicuous project which could be of theoretical, computational, or experimental flavour. Being able to clearly describe the project and the obtained results in a written document.	0	725
SOFTWARE SECURITY & ENGINEERING - SOFTWARE SECURITY	2	90537	FINAL DISSERTATION	29		FINAL EXAMINATION	For the final Examination	English	Being able to carry out autonomously a conspicuous project which could be of theoretical, computational, or experimental flavour. Being able to clearly describe the project and the obtained results in a written document.	0	725

DATA SCIENCE & ENGINEERING - DATA ANALYTICS	2	90538	DATA PROTECTION & PRIVACY	6	ING-INF/05	CORE	Computer Science	English	Learning the theoretical and practical bases of the anonymization of personal data, with a special reference to state-of-the-art techniques for the anonymization of multidimensional data, graphs, time series, longitudinal and transactional data, as well as some legal bases on the protection of personal data.	40	110
DATA SCIENCE & ENGINEERING - ARTIFICIAL INTELLIGENCE	2	90541	NATURAL LANGUAGE PROCESSING	6	INF/01	CORE	Computer Science	English	Learning how to process and represent natural language, and the main software components of a system able to understand natural language.	32	118
DATA SCIENCE & ENGINEERING - ARTIFICIAL INTELLIGENCE	2	90545	MULTIAGENT SYSTEMS	6	INF/01	CORE	Computer Science	English	Getting acquainted with the concept of an agent and multiagent system, and learning how to design intelligent autonomous agents and how to deal with the main implementation issues.	32	118
DATA SCIENCE & ENGINEERING - DATA ANALYTICS	2	90545	MULTIAGENT SYSTEMS	6	INF/01	CORE	Computer Science	English	Getting acquainted with the concept of an agent and multiagent system, and learning how to design intelligent autonomous agents and how to deal with the main implementation issues.	32	118
DATA SCIENCE & ENGINEERING - VISUAL COMPUTING	2	90545	MULTIAGENT SYSTEMS	6	INF/01	CORE	Computer Science	English	Getting acquainted with the concept of an agent and multiagent system, and learning how to design intelligent autonomous agents and how to deal with the main implementation issues.	32	118

SOFTWARE SECURITY & ENGINEERING - SOFTWARE ENGINEERING	2	101810	CAPSTONE PROJECT	9	INF/01	CORE	Computer Science	English	Acquiring experience of a realistic team development effort that follows a given methodology and harnesses different technologies for the implementation of a specific product.	40	185
SOFTWARE SECURITY & ENGINEERING - SOFTWARE SECURITY	2	101810	CAPSTONE PROJECT	9	INF/01	CORE	Computer Science	English	Acquiring experience of a realistic team development effort that follows a given methodology and harnesses different technologies for the implementation of a specific product.	40	185
SOFTWARE SECURITY & ENGINEERING - SOFTWARE SECURITY	2	101811	BINARY ANALYSIS AND SECURE CODING	9	INF/01	CORE	Computer Science	English	Learning how to write secure code, analyze the behavior and assess security properties of source and binary programs, pinpointing and fix their vulnerabilities or apply corrective counter-measures.	56	169
SOFTWARE SECURITY & ENGINEERING - SOFTWARE ENGINEERING	2	108872	BLOCKCHAIN AND DISTRIBUTED LEDGER	6	INF/01	CORE	Computer Science	English	Learning the techniques and problems related to systems based on permissioned and permissionless blockchains, and decentralized systems in general, examining with particular attention the aspects related to security.	40	110
SOFTWARE SECURITY & ENGINEERING - SOFTWARE SECURITY	2	108872	BLOCKCHAIN AND DISTRIBUTED LEDGER	6	INF/01	CORE	Computer Science	English	Learning the techniques and problems related to systems based on permissioned and permissionless blockchains, and decentralized systems in general, examining with particular attention the aspects related to security.	48	102
SOFTWARE SECURITY & ENGINEERING - SOFTWARE ENGINEERING	2	111486	TECHNICAL WRITING	1		OTHER TRAINING ACTIVITIES	Other Training activities	English	Learning to accurately plan, write and revise technical scientific documents, e.g.a thesis, in the correct format	0	25

*Degree Regulation of Master's Degree Programme in Computer Science (LM-18 Class) approved by the Degree Programme Board on 2023-04-19 and by the DIBRIS Department Board on 2023-05-16.*

									and to the required standards.		
SOFTWARE SECURITY & ENGINEERING - SOFTWARE SECURITY	2	111486	TECHNICAL WRITING	1		OTHER TRAINING ACTIVITIES	Other Training activities	English	Learning to accurately plan, write and revise technical scientific documents, e.g.a thesis, in the correct format and to the required standards.	0	25

**Università degli Studi di Genova**

**Regolamento Didattico del Corso di Laurea Magistrale in  
Computer Science**

**Classe LM-18: Informatica**

**Parte Generale**

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## **Art. 1 Premessa e ambito di competenza**

1. Il presente Regolamento, in conformità allo Statuto e al Regolamento Didattico di Ateneo (parte generale e parte speciale), disciplina gli aspetti organizzativi dell'attività didattica del Corso di Laurea Magistrale (CdLM) in Computer Science (classe LM-18: Informatica), nonché ogni diversa materia ad esso devoluta da altre fonti legislative e regolamentari.
2. Il presente Regolamento, ai sensi dell'art. 25, comma 4, del Regolamento Didattico di Ateneo (RDA), parte generale, è deliberato, a maggioranza dei componenti, dalla competente struttura didattica (Consiglio dei Corsi di Studio in Informatica e Computer Science-CCS) e sottoposto all'approvazione del Consiglio del Dipartimento di riferimento (e dei consigli degli eventuali dipartimenti associati), sentita la Scuola di Scienze MFN, previo parere favorevole della Commissione Paritetica di Scuola e di Dipartimento, ove esistente. Le delibere del CCS possono essere assunte anche in modalità telematica ai sensi dei sovraordinati regolamenti e, in particolare, dell'articolo 14 "Riunioni con modalità telematiche" del vigente Regolamento Generale di Ateneo (in vigore dal 19/12/2018).
3. Per quanto non previsto esplicitamente dal presente regolamento si rimanda al Regolamento Didattico di Ateneo, al Regolamento di Ateneo per gli Studenti, al Manifesto degli Studi e alla pagina web del CdLM.

