UNIVERSITA' DEGLI STUDI DI MILANO
PROGRAMME DESCRIPTION - ACADEMIC YEAR 2024/25
MASTER DEGREE
Computer Science (Classe LM-18)
enrolled from 2014/2015 academic year

HEADING

Degree classification - Denomination and code:	LM-18 Computer science
Degree title:	Dottore Magistrale
Length of course:	2 years
Credits required for admission:	180
Total number of credits required to complete programme:	120
Years of course currently available:	1st , 2nd
Access procedures:	Open, subject to entry requirements
Course code:	F94

PERSONS/ROLES

Head of Study Programme
Prof. ssa Sabrina Gaito

Degree Course Coordinator
Prof. Marco Tarini

Tutors - Faculty
TUTOR PER L'ORIENTAMENTO:
Carlo Bellettini
Roberto Cordone
Mattia Monga
Beatrice Santa Palano
Laura Anna Ripamonti
Giorgio Valentini

Degree Course website
https://informatica-lm.cdl.unimi.it/

Career Guidance Board

Via Celoria 18 - 20133 Milano   https://di.unimi.it/it/dipartimento/organizzazione/commissioni   Email: orientamento.uscita@di.unimi.it

Course management

Via Celoria 18 - 20133 Milano   Phone 0250316250/252   Sportello in presenza: mercoledì dalle 14.00 alle 16.00 / Sportello telefonico: giovedì dalle 9.30 alle 12.30   https://di.unimi.it/it/dipartimento/segreterie-e-servizi/ufficio-la-didattica
https://informastudenti.unimi.it/saw/ess?AUTH=SAML

Erasmus and International Student Board

Via Celoria 18 - 20133 Milano   https://di.unimi.it/it/dipartimento/organizzazione/commissioni   Email: erasmus@di.unimi.it

Internship and Master's Degree Thesis Board

Via Celoria 18 - 20133 Milano   https://di.unimi.it/it/dipartimento/organizzazione/commissioni   Email: tesi.magistrali@di.unimi.it

Master's Degree Admission Board

Via Celoria 18 - 20133 Milano   https://di.unimi.it/it/dipartimento/organizzazione/commissioni   Email: ammissioni.magistrali@di.unimi.it

Programme Transfer Board

Via Celoria 18 - 20133 Milano   https://di.unimi.it/it/dipartimento/organizzazione/commissioni   Email: trasferimenti@di.unimi.it

Student Office

Via Celoria 18 - 20133 Milano   Phone 0250325032   https://www.unimi.it/it/node/360/   https://www.unimi.it/it/node/359/

Student Orientation Board

Student representatives

Email: rappresentanti.studenti@di.unimi.it

Study Plan Board

Via Celoria 18 - 20133 Milano   https://di.unimi.it/it/dipartimento/organizzazione/commissioni   Email: piani.studio@di.unimi.it

CHARACTERISTICS OF DEGREE PROGRAMME

General and specific learning objectives

The master's degree program in Computer Science aims to provide advanced knowledge and professional skills suitable for carrying out research, design and coordination activities in the various application areas of computer science, with particular reference to the commercial, industrial and scientific sectors.

The graduate in Computer Science carries out design, development, control and management of complex IT systems. The fundamental target of her/his activity is the constant improvement of IT systems in qualitative and economic terms, and the ability to propose in the application area in which she/he works the ceaseless innovations and technical improvements that characterize the discipline.

The master degree course therefore aims to train professionals with high-level analytical and operational skills, but also having an open and critical view of the problems related with the adoption and use of Information Technology.

The Master in Computer Science ensures advanced graduates' training in the fundamental areas

that mainly characterize information technology: algorithms, languages, logical and formal methods, software development and design, information systems and data management, architectures and networks, intelligent systems, data analysis and optimization, signal and image processing, multimedia and social communication.

Expected learning outcomes

The master degree graduates have advanced theoretical knowledge and skills in the following learning areas: algorithms, languages, logical and formal methods, software development and design, information systems and data management, architectures and networks, intelligent systems, data analysis and optimization, signal and image processing, multimedia and social communication.

Knowledge and skills in the field of: basic IT methods and principles; software design and development, particularly in relation to the most advanced development and design techniques and programming languages; information systems and data management; management of a company and of the processes involved in its functioning, information management in its various forms and representations, management of distributed services; digital architectures and methodologies for the processing of digital signals, radio networks for mobile terminals and sensors and architectures for distributed systems; advanced data analysis, the treatment of uncertain information, the planning and optimization of systems and processes; automatic reasoning and decision theory; algorithmic techniques for coding, compression, manipulation and analysis of images and signals; principles and methods for the study and design of IT systems for interaction and for digital communication.

