Program description
Computer Science - master

[120 / Bodø]

The program description has been approved by the Studieutvalget of Faculty of Science and Technology on [14.06.2022]

Study programme name	Computer Science - master
Degree obtained	Master of Science in Computer Science
Target group	Computer Science Master is suitable for those interested in a scientific understanding of the development and functioning of computer systems. The candidates want to develop new technology for the benefit of society and business industry, and preferably enjoys cooperation with people with competence in other disciplines such as health science, science, engineering, economics, education/pedagogy, etc. The master candidates are well prepared for a profession as computer science experts able to develop computer solutions for complex problems in private or public sectors. They are also prepared for teaching and consultancy tasks, and for further studies up to the doctorate in computer science. The education will form the basis for their careers, together with the individual interest and pursuit in maintaining and further developing their academic and professional insight and competence. Most of our graduates go to engineering positions in the private or public sector. During the career there are many who gradually move to management positions with different combinations of management and technical tasks.
Admission requirements, required prerequisite, recommended prerequisite knowledge	Admission to the Master`s program in Computer Science requires a Bachelor`s degree (180 ECTS) or equivalent qualification, with a major in Computer Science of minimum 80 ECTS. The minimum average grade needed: • Applicants who hold a bachelor's degree or equivalent issued in Norway, Europe, Canada, USA, Australia, and New Zealand: An average grade C as a minimum requirement, or the corresponding numerical mark/percentage score is to be eligible for admission to master's level study programs. • Applicants who hold a bachelor's degree or equivalent issued in countries other than the above-mentioned region/countries: An average grade B as a minimum requirement, or the corresponding numerical mark/percentage score to be eligible for admission to master's level study programs. Excellent programming skills, (preferably in C, Python) at a systems level, and knowledge of operating systems is strongly required. Students are expected to have skills equivalent to the prerequisites the courses in the study program build upon. **Applicants from Norway or Nordic countries:** • The application deadline for Norwegian and other Nordic applicants is April 15th for admission to the autumn semester • Online application, study code xxxx (TBA). • Applicants must enclose source code for a solution of this programming task [URL]. The source code must be uploaded to the application web as a .zip file named in the form *surname.zip* (where you change surname with your name)

	Applicants from outside the Nordic countries: • The application deadline for international applicants is 1 December for admission to the autumn semester. • Online application, study code xxxx (TBA). • Applicants must enclose source code for a solution of this programming task [URL]. The source code must be uploaded to the application web as a .zip file named in the form *surname.zip* (where you change surname with your name)
Certificate of good conduct	Not relevant
Suitability assessment	Not relevant
The study programme's Learning Outcome	**Knowledge – The candidate has…** • a broad solid foundation in computer science • a deep understanding on state-of-the-art distributed software architectures • a solid understanding of advanced database concepts and implementation • a considerable depth of understanding of a selected area of specialization. Example areas are (not exclusive) AI, Internet of Things (IoT), health technology, machine learning, innovation, computer security, and more. • a solid knowledge about risks and threats in computer systems and their related security measures • a solid understanding of system and application development methods and practice relevant to the chosen specialty • a solid foundation to acquire new knowledge and to apply it to new areas of computer science or new areas where computer science is involved. • a solid foundation to analyse academic problems based on both the technological, scientific and societal history of the discipline of computing. **Skills – The candidate can…** • work independently on a significant non-trivial problem over a longer time-period • analyse and deal critically with various sources of information and use them to structure and formulate scholarly arguments, e.g., balance demands from future system users, system owners and legal requirements. • analyse a problem and plan how to work towards a solution • plan, organize and execute the work required to solve the problem and adapt to changes and limitations. • demonstrate the feasibility of the solution by implementing key parts

	- collect and analyse relevant metrics characterizing the problem and the solution - write a well-structured and clearly formulated report describing the thesis work and reflecting on its results - work independently on a limited research or development project in computer science, under supervision and in accordance with the norms for research ethics that apply **General competence – The candidate …** - has an interest for the continued development of computer science as a dynamic field under the influences of advances in the discipline, changes in technology, and in application areas, business models, and businesses - can communicate effectively, orally and in writing, within the field, and with the public as well as experts in other fields - can pursue life-long learning and development; and - is aware of relevant social and ethical issues and apply this awareness to their professional conduct - can apply knowledge and skills in new areas including advanced assignments and projects - masters the language and terminology of computer science and can communicate independent work - can contribute to new thinking, be it theory, designs, or solutions, and apply them to innovation processes
Academic content and description of the study programme	Computer Science Master is a full-time study programme offered at UiT's campus in Bodø. This master's program will give candidates a broad and solid, international level foundation for working in the field of computer science, with a deep understanding of software architectures of large, distributed systems, large scale data, and topics such as artificial intelligence, applied machine learning, computer security, and internet of things (IoT). The programme also provides a more detailed understanding and skills within your chosen area of specialization in the master's thesis. You will be able to analyse problems and efficiently work towards solutions in an organized manner, independently or in teams. You will be able to collect and analyse relevant metrics characterizing your problem and adapt to the related limitations and necessary changes. You can successfully demonstrate the feasibility of a solution through implementing key parts. You will learn about social and ethical issues that apply to computer science, and how to consider these during your professional career. The study programme consists of three mandatory courses in computer science (in distributed systems and advanced database systems), a total of 30 ECTS credits, and 30 ECTS credits of elective courses. The elective courses may be