## **Art. 2 Requisiti di ammissione e modalità di verifica (RDA, Art. 17)**

1. L'ammissione al CdLM è soggetta al possesso di: a) specifici requisiti curriculari; b) adeguata preparazione individuale; c) conoscenza della lingua inglese.
2. Per quanto riguarda i requisiti curriculari, lo studente deve aver conseguito almeno 180 CFU, 90 dei quali nei settori INF/01, ING-INF/03, ING-INF/04, ING-INF/05, ING-INF/06, FIS/01, FIS/02, FIS/03, FIS/07, MAT/01, MAT/02, MAT/03, MAT/05, MAT/06, MAT/07, MAT/08, MAT/09, SECS-S/01 e/o SECS-S/02. Nel caso di titoli di studio ottenuti all'estero, si verificherà che l'impegno necessario al conseguimento del titolo sia non inferiore a 180 CFU di cui almeno 90 dedicati ad attività formative nell'ambito dei sopra elencati settori scientifico-disciplinari.
3. Per quanto riguarda la preparazione individuale, l'ammissione è subordinata al superamento di una verifica, in ambito matematico e informatico, mediante colloquio, a cui si può aggiungere un quiz propedeutico. Il colloquio, ed eventualmente il quiz, vertono sulle conoscenze di base necessarie per seguire con profitto gli studi-
4. Per quanto riguarda la conoscenza della lingua inglese al livello B2, l'ammissione è subordinata alla presentazione di una valida certificazione per il livello B2 o superiore o al superamento di una verifica mediante colloquio.
5. Nel caso di studenti con cittadinanza extra-EU, residenti all'estero e aventi titolo di studio acquisito in un paese extra-EU, la procedura di ammissione prevede una pre-valutazione effettuata su una piattaforma online, individuata dall'Ateneo e accessibile dai siti web dell'Ateneo e del CdLM.
6. Ogni anno il CCS nomina un gruppo di lavoro incaricato di accertare il possesso dei requisiti curriculari, la preparazione individuale e la conoscenza della lingua inglese e di darne comunicazione all'interessato.
7. In riferimento all'offerta formativa per la coorte a cui questo regolamento si riferisce, il CdLM in Computer Science è riconosciuto incompatibile per l'iscrizione simultanea a qualsiasi CdLM di classe LM-18 e con i seguenti Corsi di Studio (CdS) dell'Università di Genova:

- CdLM in Computer Engineering, classe LM-32.

8. Per altri CdS appartenenti a classi diverse, anche di altri Atenei, l'analisi di compatibilità verrà effettuata nel seguente modo (DM 930/2022 e successivi chiarimenti ministeriali). Si considerano inizialmente i settori scientifico disciplinari di base e caratterizzanti dei due corsi di studio. Se i Crediti Formativi Universitari (CFU) in comune sono più di 40 i due CdS sono incompatibili per l'iscrizione contemporanea. Se dall'analisi precedente risulta che i CFU in comune sono meno di 40, si passa all'analisi degli obiettivi formativi e di ulteriori informazioni disponibili sul contenuto dei singoli insegnamenti per evidenziare argomenti comuni trattati in insegnamenti caratterizzati da settori scientifico disciplinari diversi. Se anche dopo questa analisi i CFU in comune risultano meno di 40, i due CdS sono dichiarati compatibili per l'iscrizione contemporanea. Nel caso di presenza di diversi curricula, il calcolo verrà effettuato nel caso meno favorevole ovvero quello caratterizzato dal maggior numero di CFU comuni.

### **Art. 3 Curricula (RDA, Art. 19)**

1. Il CdLM si articola in due curricula: **Data Science and Engineering**, incentrato sulla gestione, analisi e visualizzazione di grandi quantità di dati digitali per l'intelligenza artificiale, l'analisi dei dati o il visual computing, e **Software Security & Engineering**, incentrato sullo sviluppo di sistemi software innovativi e di alta qualità, attraverso tecnologie all'avanguardia, valutazione della sicurezza e processi standardizzati.
2. Il curriculum **Data Science and Engineering** si articola in tre percorsi distinti: a) **Artificial Intelligence**, incentrato su machine learning avanzato, visione ed elaborazione vocale e del linguaggio naturale; b) **Data Analytics**, relativo all'analisi di dati strutturati, dall'acquisizione mediante tecnologie dell'Internet of Things fino alla gestione dei dati su larga scala, data warehousing e visualizzazione dei dati; c) **Visual Computing**, focalizzato su computer graphics, realtà aumentata e modellazione geometrica. Il curriculum **Software Security & Engineering** si articola in due percorsi: a) **Software Security**, incentrato su protezione dei dati e privacy, informatica forense, analisi dei malware e programmazione sicura; b) **Software Engineering**, incentrato su progettazione di sistemi software, gestione di progetti e gestione dei dati avanzata.

### **Art. 4 Attività formative (RDA, Art. 19)**

1. Le tabelle riportate in allegato descrivono le attività didattiche del CdLM; alcune attività sono obbligatorie per un certo curriculum o percorso, altre sono autonomamente scelte dallo studente. Il piano delle attività è suddiviso per anni: per ogni attività, viene precisato un anno di riferimento, ovvero l'anno in cui questa dovrebbe essere inserita nel piano di studio di uno studente a tempo pieno.
2. Per ogni anno accademico, il Manifesto degli Studi precisa quali attività vengono offerte dal CdL per coprire le scelte degli studenti, senza per questo pregiudicare la libertà degli studenti di scegliere altre attività offerte presso l'Ateneo, o altre sedi convenzionate, coerenti con il progetto formativo e nel rispetto delle eventuali propedeuticità.
3. Le tabelle suddette precisano, per ogni attività formativa, i curricula e i percorsi in cui è erogata, la lingua di erogazione (inglese), gli obiettivi formativi specifici, i CFU, l'eventuale articolazione in moduli, la durata in ore delle attività in presenza, le ore destinate allo studio individuale e le eventuali propedeuticità. Indipendentemente dalle scelte dello studente all'interno delle attività proposte, la quota dell'impegno orario complessivo annuo riservata allo studio personale o ad altre attività formative di tipo individuale è superiore al 50%.