Graduates will be able to apply the acquired knowledge and skills to the analysis, design, implementation and evaluation of complex IT systems operating in different application areas; to use the cognitive tools developed during the course to analyze and evaluate from a professional point of view the correctness and compliance of design choices as well as the effects of decisions on the functioning of IT systems.

The student will be able to apply the acquired knowledge to: solve new problems; design and develop any type of software and for any environment; solve problems related to data management; address the development of wireless networks and digital architectures; extract knowledge from data collections or observations, to create predictive models based on observations, and to create systems for planning, optimization and control of processes; develop software for graphic manipulation and for the acquisition, representation and intelligent analysis of signals, images and videos; the study and design of computer systems for digital interaction and communication.

Graduates will have to acquire a full capacity to make aware and independent judgments on the decisions and design choices of the companies, organizations and bodies.

Expected learning outcomes. Ability to: reason critically and to discuss design and implementation choices; develop autonomous and independent reasoning; awareness of the existence of different alternative methodological approaches for the design and analysis of systems, and understanding of the relevance of this plurality; critically evaluate the relevance and merits of alternative projects; critically evaluate and interpret evidence.

Graduates must be able to argue their positions and communicate the results of their own analyses and evaluations in a clear and effective way.

Expected learning outcomes: written communication skills, ability to present and evaluate critically in writing ideas and technique and methodological topics, ability to formulate and express orally complex technical and methodological arguments, ablity to elaborate in an accomplished and consistent manner an original research dissertation on a complex topic.

The program aims to lead the students to the frontier of the research in some of the reference disciplinary areas. Expected learning outcomes: ability to organize one's ideas critically and systematically; identify, select and collect information through the appropriate use of the relevant sources; use libraries, databases, archives and paper and electronic repertories to access relevant scientific and documentary information.

Professional profile and employment opportunities

Researcher and specialist in basic computer science research.

Functions: junior researcher associated with academic research groups, or laboratories of public and private bodies. Skills: in-depth awareness of the fundamentals of one's discipline and of the problems that characterize it with respect to the other sciences. Ability to elaborate and communicate original ideas in the field of basic computer science, in particular relating to the mathematical, logical and statistical foundations of computation, design and analysis of algorithms in abstract and, depending on the paths followed during the degree course, in different disciplinary areas. Opportunities: in public and private research institutions, as well as in high-tech companies that develop new methodologies and innovative systems. Continuation of the course of studies with third level training.

Application and system software analyst and designer.

Functions: high responsibility roles in the public or private sector with respect to the coordination, management and control of medium-large computer systems projects. Autonomous professional activities. Skills: mastery of different programming paradigms and languages, of the analysis and specification of requirements in software engineering, in the synthesis of programs, in the verification of the absence of errors within programs, in the verification of correctness with respect to the specifications. Control of the use of resources in sequential, object-oriented, concurrent and distributed environments. Knowledge of the methodologies and architectures relevant to the different areas of traditional IT as well as to the sectors of multimedia publishing, graphics and unconventional interaction, mobile and pervasive computing, social computing, web analytics and digital marketing. Opportunities: in manufacturing companies in the areas of IT systems and networks, in high-tech companies that develop or use new innovative IT methodologies and systems, and in companies and public and private organizations which use complex IT systems to manage their data and processes.

System analyst.

Functions: roles of high responsibility in the analysis and management of medium-large IT systems. Generally the perspectives are mainly in the technological field, but having particular management skills the graduate can attain high management roles even in different areas. Skills: knowledge of the most advanced technologies to adapt them to business objectives, with particular reference to: operating systems and network infrastructures, internet and intranet applications, the most common hardware and software architectures, the most common organizational and business management models, relational databases, Data Warehousing and Data Mining, the main technological platforms ERP and CRM. Opportunities: all areas of the public and private sector that use information technologies and operate in segments of market such as industry, banks, insurance, logistics and transport, healthcare, public administration, new media, companies of services.

Specialist in computer networks and communications.

Functions: roles of high responsibility and wide autonomy in medium-large telematic systems projects. Skills: ability to analyze, design, test, evaluate and optimize the performance of networks and network systems telecommunications. The graduate possesses advanced knowledge in IT sectors such as distributed systems, systems information, security, web technologies; she/he designs advanced systems and applications in innovative contexts, mobile and complex systems; has acquired advanced skills for solving problems and for learning innovative methodologies and technologies. Opportunities: all areas of the public and private sector that use communication technologies and operate in market sectors such as industry, banks, logistics and transport, healthcare, public administrations, new media, service companies, digital marketing.

