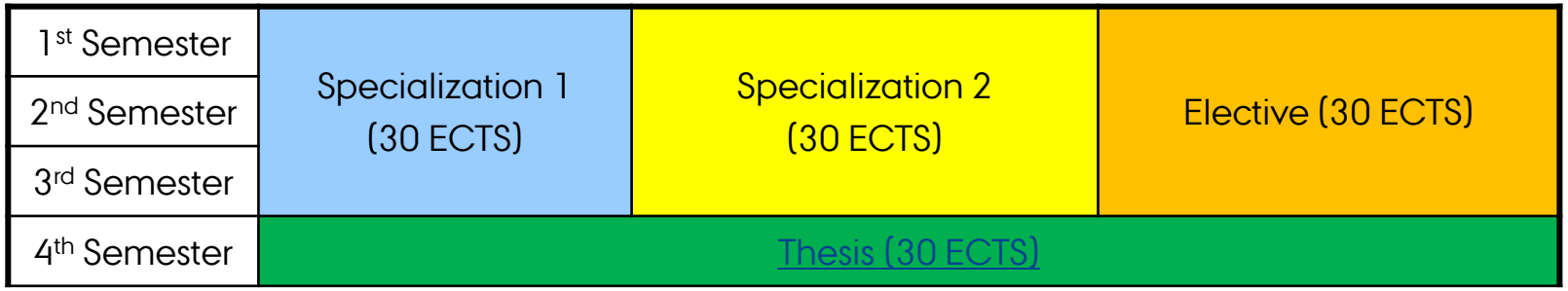
MASTER'S DEGREE PROGRAM COMPUTER SCIENCE

STRUCTURE OF MASTER'S DEGREE PROGRAM



Mandatory:

- Two 30 ECTS specializations

Elective:

- Recommendation is a 3rd specialization.
- A small number of elective courses in computer science is offered in addition to specializations. Project work (partly) is also a possibility.
- Elective courses may be supportive rather than core computer science, e.g. extra mathematics courses.
- There may be requirements for the composition of the study program in connection with possible admission. In this case mandatory courses replace the elective courses (partly).

Thesis: Written within the area of specialization 1 or 2

CURRENT SPECIALIZATIONS

Specializations are taught by active researchers in the corresponding field

Current offerings

- Advanced Machine Learning and Data Science (30 ECTS)
- Algorithmics (30 ECTS)
- Cryptology (30 ECTS)
- Data-Intensive Systems (30 ECTS)
- Human-computer Interaction (30 ECTS)
- Logic, Semantics and Verification (30 ECTS)
- Programming Languages and Software Security (30 ECTS)
- Ubiqitous Computing and Interaction (30 ECTS)
- Bioinformatics (30 ECTS)
  - For more than a single specialization in bioinformatics apply for the special Master's Degree Program in Bioinformatics

ADVANCED MACHINE LEARNING AND DATA SCIENCE

1st Sem (Fall)	Deep Learning for Visual Recognition (10 ECTS)	
2nd Sem (Spring)	Cluster Analysis (10 ECTS)	CS
3rd Sem (Fall)	Algorithms, Incentives, and Data (10 ECTS)	IC

- Semesters are independent – can be taken in any order
- Machine Learning is a prerequisite for this specialization

Algorithms, Data Structures and Foundations of Machine Learning

- Chris Schwiegelshohn
- Gerth Stølting Brodal
- Kasper Green Larsen
- Peyman Afshani

Computational Complexity and Game Theory

- Ioannis Caragiannis
- Kristoffer Arnsfelt Hansen
- Srikanth Srinivasan

ALGORITHMICS

1st Sem (Fall)	Computational Geometry: Theory and Experimentation (10 ECTS)	PA
2nd Sem (Spring)	Randomized Algorithms (10 ECTS)	KGL + IC
3rd Sem (Fall)	Theory of Algorithms and Computational Complexity (10 ECTS) OR Quantum Information Processing (10 ECTS)	KAH IBD + SS

- Semesters are independent – can be taken in any order
- Third semester may be replaced with Advanced Data Management and Analysis (10 ECTS) from the Data-Intensive Systems group

Algorithms, Data Structures and Foundations of Machine Learning

- Chris Schwiegelshohn
- Gerth Stølting Brodal
- Kasper Green Larsen
- Peyman Afshani

Computational Complexity and Game Theory

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CRYPTOLOGY

1st Sem (Fall)	Cryptology (10 ECTS)	IBD
2nd Sem (Spring)	Cryptologic Protocol Theory (10 ECTS) OR Systems Security (10 ECTS)	SY + IBD DFA
3rd Sem (Fall)	Cryptographic Computing (10 ECTS) OR Quantum Information Processing (10 ECTS)	CO + PS IBD + SS

- Cryptology is prerequisite for Cryptologic Protocol Theory and Cryptographic Computing
- Systems Security is independent of the other courses

Cryptography and Security

- Claudio Orlandi
- Diego F. Aranha
- Ivan Bjerre Damgård
- Jesper Buus Nielsen
- Peter Scholl
- Sophia Yakoubov