**Art. 5 Piano di studio (RDA, Art. 19)**

1. Il piano di studio è redatto dallo studente inserendo le attività didattiche che intende frequentare, seguendo quanto riportato nel Manifesto degli Studi. Non è richiesto l'inserimento degli insegnamenti già inclusi nei piani di studio presentati negli anni precedenti per i quali non sia ancora stato sostenuto l'esame.
2. Lo studente può modificare di anno in anno il piano di studio anche relativamente agli anni precedenti, limitatamente agli esami non ancora sostenuti. Non è possibile sostenere esami relativi ad attività non presenti nel piano di studio.
3. I piani di studio vengono esaminati dal CCS e accettati o respinti; nel caso in cui una richiesta di variazione al piano di studio sia respinta, rimane valido l'ultimo piano di studio approvato. I piani di studio che seguono tutte le indicazioni riportate nel Manifesto degli Studi vengono approvati automaticamente da parte del CCS (piani di studio standard). I piani di studio difforni dai percorsi proposti nel Manifesto degli Studi (piani di studio individuali) verranno sottoposti al parere del CCS che ne esaminerà la coerenza, decidendo se accettarli o chiedere che vengano modificati.
4. Per inserire nel piano di studio un'attività prevista al secondo anno, devono essere presenti nel piano tutte le attività previste al primo anno.
5. Il piano di studio non aderente ai a quanto riportato nel Manifesto degli Studi, ma conforme all'ordinamento didattico, è soggetto ad approvazione da parte sia del CCS sia del Consiglio di Dipartimento. Non possono essere approvati piani di studio difforni dall'ordinamento didattico.
6. I piani di studio sono presentati o modificati con le modalità ed i termini stabiliti dalla Scuola di Scienze MFN.

**Art. 6 Frequenza e modalità di svolgimento delle attività didattiche (RDA, Art. 22)**

1. Le attività didattiche del CdLM si svolgono per lo più secondo la modalità *convenzionale*: lezioni e attività di laboratorio in presenza, anche se è previsto il supporto di strumenti per la formazione a distanza.
2. La frequenza alle attività didattiche è fortemente raccomandata.
3. Tutte le attività didattiche del CdLM sono svolte in lingua inglese.
4. Il calendario delle lezioni è articolato in due periodi didattici: il primo periodo si estende tra settembre e dicembre e il secondo tra febbraio e maggio. I periodi didattici e gli orari delle attività formative sono reperibili in apposite pagine web. L'orario delle lezioni garantisce la possibilità di frequenza dei percorsi riportati nel vigente Manifesto degli Studi.

**Art. 7 Esami e altre verifiche del profitto (RDA, Art. 20 e 22)**

1. Per ogni attività didattica la verifica del profitto individuale degli studenti avviene attraverso un esame finale, o attraverso altre forme specificate nei commi successivi. Le modalità di esame vengono indicate nelle schede di ciascuna attività didattica pubblicata sulle pagine del sito web di Ateneo relative al del CdLM.

2. Ai fini del presente articolo si distinguono gli insegnamenti dalle altre attività formative. Per gli insegnamenti, l'esame finale può essere svolto con una o più delle seguenti modalità: prova scritta, prova orale, prova individuale di laboratorio. Forme alternative di verifica del profitto sono: laboratori guidati con obbligo di frequenza, realizzazione di progetti, redazione di tesine, preparazione e presentazione di seminari. Tali forme alternative sostituiscono una o più prove dell'esame finale, e si svolgono una o più volte durante l'anno. Laboratori guidati, progetti, tesine, seminari si possono svolgere in periodo di lezioni, e sono integrativi delle prove di esame finale. L'esame finale, invece, non si può svolgere in periodo di lezione ma solo nei periodi espressamente dedicati. Il docente incaricato può derogare da questa regola esclusivamente nel caso di studenti che, nell'anno accademico in corso, non abbiano inserito attività formative nel proprio piano di studio.
3. Per altre attività formative, non riconducibili a quelle considerate nei commi precedenti, sono possibili due tipologie di valutazione: idoneità, nel qual caso i CFU corrispondenti non concorrono al calcolo della media finale, oppure votazione in trentesimi, con valutazione demandata ad apposita commissione designata dal CCS.
4. Per studenti con disabilità e studenti con DSA, le modalità di verifica si conformano a quanto stabilito nel RDA.
5. Il calendario degli esami di profitto è stabilito entro la scadenza ministeriale per l'anno accademico successivo e viene pubblicato sulle pagine del sito web di Ateneo relative al CdLM. Il calendario delle eventuali prove di verifica in itinere è stabilito dal CCS e comunicato agli studenti con congruo anticipo.

#### **Art. 8 Riconoscimento di crediti (RDA, Art. 18)**

1. La carriera pregressa degli studenti che si iscrivono al CdLM è valutata caso per caso tenendo conto dei contenuti e del carico di studio. In caso di riconoscimento vengono precisati i CFU attribuiti, non necessariamente identici a quelli attribuiti all'origine. Non è richiesta la precisa corrispondenza con le singole attività formative previste nel CdLM, ma deve essere salvaguardata la complessiva coerenza delle attività riconosciute con gli obiettivi formativi del CdLM, anche prevedendo un piano di studio personalizzato.
2. Ad ogni studente iscritto al CdLM, al quale siano stati riconosciuti dei CFU sulla base della valutazione della carriera pregressa, viene assegnata una coorte di riferimento e la durata attesa del suo percorso di studi.
3. Per quanto riguarda le conoscenze e le abilità professionali certificate individualmente ai sensi delle norme vigenti in materia, nonché le altre conoscenze e abilità maturate in attività formative di livello post-secondario alla cui progettazione e realizzazione l'Università abbia concorso, il numero massimo di CFU riconoscibili è pari a 12 CFU.