Initial knowledge required

Candidates must have earned at least the following credits in their previous studies:
- 48 credits in the following academic fields: INF/01 (Computer science);
- 12 credits in the MAT/01-09 academic fields.

For the purposes of admission to the programme, the Academic Board reserves the right to carefully assess the student's career if not perfectly in line with the above requirements.

Admission requirements will be assessed based on the following qualifications: degree certificate with marks, transcript of records, course syllabus where not available on the website of the University of Milan.

The candidate's educational background will be assessed based on the exam grades achieved in the academic fields (SSD) listed under the admission requirements. If necessary, the candidate will be required to pass an individual interview.

Any curricular additions, in terms of university credits (CFU), must be achieved before the above assessment, by attending the following courses, and taking the relevant exams, within the degree programmes in Computer Science, Computer Science for New Media Communications, Music Information Science, Computer Systems and Networks Security.

Compulsory attendance

Attendance is strongly recommended for both courses and laboratories.

Degree programme final exams

After earning the required academic credits, in compliance with the programme regulations, the student may sit the final exam and obtain their degree. The final exam consists of the presentation and discussion of an original degree thesis (in English or Italian), proving the candidate's research, reworking and synthesis skills. The student will write their thesis under the guidance of a supervisor.

Campus

IT course venues: via Celoria 18 - Milan.

Other course venues: Teaching sector, via Celoria; Teaching sector, via Golgi 19; Teaching sector, via Venezian 15.

Laboratories

Computer laboratory (Silab) at the Department of Computer Science, via Celoria 18, Milan.

Notes

In order to obtain their degree, students must be proficient in English at a B2 level under the Common European Framework of Reference for Languages (CEFR). This proficiency level may be certified as follows:
- By submitting a language certificate attesting B2 or higher level in English and issued no more than three years before the date of submission. You will find the list of language certificates recognized by the University at: https://www.unimi.it/en/node/39322). The certificate must be uploaded during the enrolment procedure, or subsequently to the portal http://studente.unimi.it/uploadCertificazioniLingue;
- By taking a placement test offered by the University Language Centre (SLAM) between October and January of the first year. Students who fail the test will be required to take a SLAM course.

The placement test is mandatory for all those who do not hold a valid certificate attesting to B2 or higher level.

Those who have not taken the placement test by the end of January or fail the end-of-course exam six times must obtain the necessary certification privately before graduating.

EXPERIENCE OF STUDY ABROAD AS PART OF THE TRAINING PROGRAM

The University of Milan supports international mobility by providing its students with the opportunity to spend study and internship periods abroad. It is a unique chance to enrich your educational path in a new exciting environment.

The agreements entered into by the University with over 300 universities from the 27 EU member countries under the European Erasmus+ programme allow regularly enrolled students to carry out part of their studies at one of the partner universities or to undertake internships at companies, training and research centres and other organizations.

Similar international mobility opportunities are provided outside Europe, through agreements with a number of prestigious institutions.

Study and internships abroad

The education program can be enriched by educational activities abroad both to deepen some topics and as socialization experience in international environments. Within the Erasmus+ program study periods can be taken in over 50 universities in Belgium, Czech Republic, Finland, France, Germany, Greece, Hungary, Lithuania, Norway, Netherlands, Poland, Portugal, Romania, Slovenia, Spain, Switzerland, Turkey. Courses will be recognized in the personalized study plan. These periods abroad are typically 5-month long and include courses for about 30 CFU, in the area of information and communication technology and related applications. Recognition of these educational activities will be based on the Learning Agreement, to be defined in advance by the student and the Erasmus coordinator at the Computer Science Department before starting the period abroad: course in the learning agreement with passed exams will replace the educational activities of the study plan ("manifesto"), either by covering the same topics or complementing the acquired basic competences. The Erasmus Committee at the Computer Science Department will perform the recognition of CFU obtained abroad and the definition of the personalized study plan. Similarly, stages to prepare the final dissertation are allowed in the same foreign universities. Recognition will be performed by the Department Erasmus Committee.

The degree course offers integrated study programmes that award joint/multiple degrees (https://www.unimi.it/en/international/study-abroad/double-degree).