DATA-INTENSIVE SYSTEMS

1st Sem (Fall)	Data Visualization (10 ECTS) OR Deep Learning for Visual Recognition (10 ECTS)	
2nd Sem (Spring)	Data Mining (10 ECTS) *	DM
3rd Sem (Fall)	Advanced Data Management and Analysis (10 ECTS)	PK

- Semesters are independent – can be taken in any order
- (*) Machine Learning is a prerequisite for Data Mining
- Data Visualization and Deep Learning for Visual Recognition are taught by and shared with the Ubiqitous Computing and Interaction group

Data-intensive Systems

- Cigdem Aslay
- Davide Mottin
- Ira Assent
- Panagiotis Karras




HUMAN-COMPUTER INTERACTION

1st Sem (Fall)	Interactivity and Computer Mediation – Concepts, Theories, Methods, Cases (10 ECTS)	OB
2nd Sem (Spring)	Designing Interactive Technologies (10 ECTS)	NE
3rd Sem (Fall)	Multimodal Interaction (10 ECTS) (not in 2023) Engineering Interactive Technologies (10 ECTS)	EH MW

- Semesters are independent – can be taken in any order

Collaboration and Computer-Human Interaction

- Clemens Nylandsted Klokmose
- Eve Hoggan
- Henrik Korsgaard
- Michael Wessely
- Olav Bertelsen
- Susanne Bødker

Ubiqitous Computing and Interaction

- Hans-Jörg Schultz
- Niklas Elmqvist
- Kaj Grønbæk
- Ken Pfeuffer
- Marianne Graves Petersen
- Niels Olof Bouvin

PROGRAMMING LANGUAGES AND SOFTWARE SECURITY

1st Sem (Fall)	Program Analysis (10 ECTS)	AM + MM
2nd Sem (Spring)	Language-based Security (10 ECTS)	AA
3rd Sem (Fall)	Advanced Topics in Programming Language Theory (10 ECTS)	BS

- Semesters are independent – can be taken in any order

Logic and Semantics

- Amin Timany
- Aslan Askarov
- Bas Spitters
- Jaco van de Pol
- Jean Yves Alexis Pichon
- Lars Birkedal

Programming Languages

- Anders Møller
- Andreas Pavlogiannis
- Magnus Madsen

LOGIC, SEMANTICS AND VERIFICATION

1st Sem (Fall)	Formal Software Verification (10 ECTS)	BS
2nd Sem (Spring)	Algorithmic Model Checking (10 ECTS)	JvdP + AP
3rd Sem (Fall)	Program Logics (10 ECTS)	AT + LB

- Semesters are independent – can be taken in any order

Logic and Semantics

- Amin Timany
- Aslan Askarov
- Bas Spitters
- Jaco van de Pol
- Jean Yves Alexis Pichon
- Lars Birkedal

Programming Languages

- Anders Møller
- Andreas Pavlogiannis
- Magnus Madsen

UBIQITOUS COMPUTING AND INTERACTION

1st sem (Fall)	Building the Internet of Things with P2P and Cloud Computing (10 ECTS)	NOB
2nd Sem (Spring)	Augmented Reality (5 ECTS)	KP
	Advanced Augmented Reality Project (5 ECTS)	KP
3rd Sem (Fall)	Data Visualization (10 ECTS) OR Deep Learning for Visual Recognition (10 ECTS)	H-JS

- Semesters are independent – can be taken in any order

Collaboration and Computer-Human Interaction

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- Eve Hoggan
- Henrik Korsgaard
- Michael Wessely
- Olav Bertelsen
- Susanne Bødker

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SPECIALIZATIONS FROM MASTER'S DEGREE PROGRAM IN BIOINFORMATICS (OFFERED BY BIOINFORMATICS RESEARCH CENTRE)

Algorithms and Programming

	Recommended order of courses	Alternative order of courses
1st Sem (Fall)	Genome-Scale Algorithms (10 ECTS) (not in 2023)	Evolutionary Thinking (10 ECTS)
2nd Sem (Spring)	Algorithms in Bioinformatics (10 ECTS)	Algorithms in Bioinformatics (10 ECTS)
3rd Sem (Fall)	Evolutionary Thinking (10 ECTS) OR Projects in Bioinformatics (10 ECTS)	Genome-Scale Algorithms (10 ECTS) (not in 2023)

Statistics and Data

1st Sem (Fall)	Data Science in Bioinformatics (10 ECTS)
2nd Sem (Spring)	Statistical and Machine Learning in Bioinformatics (10 ECTS)
3rd Sem (Fall)	Evolutionary Thinking (10 ECTS) OR Genome-Scale Algorithms (10 ECTS) (not in 2023) OR Projects in Bioinformatics (10 ECTS)

For more info about the Master's program in bioinformatics, see http://www.birc.au.dk/Studies

Contact: Christian Storm Pedersen cstorm@birc.au.dk

ELECTIVE COURSES (CS)

Elective courses (apart from specialisations):

Fall & Spring:

- Project work in Computer Science (5 or 10 ECTS)
- Vocational Training Project at Department of Computer Science (10 ECTS)

SPECIALIZATIONS: PREREQUISITES

If you don't have the prerequisite courses or similar background in your bachelor, you can take a bachelor course as part of your MSc program.