#### **Art. 9 Mobilità e studi compiuti all'estero (RDA, Art. 23)**

1. Gli studenti possono svolgere periodi di studio all'estero, sulla base di accordi con università straniere. Le opportunità di studio all'estero sono rese note agli studenti attraverso appositi bandi di selezione, a cura dell'Ateneo.
2. Per candidarsi ai bandi Erasmus, lo studente deve avere acquisito almeno 18 CFU se presenta domanda di mobilità al primo anno e almeno 72 CFU se presenta domanda di mobilità al secondo anno.

3. La conversione dei voti registrati per gli insegnamenti sostenuti all'estero nell'ambito di programmi Erasmus+ avverrà secondo criteri approvati annualmente dal CCS e resi disponibili sul sito web del CdLM e della Scuola di Scienze MFN. Allo scopo di incentivare la mobilità nell'ambito di programmi Erasmus+, potrà essere riconosciuta una maggiorazione fino a 3 CFU dei crediti acquisiti all'estero per gli studenti che abbiano conseguito almeno 30 CFU durante la mobilità.
4. In considerazione delle specificità del percorso offerto, il CCS considererà per l'approvazione solo Learning Agreement per periodi all'estero a partire dal secondo anno.

#### **Art. 10 Prova finale (RDA, Art. 21)**

1. Per essere ammessi all'esame di Laurea Magistrale occorre avere conseguito tutti i crediti delle attività formative previste dal piano di studio, tranne quelli relativi alla prova finale stessa, entro le scadenze previste dalla Scuola di Scienze MFN e pubblicate sul relativo sito web.
2. L'esame di Laurea Magistrale consiste nella discussione in lingua inglese di una attività svolta dallo studente sotto la guida di uno o più relatori, di cui almeno uno membro del CCS e docente di un insegnamento non mutuato, e il controllo di un correlatore.
3. L'attività svolta consiste in: (i) svolgere autonomamente un progetto significativo, di valenza teorica, computazionale o sperimentale; (ii) produrre un documento chiaro ed efficace in inglese che descrive il progetto e i risultati ottenuti.
4. Il voto di laurea viene calcolato come segue: a) si attribuisce un voto in trentesimi all'attività svolta; b) si calcola un punteggio base, ottenuto dalla media, pesati sui crediti, dei voti attribuiti agli esami dei singoli insegnamenti e all'attività svolta; il voto 30 e lode viene valutato 31; b) si converte il punteggio in base 110; c) a questo punteggio base, si aggiunge un incremento nell'intervallo [0,4] anche sulla base di una breve presentazione, in cui la capacità di rendere accessibili i risultati ottenuti sia elemento di valutazione; d) se il punteggio raggiunto è maggiore o uguale a 110/110, la commissione di laurea può concedere la lode.

#### **Art. 11 Orientamento e tutorato (RDA, Art. 24)**

1. Il CCS, di concerto con la Scuola di Scienze MFN, avvalendosi di una apposita commissione, organizza e partecipa ad attività e iniziative per favorire la scelta consapevole degli studi universitari, la continuità del percorso formativo, l'inserimento nel mondo del lavoro.
2. La Scuola di Scienze MFN, di concerto con il CCS che si avvale di uno specifico gruppo di lavoro, organizza e gestisce un servizio di tutorato per l'accoglienza e il sostegno degli studenti, al fine di prevenire la dispersione e il ritardo negli studi e di promuovere una proficua partecipazione attiva alla vita universitaria in tutte le sue forme.
3. Specifiche forme di orientamento e tutorato sono predisposte per studenti con disabilità e studenti con DSA.

**Art. 12 Verifica periodica dei crediti**

1. I crediti formativi universitari acquisiti nell'ambito del corso di laurea possono essere sottoposti a verifica di obsolescenza dopo 6 anni.
2. Qualora il CCS riconosca l'obsolescenza anche di una sola parte dei relativi contenuti formativi, lo stesso CCS stabilisce le prove integrative che dovranno essere sostenute dallo studente, definendo gli argomenti delle stesse e le modalità di verifica. Una volta superate le verifiche previste, il CCS convalida i crediti acquisiti con apposita delibera.

## Parte Generale

Indirizzo	Anno di corso	Codice_ins	Nome_ins	CFU	SSD	Tipologia	Ambito	Lingua	Obiettivi formativi	Ore riservate attività didattica assistita	Ore riservate allo studio personale
SOFTWARE SECURITY & ENGINEERING - SOFTWARE ENGINEERING	1	86798	MACHINE LEARNING AND DATA ANALYSIS	6	ING-INF/05	CARATTERIZZANTI	Discipline Informatiche	Inglese	Students will be provided with advanced skills related to machine learning and data analysis. Students will learn insights on machine learning and data analysis methodologies and a series of real world applications.	48	102
SOFTWARE SECURITY & ENGINEERING - SOFTWARE SECURITY	1	86798	MACHINE LEARNING AND DATA ANALYSIS	6	ING-INF/05	CARATTERIZZANTI	Discipline Informatiche	Inglese	Students will be provided with advanced skills related to machine learning and data analysis. Students will learn insights on machine learning and data analysis methodologies and a series of real world applications.	48	102
SOFTWARE SECURITY & ENGINEERING - SOFTWARE ENGINEERING	1	86800	VIRTUALIZATION AND CLOUD COMPUTING	6	ING-INF/05	CARATTERIZZANTI	Discipline Informatiche	Inglese	The course provides the foundations of the main virtualization technologies at the state of the art. In detail, the course focuses on several types of virtualization, like Storage-level, OS-level, Application-level, and Enterprise-level virtualization. The course is mostly practical, with the aim to teach the student how to deal with current virtualization technologies to build actual virtualized architectures.	48	102
SOFTWARE SECURITY & ENGINEERING - SOFTWARE SECURITY	1	86800	VIRTUALIZATION AND CLOUD COMPUTING	6	ING-INF/05	CARATTERIZZANTI	Discipline Informatiche	Inglese	The course provides the foundations of the main virtualization technologies at the state of the art. In detail, the course focuses on several types of virtualization, like Storage-level, OS-level, Application-level, and Enterprise-level virtualization. The course is mostly practical, with the aim to teach the student how to deal with current virtualization technologies to build actual virtualized architectures.	48	102