Erasmus: the coordinator for the Department of Informatics is Prof. Fabio Scotti

International Programs: the coordinator for the Department of Informatics is Prof. Davide Rocchesso.

More information are available at the following link: https://di.unimi.it/it/rapporti-internazionali/mobilita-internazionale/opportunita-internazionali

How to participate in Erasmus mobility programs

The students of the University of Milan can participate in mobility programmes, through a public selection procedure.

Ad hoc commissions will evaluate:
• Academic career
• the candidate's proposed study programme abroad
• his/her foreign language proficiency
• the reasons behind his/her application

Call for applications and informative meetings

The public selection for Erasmus+ mobility for study generally begins around February each year with the publication of a call for applications specifying destinations and requirements. Regarding the Erasmus+ Mobility for Traineeship, the University of Milan usually publishes two calls a year enabling students to choose a destination defined by an inter-institutional agreement or to find a traineeship position on their own.

The University organizes informative meetings to illustrate mobility opportunities and rules for participation.

Erasmus+ scholarship

The European Union grants the winners of the Erasmus+ programme selection a scholarship to contribute to their mobility costs, which may be supplemented by the University funding for disadvantaged students.

Language courses

Students who pass the selections for mobility programmes can benefit from intensive foreign language courses offered each year by the University Language Centre (SLAM).
https://www.unimi.it/en/node/8/
Learn more at https://www.unimi.it/en/node/274/
For assistance, please contact:
International Mobility Office
Via Santa Sofia 9 (second floor)
Tel. 02 503 13501-12589-13495-13502
Contacts: InformaStudenti; mobility.out@unimi.it
Student Desk booking through InformaStudenti

1st COURSE YEAR Core/compulsory courses/activities common

Learning activity		Ects	Sector
English proficiency B2 (3 ECTS)		3	ND
	Total compulsory credits	3	

Further elective courses

Students must acquire at least 18 credits among the following characteristic courses.

Learning activity	Ects	Sector
ADVANCED PROGRAMMING *Alternate years course, available in 2024/25*	6	INF/01
ARTIFICIAL INTELLIGENCE	6	INF/01
DISTRIBUTED AND PERVASIVE SYSTEMS	6	INF/01
INFORMATION MANAGEMENT	6	INF/01
MULTIMEDIA ARCHITECTURES	6	INF/01
NATURAL INTERACTION	6	INF/01
SOFTWARE DEVELOPMENT IN COMPLEX TEAMS	6	INF/01
STATISTICAL METHODS FOR MACHINE LEARNING	6	INF/01
THEORETICAL COMPUTER SCIENCE	6	INF/01
WIRELESS AND MOBILE NETWORKS	6	INF/01

Students must achieve at least 30 and not more than 36 CFU choosing from the following Table 1.

Learning activity	Ects	Sector
3D VIDEO GAMES	6	INF/01
ADVANCED INTELLIGENT SYSTEMS	6	INF/01
ADVANCED PROGRAMMING *Alternate years course, available in 2024/25*	6	INF/01
ADVANCED PROGRAMMING TECHNIQUES *Alternate years course, not available in 2024/25*	6	INF/01
ADVANCES IN OPERATING SYSTEMS	6	INF/01
ALGORITHMS AND COMPLEXITY	6	INF/01
ALGORITHMS FOR MASSIVE DATASETS	6	INF/01
ARTIFICIAL INTELLIGENCE	6	INF/01
ARTIFICIAL INTELLIGENCE FOR VIDEO GAMES	6	INF/01
ARTIFICIAL VISION	6	INF/01
AUDIO PATTERN RECOGNITION	6	INF/01
Business information sistems	6	INF/01
CLOUD COMPUTING TECHNOLOGIES	6	INF/01
DEVELOPMENT OF APPLICATIONS FOR MOBILE DEVICES	6	INF/01
DISTRIBUTED AND PERVASIVE SYSTEMS	6	INF/01
FORMAL LANGUAGE THEORY	6	INF/01
HEURISTIC ALGORITHMS	6	INF/01
INFORMATION MANAGEMENT	6	INF/01
INTELLIGENT SYSTEMS FOR INDUSTRY, SUPPLY CHAIN AND ENVIRONMENT	6	INF/01
METHODS FOR IMAGE PROCESSING	6	INF/01
MIDI PROGRAMMING	6	INF/01
MULTIMEDIA ARCHITECTURES	6	INF/01
NATURAL INTERACTION	6	INF/01
NEW GENERATION DATA MODELS AND DBMSs	6	INF/01
ONLINE GAME DESIGN	6	INF/01
PARALLEL AND DISTRIBUTED ALGORITHMS	6	INF/01
PRIVACY AND DATA PROTECTION	6	INF/01
PRIVACY AND DATA PROTECTION	6	INF/01
PROBABILISTIC METHODS FOR INFORMATICS	6	INF/01
PROGRAMMING FOR MUSIC	6	INF/01
REAL-TIME GRAPHICS PROGRAMMING	6	INF/01
RISK ANALYSIS AND MANAGEMENT	6	INF/01
SENSOR SYSTEM DESIGN	6	INF/01
SERVICE-ORIENTED ARCHITECTURE SECURITY	6	INF/01
Simulazione	6	INF/01
SOFTWARE DEVELOPMENT IN COMPLEX TEAMS	6	INF/01
SOFTWARE PROTECTION TECHNIQUES	6	INF/01
SOFTWARE VERIFICATION AND VALIDATION *Alternate years course, not available in 24-25*	6	INF/01
STATISTICAL METHODS FOR MACHINE LEARNING	6	INF/01
THEORETICAL COMPUTER SCIENCE	6	INF/01
VIRTUAL REALITY	6	INF/01
WEB ALGORITHMICS	6	INF/01
WIRELESS AND MOBILE NETWORKS	6	INF/01