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within topics such as economics, management, psychology and entrepreneurship or the student can also choose electives in computer science or other science courses. The programme concludes with a master thesis of 60 ECTS credits.

For the master thesis you will apply broad skills in computer science, combined with deeper insights in your selected specialty to solve difficult problems within the area you are pursuing. The theme of your master's thesis will reflect and may well contribute to ongoing research activities at the department within the broad areas of computer systems research and/or medical informatics and applications.

Current topics include software architectures, distributed systems, exascale computing, computer security, programming methodologies, dependable systems, real-time systems, operating systems, performance measurements and evaluation, large scale visualization, feature-rich large-scale search, computer networks and communication, handling of massive data, web-services and -architectures, collaborative editing, bioinformatics, social media, analysis of social data, medical informatics and technological issues in health science*s*.

Since the study programme is very experimental with a lot of practical programming exercises and laboratory work emphasis is placed on that the students are acquiring computer science and engineering skills. The computer science courses are directly connected to the on-going research carried out by the academic staff at the department.

Computer science is key to many innovation projects and processes. This study covers innovation both in encompassing the making of new technological solutions for society at large as one of its main academic concerns, but also in offering elective courses and innovation activities to students. This enables the student to transfer ideas to new areas and think innovative and in new ways.

In connection with exchange stays, it is possible for students to take courses abroad.
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Table: programme structure

Term	10 ECTS	10 ECTS	10 ECTS
1.	INF-3200 Distributed Systems Fundamentals	Elective	Elective
2	Study exchange		
2.	INF-3203 Advanced Distributed Systems	INF-3701 Advanced database systems	Elective
3.	INF-3990 Master's Thesis in Computer Science		
4.	INF-3990 Master's Thesis in Computer Science		

Elective courses (10 ECTS) (non-exclusive list)

	- INF 3XX Systems support for AI / ML - INF 3YY Internet of Things (IoT) - INF-3010 Energy Informatics – Smart Energy and Power Systems Modelling - INF-3201 Parallel Programming - INF-3210 Energy Informatics - Green Computing - INF-3310 Advanced computer security - INF-3315 Privacy preserving computation (H2024) - INF-3910-6 Introduction to Artificial Intelligence and applied methods - INF-3770 Computer Science in health technology - INF-3780 Computer Science Clinic – Physical and Virtual Environments - INF-3993 Individual special curriculum in Computer Science – (10 ECTS) - INF-3995 Individual special curriculum in Computer Science – (20 ECTS) In addition, it will be possible to choose courses from other disciplines from UiT and from other partner institutions.
Learning activities, examination, and assessment	The study programme offers varied teaching activities. Most courses are intensive and project oriented. In lectures, theory and academic theme are examined. In the group work, students are expected to be active in discussions of issues in the subject matter. Students work in laboratories where compulsory assignments are solved to acquire practical skills in designing, building and maintaining computer systems, either individually or in teams with other students. Lectures in the mandatory courses are streamed from Tromsø, but the students will receive good seminar / colloquium teaching locally in Bodø. Mandatory coursework is given to each course. Approved assignments give access to the exam. The examination structure differs between the courses, from written examination to project work reports, presentation of scientific work or oral examination. And often a combination of these methods. Details on assessment methods and access to any types of exams in the teaching free semester are stated in course descriptions. In addition to collaborating with other informatics students, the students will also work with people who have knowledge in other areas. In order to train this, it is important that the student takes an active role, is present and contributes to the learning environment, both in organized teaching and otherwise during the weeks where the students cooperate and largely learn from each other. All academic staff who teach the study programme are active researchers in various research projects. The courses are based on relevant research and are related to the departments research activity. As a student, you will be able to engage in projects in the research laboratories along the way. Special curriculum and master theses are often part of a larger project context, in a working community in a research group. In the work on these assignments, individual guidance is provided from the department's academic staff. The Master's thesis may by agreement also be conducted in, or in cooperation with, a company.