DATA SCIENCE & ENGINEERING - ARTIFICIAL INTELLIGENCE	1	90498	MACHINE LEARNING	9	INF/01	CARATTERIZZANTI	Discipline Informatiche	Inglese	Learning how to use classical supervised and unsupervised machine learning algorithms by grasping the underlying computational and modeling issues.	72	153
DATA SCIENCE & ENGINEERING - DATA ANALYTICS	1	90498	MACHINE LEARNING	9	INF/01	CARATTERIZZANTI	Discipline Informatiche	Inglese	Learning how to use classical supervised and unsupervised machine learning algorithms by grasping the underlying computational and modeling issues.	72	153
DATA SCIENCE & ENGINEERING - VISUAL COMPUTING	1	90498	MACHINE LEARNING	9	INF/01	CARATTERIZZANTI	Discipline Informatiche	Inglese	Learning how to use classical supervised and unsupervised machine learning algorithms by grasping the underlying computational and modeling issues.	72	153
DATA SCIENCE & ENGINEERING - ARTIFICIAL INTELLIGENCE	1	90520	DIGITAL SIGNAL & IMAGE PROCESSING	9	INF/01	CARATTERIZZANTI	Discipline Informatiche	Inglese	Acquiring the basic tools for the analysis of 1D and 2D signals in both the space and frequency domains	72	153
DATA SCIENCE & ENGINEERING - VISUAL COMPUTING	1	90520	DIGITAL SIGNAL & IMAGE PROCESSING	9	INF/01	CARATTERIZZANTI	Discipline Informatiche	Inglese	Acquiring the basic tools for the analysis of 1D and 2D signals in both the space and frequency domains	72	153
DATA SCIENCE & ENGINEERING - DATA ANALYTICS	1	90524	INTERNET OF THINGS	9	INF/01	CARATTERIZZANTI	Discipline Informatiche	Inglese	Learning methods, protocols, architectures, and platforms for the development of distributed and mobile applications for the Internet of Things, including machine to machine protocols, distributed algorithms for fault tolerance and replication, service oriented architectures platforms, embedded operating systems, real time and streaming data,	56	169



									geolocation, and collaborative framework.		
SOFTWARE SECURITY & ENGINEERING - SOFTWARE ENGINEERING	1	90524	INTERNET OF THINGS	9	INF/01	CARATTERIZZANTI	Discipline Informatiche	Inglese	Learning methods, protocols, architectures, and platforms for the development of distributed and mobile applications for the Internet of Things, including machine to machine protocols, distributed algorithms for fault tolerance and replication, service oriented architectures platforms, embedded operating systems, real time and streaming data, geolocation, and collaborative framework.	56	169
SOFTWARE SECURITY & ENGINEERING - SOFTWARE SECURITY	1	90524	INTERNET OF THINGS	9	INF/01	CARATTERIZZANTI	Discipline Informatiche	Inglese	Learning methods, protocols, architectures, and platforms for the development of distributed and mobile applications for the Internet of Things, including machine to machine protocols, distributed algorithms for fault tolerance and replication, service oriented architectures platforms, embedded operating systems, real time and streaming data, geolocation, and collaborative framework.	56	169
DATA SCIENCE & ENGINEERING - DATA ANALYTICS	1	90530	NETWORK ANALYSIS	6	INF/01	AFFINI O INTEGRATIVE	Attività Formative Affini o Integrative	Inglese	Learning algorithms and techniques for large scale graph analytics, including centrality measures, connected components, graph clustering, graph properties for random, small-world, and scale free graphs, graph metrics for robustness and resiliency, and graph algorithms for reference problems.	40	110
SOFTWARE SECURITY & ENGINEERING - SOFTWARE SECURITY	1	90538	DATA PROTECTION & PRIVACY	9	ING-INF/05	CARATTERIZZANTI	Discipline Informatiche	Inglese	Learning the theoretical and practical bases of the anonymization of personal data, with a special reference to state-of-the-art techniques for the anonymization of multidimensional	56	169

									data, graphs, time series, longitudinal and transactional data, as well as some legal bases on the protection of personal data.		
DATA SCIENCE & ENGINEERING - ARTIFICIAL INTELLIGENCE	1	90539	COMPUTATIONAL VISION	6	INF/01	AFFINI O INTEGRATIVE	Attività Formative Affini o Integrative	Inglese	Learning how to represent image content adaptively by means of shallow or deep computational models and biologically-inspired hierarchical models, and how to tackle image classification and categorization problems.	40	110
DATA SCIENCE & ENGINEERING - VISUAL COMPUTING	1	90539	COMPUTATIONAL VISION	6	INF/01	AFFINI O INTEGRATIVE	Attività Formative Affini o Integrative	Inglese	Learning how to represent image content adaptively by means of shallow or deep computational models and biologically-inspired hierarchical models, and how to tackle image classification and categorization problems.	40	110
DATA SCIENCE & ENGINEERING - ARTIFICIAL INTELLIGENCE	1	90549	ADDITIONAL USEFUL KNOWLEDGE	3		ALTRE ATTIVITA'	Altre Conoscenze Utili per l'Inserimento Nel Mondo del Lavoro	Inglese	Acquiring additional useful knowledge on elements of enterprise culture, skill activities, basics of program management, as well as on personal interests related to the Master degree topics through research seminar attendance.	0	75
DATA SCIENCE & ENGINEERING - DATA ANALYTICS	1	90549	ADDITIONAL USEFUL KNOWLEDGE	3		ALTRE ATTIVITA'	Altre Conoscenze Utili per l'Inserimento Nel Mondo del Lavoro	Inglese	Acquiring additional useful knowledge on elements of enterprise culture, skill activities, basics of program management, as well as on personal interests related to the Master degree topics through research seminar attendance.	0	75
DATA SCIENCE & ENGINEERING - VISUAL COMPUTING	1	90549	ADDITIONAL USEFUL KNOWLEDGE	3		ALTRE ATTIVITA'	Altre Conoscenze Utili per l'Inserimento Nel Mondo del Lavoro	Inglese	Acquiring additional useful knowledge on elements of enterprise culture, skill activities, basics of program management, as well as on personal interests related to the Master degree topics through research seminar attendance.	0	75