Students must achieve at least 12 and not more than 18 CFU choosing from the following Table 2. Those who have obtained 30 credits from the above table 1 must obtain 18 from table 2; those who have obtained 36 credits from the above table 1 will have to receive 12 from table 2.

Business Safety Management (6 cfu) will be held from the academic year. 2025/26

AFFECTIVE COMPUTING	6	ING-INF/05
BIOMEDICAL SIGNAL PROCESSING	6	ING-INF/06
COMBINATORIAL OPTIMIZATION	6	MAT/09
COMPLEMENTS OF OPERATING RESEARCH	6	MAT/09
COMPUTATIONAL GEOMETRY	6	MAT/03
COMPUTING EDUCATION	6	INF/01
DECISION METHODS AND MODELS	6	MAT/09
DIGITAL CITIZENSHIP AND CIVIC ACTIVISM *Alternate years course, not available in 24-25*	6	INF/01
FORMAL METHODS	6	INF/01
GEOSPATIAL DATA MANAGEMENT	6	ING-INF/05
GPU COMPUTING	6	INF/01
GRAPH THEORY *Not available in 2024/25*	6	INF/01
LOGISTICS	6	MAT/09
MATHEMATICAL LOGIC	6	MAT/01
NATURAL LANGUAGE PROCESSING	6	INF/01
NUMERICAL ANALYSIS	6	MAT/08
SOUND IN INTERACTION	6	INF/01
SYSTEM MODELING AND ANALYSIS	6	INF/01

Free choice courses.

Students will have to achieve 12 free cfu among the courses of the previous tables, among the following courses activated by the Department, by Conservatorio, or among all the courses activated by the university.

It is not possible to choose courses activated by old study degrees.

Students can request the recognition of credits for training activities at external institutions, presenting a certification. Each certification can give rise to a maximum of 3 credits, and up to 2 certifications can be recognized. The students who intend to request the recognition of the certifications must complete the "application" form available on the page https://www.unimi.it/en/study/student-services/welcome-desk-infostudenti/general-forms and send ver to the secretary of his / her degree together with a copy of the certifications achieved.

The evaluation will be carried out by a special commission based on the following parameters:

- Validity: the certification must have been obtained for a maximum of 5 years.

- Specificity: the object of the certification must be those referable to those required by the degree course in which the student is regularly enrolled.

- Specialization: the certification must concern specialized and / or professional skills.

- Level: the certification must attest to skills of a medium or advanced level. Basic and entry level certifications are excluded.

Free choice courses (Conservatorio):

- 1 semester, Informatica Musicale e Musica Digitale, 3 cfu (COME/05)

- 2 semester, Informatica Musicale, 3 cfu (COME/05)

- 2 semester, Campionamento, Sintesi ed Elaborazione Digitale dei Suoni, 3 cfu (COME/05)

- 2 semester, Sistemi e Linguaggi di Programmazione per l'Audio e le Applicazioni Musicali 1, 3 cfu (COME/05)

- 1 semester, Sistemi e Linguaggi di Programmazione per l'Audio e le Applicazioni Musicali 2, 3 cfu (COME/05)

End of course requirements		
FINAL EXAM	39	NA
Total compulsory credits	39	