	The UiT master's in computer science combines practical problem solving and mastering of the required technological platform with theoretical reasoning. The practical issues are, with all their details and implications to society, handled in the context of the discipline of Computing (as described by ACM/IEEE CS) and provides knowledge and reflection to develop understanding among students and graduates.
Table: Summary of coursework requirements and assessment	Example:

Subject	Coursework requirements	Assessment	Term	Assessment scale	ECTS
INF-3200	2 mandatory assignments	Oral exam, counting 100%	1	A-F	10
INF-3203	2 mandatory assignments	Oral exam, counting 100%	2	A-F	10
INF-3701	2 mandatory assignments	4 hour written exam, counting 100%	2	A-F	10
INF-3990		Thesis and a final oral examination	3 - 4	A-F	60

| The study programme's relevance | Computer science is today's most expansive, innovative and applied discipline and technology. Knowledge of computer science methods and tools is currently included in most areas of knowledge production and other value creation today. Application in other disciplines also concerns because computer science is an important factor for the further development of these.

The study programme leads to a degree as a Master of Science in Computer Science and qualifies for admission to the PhD programme in Computer Science, assuming satisfactory grade level.

After graduating with a master's degree in Computer Science, you can work all over the world all sectors and industries as the digital transformation progresses.

Some examples of sectors are IT, health, finance, energy, and research.

Typical positions are system developer, engineer, scientist/researcher, or consultants, within job areas such as web, mobile phones, security, computer games, 3D- and film animation, search engines, operating systems, databases, and networks. Many move to management positions or combine management positions with professional roles or establish their own firms. |
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| Work scope | To complete the study programme until the master's degree requires motivation and targeted work effort. To achieve the learning outcomes for the study |

	programme, students must expect to spend more than 40 hours a week in the study from the study start, including lectures, group hours, laboratory work and self-taught self-study. Throughout the year, it reflects a workload of 1500-1800 hours.
For master's theses/independent work in master's degrees	The master's degree thesis consists of an independent scientific work of two semesters, equivalent to 60 ECTS credits. The thesis must be done individually, as group collaboration usually is not permitted. A supervision contract for the thesis is set up before the start-up, which regulates rights, obligations and resource use and resource access for the parties involved. Assessment form is submission of a master thesis and final oral exam. The student is encouraged to work in cooperation with one of our partners (private or public enterprises). Cooperation typically includes research topic, goals and deliverables, access to company resources, membership of company teams, etc.
Language of instruction and examination	The language of instruction is English, and all of the syllabus material is in English. Examination questions will be given in English but may be answered either in English or a Scandinavian language. The Master's thesis may be written either in English or a Scandinavian language.
Internationalisation	Language is English and all of the syllabus material is in English. The master's degree in computer science does have international admission, so the students in the master's degree in physics are both Norwegian and international students, as well as exchange students. The academic staff at the department associated with the study programme has active cooperation with leading research communities internationally, and this also benefits the students in the form of guest lectures.
Student exchange	Exchange studies abroad or at other educational institutions in Norway can be recognized in the master's degree if recommended by your supervisor, and only if the external courses are validated prior to departure. Students can carry out an exchange stay in the second semester of the study. The exchange studies abroad should be planned in collaboration with the student advisor and the student's supervisor. The Department of computer science has subject-specific exchange agreements (Erasmus +) with several universities in Europe where the agreements with the Technical University of Munich, Germany and Vrije Universiteit Amsterdam, Netherlands are recommended. An overview of the departments exchange agreements can be found at the Department of Computer Science's web pages. Students wishing to carry out an exchange stay as part of the study programme must contact the department administration in good time before leaving, no later than the semester start of the semester before departure. The pre-approved courses are included as part of the study at UiT. If the student does not accomplish the pre-approved arrangement this may lead to extended study time. The amount of work should be representative of the period during which the student is on exchange stays.
Supervised professional training	Not relevant

Administrative responsibility and academic responsibility	Programme management with the academic responsibility of the Computer Science - Master has been added to a Study Programme Board at the Department of Computer Science. The Department of Computer Science at the Faculty of Science and Technology is administratively responsible for the study programme.
Quality assurance	The study programme is evaluated annually. The courses included in the study programmes are evaluated at least every third time they are given. Course evaluation is normally conducted as a dialogue between the students and the teacher, combined with the assessment of available data. An overview of the courses to be evaluated each semester can be found on the faculty's web pages. Annually, each class on the study programme elects a representative who can be spokesperson towards the academic community in various study-related cases. The courses of the study programme change as a result of the development of computer science as a discipline, the relevant technologies available and the department academic staff's evaluation in dialogue with the business industry. For quality assurance of learning outcomes, exam questions are evaluated against national quality standards in computer science as practiced at the universities of Oslo, Bergen, Trondheim and Tromsø. Well-qualified external examiners are used in accordance with UiT regulations.
Other regulations	Faculty of Science and Technology has prepared Supplementary provisions for the two years master's degree programme (120 credits).