DATA SCIENCE & ENGINEERING - DATA ANALYTICS	1	101798	DATA WAREHOUSING	9	INF/01	CARATTERIZZANTI	Discipline Informatiche	Inglese	Learning the theoretical, methodological, and technological fundamentals of data management and analysis in decision support systems, with a specific reference to data warehousing architectural and design issues, as well as key elements of data integration and governance, data quality and cleaning, ExtractionTransformation-Loading processes, conceptual, logical, and physical design of data warehouses, storage architectures and scalable parallel processing, use of data warehouses for business reporting and online analytical processing.	72	153
DATA SCIENCE & ENGINEERING - ARTIFICIAL INTELLIGENCE	1	101804	DEEP LEARNING	9	INF/01	CARATTERIZZANTI	Discipline Informatiche	Inglese	Learning how to use deep learning algorithms, including classical approaches and very recent networks, by grasping the underlying computational and modeling issues.	56	169
DATA SCIENCE & ENGINEERING - VISUAL COMPUTING	1	101804	DEEP LEARNING	9	INF/01	CARATTERIZZANTI	Discipline Informatiche	Inglese	Learning how to use deep learning algorithms, including classical approaches and very recent networks, by grasping the underlying computational and modeling issues.	56	169
SOFTWARE SECURITY & ENGINEERING - SOFTWARE ENGINEERING	1	101805	MOBILE DEVELOPMENT	6	INF/01	AFFINI O INTEGRATIVE	Attività Formative Affini o Integrative	Inglese	Learning the design and development of mobile applications by using state of the practice IDEs, frameworks, languages, and technologies.	40	110
SOFTWARE SECURITY & ENGINEERING - SOFTWARE SECURITY	1	101805	MOBILE DEVELOPMENT	6	INF/01	AFFINI O INTEGRATIVE	Attività Formative Affini o Integrative	Inglese	Learning the design and development of mobile applications by using state of the practice IDEs, frameworks, languages, and technologies.	40	110

SOFTWARE SECURITY & ENGINEERING - SOFTWARE ENGINEERING	1	101806	IT PROJECT MANAGEMENT	6	INF/01	AFFINI O INTEGRATIVE	Attività Formative Affini o Integrative	Inglese	Learning the fundamental concepts, roles, and responsibilities of IT project management and develop skills for effective project management and leadership.	48	102
SOFTWARE SECURITY & ENGINEERING - SOFTWARE ENGINEERING	1	101807	SOFTWARE SYSTEMS DESIGN AND MODELLING	9	INF/01	CARATTERIZZANTI	Discipline Informatiche	Inglese	Learning through practical experience the basic conceptual tools for the design and modelling of software systems, and acquiring communication skills and lifelong learning capabilities.	56	169
SOFTWARE SECURITY & ENGINEERING - SOFTWARE ENGINEERING	1	101808	FUNCTIONAL AND SECURITY TESTING TECHNIQUES	6	INF/01	CARATTERIZZANTI	Discipline Informatiche	Inglese	Learning the fundamentals in functional and security testing of software systems, with special emphasis on challenges posed by Web and Mobile applications, and getting acquainted with automated tools used to practice testing techniques.	48	102
SOFTWARE SECURITY & ENGINEERING - SOFTWARE SECURITY	1	101808	FUNCTIONAL AND SECURITY TESTING TECHNIQUES	6	INF/01	CARATTERIZZANTI	Discipline Informatiche	Inglese	Learning the fundamentals in functional and security testing of software systems, with special emphasis on challenges posed by Web and Mobile applications, and getting acquainted with automated tools used to practice testing techniques.	48	102
DATA SCIENCE & ENGINEERING - ARTIFICIAL INTELLIGENCE	1	101809	DISTRIBUTED COMPUTING	9	INF/01	CARATTERIZZANTI	Discipline Informatiche	Inglese	Learning the fundamental design principles for distributed systems and getting more in-depth knowledge of a few chosen architectures relative to the students' curriculum; getting familiarity with the concepts of reliability, availability, and fault tolerance.	72	153

DATA SCIENCE & ENGINEERING - DATA ANALYTICS	1	101809	DISTRIBUTED COMPUTING	9	INF/01	CARATTERIZZANTI	Discipline Informatiche	Inglese	Learning the fundamental design principles for distributed systems and getting more in-depth knowledge of a few chosen architectures relative to the students' curriculum; getting familiarity with the concepts of reliability, availability, and fault tolerance.	72	153
DATA SCIENCE & ENGINEERING - VISUAL COMPUTING	1	101809	DISTRIBUTED COMPUTING	9	INF/01	CARATTERIZZANTI	Discipline Informatiche	Inglese	Learning the fundamental design principles for distributed systems and getting more in-depth knowledge of a few chosen architectures relative to the students' curriculum; getting familiarity with the concepts of reliability, availability, and fault tolerance.	72	153
SOFTWARE SECURITY & ENGINEERING - SOFTWARE ENGINEERING	1	101809	DISTRIBUTED COMPUTING	6	INF/01	CARATTERIZZANTI	Discipline Informatiche	Inglese	Learning the fundamental design principles for distributed systems and getting more in-depth knowledge of a few chosen architectures relative to the students' curriculum; getting familiarity with the concepts of reliability, availability, and fault tolerance.	48	102
SOFTWARE SECURITY & ENGINEERING - SOFTWARE SECURITY	1	101809	DISTRIBUTED COMPUTING	6	INF/01	CARATTERIZZANTI	Discipline Informatiche	Inglese	Learning the fundamental design principles for distributed systems and getting more in-depth knowledge of a few chosen architectures relative to the students' curriculum; getting familiarity with the concepts of reliability, availability, and fault tolerance.	48	102
SOFTWARE SECURITY & ENGINEERING - SOFTWARE SECURITY	1	101812	DIGITAL FORENSICS	6	INF/01	AFFINI O INTEGRATIVE	Attività Formative Affini o Integrative	Inglese	Learning how to conduct digital investigations, following the standard process involving identification, acquisition, storage, and analysis of digital evidence.	40	102

DATA SCIENCE & ENGINEERING - ARTIFICIAL INTELLIGENCE	1	108871	AUGMENTED REALITY	6	INF/01	AFFINI O INTEGRATIVE	Attività Formative Affini o Integrative	Inglese	Learning the theoretical and methodological fundamentals of Augmented Reality, from the concepts of 3D Computational Vision to model the real-world world, to the synthesis of the virtual environments, and their fusion.	40	110
DATA SCIENCE & ENGINEERING - DATA ANALYTICS	1	108871	AUGMENTED REALITY	6	INF/01	AFFINI O INTEGRATIVE	Attività Formative Affini o Integrative	Inglese	Learning the theoretical and methodological fundamentals of Augmented Reality, from the concepts of 3D Computational Vision to model the real-world world, to the synthesis of the virtual environments, and their fusion.	40	110
DATA SCIENCE & ENGINEERING - VISUAL COMPUTING	1	109186	COMPUTER GRAPHICS	6	INF/01	AFFINI O INTEGRATIVE	Attività Formative Affini o Integrative		Learning the theoretical and methodological fundamentals of Computer Graphics	40	110
DATA SCIENCE & ENGINEERING - DATA ANALYTICS	2	61884	ADVANCED DATA MANAGEMENT	9	INF/01	CARATTERIZZANTI	Discipline Informatiche	Inglese	Learning the theoretical, methodological, and technological fundamentals of data management for advanced data processing architectures, with a specific reference to large-scale distributed environments, like key elements of NoSQL and stream-based systems as well as basic issues in parallel and distributed query processing, multi-query processing, and high-throughput transactional systems.	56	169
SOFTWARE SECURITY & ENGINEERING - SOFTWARE ENGINEERING	2	61884	ADVANCED DATA MANAGEMENT	9	INF/01	CARATTERIZZANTI	Discipline Informatiche	Inglese	Learning the theoretical, methodological, and technological fundamentals of data management for advanced data processing architectures, with a specific reference to large-scale distributed environments, like key elements of NoSQL and stream-based systems as well as basic issues in parallel and distributed query processing, multi-query processing, and high-throughput transactional systems.	56	169

DATA SCIENCE & ENGINEERING - VISUAL COMPUTING	2	80412	GEOMETRIC MODELING	6	INF/01	CARATTERIZZANTI	Discipline Informatiche	Inglese	Learning theoretical foundations, techniques and methodologies for the representation and manipulation of solid objects, 2D and 3D scalar surfaces and fields, and related computational techniques. Learning computational techniques for resolving geometric problems (computational geometry and geometry processing). Reference applications: computer graphics, scientific visualization, CAD systems, geographic information systems, virtual reality.	40	110
DATA SCIENCE & ENGINEERING - ARTIFICIAL INTELLIGENCE	2	90529	DATA VISUALIZATION	6	INF/01	CARATTERIZZANTI	Discipline Informatiche	Inglese	Learning basic principles from vision and human perception. Learning principles, methods, and techniques for effective visual analysis of data, including techniques for visualizing spatial, non-spatial, and temporal data.	40	110
DATA SCIENCE & ENGINEERING - DATA ANALYTICS	2	90529	DATA VISUALIZATION	6	INF/01	CARATTERIZZANTI	Discipline Informatiche	Inglese	Learning basic principles from vision and human perception. Learning principles, methods, and techniques for effective visual analysis of data, including techniques for visualizing spatial, non-spatial, and temporal data.	40	110
DATA SCIENCE & ENGINEERING - VISUAL COMPUTING	2	90529	DATA VISUALIZATION	6	INF/01	CARATTERIZZANTI	Discipline Informatiche	Inglese	Learning basic principles from vision and human perception. Learning principles, methods, and techniques for effective visual analysis of data, including techniques for visualizing spatial, non-spatial, and temporal data.	40	110
DATA SCIENCE & ENGINEERING - ARTIFICIAL INTELLIGENCE	2	90535	HIGH PERFORMANCE COMPUTING	9	INF/01	CARATTERIZZANTI	Discipline Informatiche	Inglese	Learning the main aspects of modern, heterogeneous high-performance computing systems (pipeline/superscalar processors, shared-memory/message-passing multiprocessors, vector processors, GPUs) and basic programming skills for high-performance computing (cache	56	169

									optimization, vectorization, optimizations OpenMP, MPI, CUDA).		
DATA SCIENCE & ENGINEERING - VISUAL COMPUTING	2	90535	HIGH PERFORMANCE COMPUTING	9	INF/01	CARATTERIZZANTI	Discipline Informatiche	Inglese	Learning the main aspects of modern, heterogeneous high-performance computing systems (pipeline/superscalar processors, shared-memory/message-passing multiprocessors, vector processors, GPUs) and basic programming skills for high-performance computing (cache optimization, vectorization, optimizations OpenMP, MPI, CUDA).	56	169
DATA SCIENCE & ENGINEERING - ARTIFICIAL INTELLIGENCE	2	90537	FINAL DISSERTATION	30		PROVA FINALE	Per la Prova Finale	Inglese	Being able to carry out autonomously a conspicuous project which could be of theoretical, computational, or experimental flavour. Being able to clearly describe the project and the obtained results in a written document.	0	750
DATA SCIENCE & ENGINEERING - DATA ANALYTICS	2	90537	FINAL DISSERTATION	30		PROVA FINALE	Per la Prova Finale	Inglese	Being able to carry out autonomously a conspicuous project which could be of theoretical, computational, or experimental flavour. Being able to clearly describe the project and the obtained results in a written document.	0	750
DATA SCIENCE & ENGINEERING - VISUAL COMPUTING	2	90537	FINAL DISSERTATION	30		PROVA FINALE	Per la Prova Finale	Inglese	Being able to carry out autonomously a conspicuous project which could be of theoretical, computational, or experimental flavour. Being able to clearly describe the project and the obtained results in a written document.	0	750



SOFTWARE SECURITY & ENGINEERING - SOFTWARE ENGINEERING	2	90537	FINAL DISSERTATION	29		PROVA FINALE	Per la Prova Finale	Inglese	Being able to carry out autonomously a conspicuous project which could be of theoretical, computational, or experimental flavour. Being able to clearly describe the project and the obtained results in a written document.	0	725
SOFTWARE SECURITY & ENGINEERING - SOFTWARE SECURITY	2	90537	FINAL DISSERTATION	29		PROVA FINALE	Per la Prova Finale	Inglese	Being able to carry out autonomously a conspicuous project which could be of theoretical, computational, or experimental flavour. Being able to clearly describe the project and the obtained results in a written document.	0	725
DATA SCIENCE & ENGINEERING - DATA ANALYTICS	2	90538	DATA PROTECTION & PRIVACY	6	ING-INF/05	CARATTERIZZANTI	Discipline Informatiche	Inglese	Learning the theoretical and practical bases of the anonymization of personal data, with a special reference to state-of-the-art techniques for the anonymization of multidimensional data, graphs, time series, longitudinal and transactional data, as well as some legal bases on the protection of personal data.	40	110
DATA SCIENCE & ENGINEERING - ARTIFICIAL INTELLIGENCE	2	90541	NATURAL LANGUAGE PROCESSING	6	INF/01	CARATTERIZZANTI	Discipline Informatiche	Inglese	Learning how to process and represent natural language, and the main software components of a system able to understand natural language.	32	118
DATA SCIENCE & ENGINEERING - ARTIFICIAL INTELLIGENCE	2	90545	MULTIAGENT SYSTEMS	6	INF/01	CARATTERIZZANTI	Discipline Informatiche	Inglese	Getting acquainted with the concept of an agent and multiagent system, and learning how to design intelligent autonomous agents and how to deal with the main implementation issues.	32	118
DATA SCIENCE & ENGINEERING - DATA ANALYTICS	2	90545	MULTIAGENT SYSTEMS	6	INF/01	CARATTERIZZANTI	Discipline Informatiche	Inglese	Getting acquainted with the concept of an agent and multiagent system, and learning how to design intelligent autonomous agents and how to deal with the main implementation issues.	32	118

DATA SCIENCE & ENGINEERING - VISUAL COMPUTING	2	90545	MULTIAGENT SYSTEMS	6	INF/01	CARATTERIZZANTI	Discipline Informatiche	Inglese	Getting acquainted with the concept of an agent and multiagent system, and learning how to design intelligent autonomous agents and how to deal with the main implementation issues.	32	118
SOFTWARE SECURITY & ENGINEERING - SOFTWARE ENGINEERING	2	101810	CAPSTONE PROJECT	9	INF/01	CARATTERIZZANTI	Discipline Informatiche	Inglese	Acquiring experience of a realistic team development effort that follows a given methodology and harnesses different technologies for the implementation of a specific product.	40	185
SOFTWARE SECURITY & ENGINEERING - SOFTWARE SECURITY	2	101810	CAPSTONE PROJECT	9	INF/01	CARATTERIZZANTI	Discipline Informatiche	Inglese	Acquiring experience of a realistic team development effort that follows a given methodology and harnesses different technologies for the implementation of a specific product.	40	185
SOFTWARE SECURITY & ENGINEERING - SOFTWARE SECURITY	2	101811	BINARY ANALYSIS AND SECURE CODING	9	INF/01	CARATTERIZZANTI	Discipline Informatiche	Inglese	Learning how to write secure code, analyze the behavior and assess security properties of source and binary programs, pinpointing and fix their vulnerabilities or apply corrective counter-measures.	56	169
SOFTWARE SECURITY & ENGINEERING - SOFTWARE ENGINEERING	2	108872	BLOCKCHAIN AND DISTRIBUTED LEDGER	6	INF/01	CARATTERIZZANTI	Discipline Informatiche	Inglese	Learning the techniques and problems related to systems based on permissioned and permissionless blockchains, and decentralized systems in general, examining with particular attention the aspects related to security.	40	110
SOFTWARE SECURITY & ENGINEERING - SOFTWARE SECURITY	2	108872	BLOCKCHAIN AND DISTRIBUTED LEDGER	6	INF/01	CARATTERIZZANTI	Discipline Informatiche	Inglese	Learning the techniques and problems related to systems based on permissioned and permissionless blockchains, and decentralized systems in general, examining with particular attention the aspects related to security.	48	102

SOFTWARE SECURITY & ENGINEERING - SOFTWARE ENGINEERING	2	111486	TECHNICAL WRITING	1		ULTERIORI ATTIVITA' FORMATIVE	Ulteriori attività formative	Inglese	Learning to accurately plan, write and revise technical scientific documents, e.g.a thesis, in the correct format and to the required standards.	0	25
SOFTWARE SECURITY & ENGINEERING - SOFTWARE SECURITY	2	111486	TECHNICAL WRITING	1		ULTERIORI ATTIVITA' FORMATIVE	Ulteriori attività formative	Inglese	Learning to accurately plan, write and revise technical scientific documents, e.g.a thesis, in the correct format and to the required standards.	0	25