Specialization	Prerequisite (bachelor course)	Recommended / required
Advanced Machine Learning and Data Science	Machine Learning	required
Algorithms and Data Structures	Optimization	recommended
Cryptology	Distributed Systems and Security	recommended
Data-Intensive Systems	Machine Learning	recommended
Human-Computer Interaction	Human-Computer Interaction	required
Logic, Semantics and Verification	Computability and Logic	recommended
Programming Languages and Software Security	Compilation	required
Ubiqitous Computing and Interaction	Distributed Systems and Security	recommended

EXAMPLE 1:

Advanced Machine Learning and Data Science + **Data-Intensive Systems**

1. Sem (Fall)	Deep Learning for Visual Recognition (10 ECTS)	Data Visualization (10 ECTS)	Elective 1
2. Sem (Spring)	Cluster Analysis (10 ECTS)	Data Mining (10 ECTS)	Elective 2
3. Sem (Fall)	Algorithms, Incentives, and Data (10 ECTS)	Advanced Data Management and Analysis (10 ECTS)	Elective 3
4. Sem (Spring)	Thesis (30 ECTS)		

OR

1. Sem (Fall)	Deep Learning for Visual Recognition (10 ECTS)	Data Visualization (10 ECTS)	Machine Learning (10 ECTS)
2. Sem (Spring)	Cluster Analysis (10 ECTS)	Data Mining (10 ECTS)	Elective 1
3. Sem (Fall)	Algorithms, Incentives, and Data (10 ECTS)	Advanced Data Management and Analysis (10 ECTS)	Elective 2
4. Sem (Spring)	Thesis (30 ECTS)		

EXAMPLE 2:

Programming Languages and Software Security + **Logic, Semantics and Verification**

1. Sem (Fall)	Program Analysis (10 ECTS)	Formal Software Verification (10 ECTS)	Elective 1
2. Sem (Spring)	Language-based Security (10 ECTS)	Algorithmic Model Checking (10 ECTS)	Elective 2
3. Sem (Fall)	Advanced Topics in Programming Language Theory (10 ECTS)	Program Logics (10 ECTS)	Elective 3
4. Sem (Spring)	Thesis (30 ECTS)		

OR

1. Sem (Fall)	Compilation (10 ECTS)	Formal Software Verification (10 ECTS)	Elective 1
2. Sem (Spring)	Language-based Security (10 ECTS)	Algorithmic Model Checking (10 ECTS)	Computability and Logic (10 ECTS)
3. Sem (Fall)	Advanced Topics in Programming Language Theory (10 ECTS)	Program Logics (10 ECTS)	Program Analysis (10 ECTS)
4. Sem (Spring)	Thesis (30 ECTS)		

EXAMPLE 3:

Human-Computer Interaction + **Ubiqitous computing and Interaction**

1. Sem (Fall)	Interactivity and Computer Mediation – Concepts, Theories, Methods, Cases (10 ECTS)	Building the Internet of Things with P2P and Cloud Computing (10 ECTS)	Elective 1
2. Sem (Spring)	Designing Interactive Technologies (10 ECTS)	Augmented Reality (5 ECTS) + Advanced Augmented Reality Project (5 ECTS)	Elective 2
3. Sem (Fall)	Engineering Interactive Technologies (10 ECTS)	Data Visualization (10 ECTS)	Elective 3
4. Sem (Spring)	Thesis (30 ECTS)		

OR

1. Sem (Fall)	Human-Computer Interaction (10 ECTS)	Data Visualization (10 ECTS)	Distributed Systems and Security (10 ECTS)
2. Sem (Spring)	Designing Interactive Technologies (10 ECTS)	Augmented Reality (5 ECTS) + Advanced Augmented Reality Project (5 ECTS)	Elective 1
3. Sem (Fall)	Multimodal Interaction (10 ECTS)	Building the Internet of Things with P2P and Cloud Computing (10 ECTS)	Interactivity and Computer Mediation – Concepts, Theories, Methods, Cases (10 ECTS)
4. Sem (Spring)	Thesis (30 ECTS)		

EXAMPLE 4: Algorithmics + Cryptology

1. Sem (Fall)	Computational Geometry: Theory and Experimentation (10 ECTS)	Cryptology (10 ECTS)	Elective
2. Sem (Spring)	Randomized Algorithms (10 ECTS)	Cryptologic Protocol Theory (10 ECTS)	Systems Security (10 ECTS)
3. Sem (Fall)	Theory of Algorithms and Computational Complexity (10 ECTS)	Cryptographic Computing (10 ECTS)	Quantum Information Processing (10 ECTS)
4. Sem (Spring)	Thesis (30 ECTS)		

OR

1. Sem (Fall)	Computational Geometry: Theory and Experimentation (10 ECTS)	Cryptology (10 ECTS)	Distributed Systems and Security (10 ECTS)
2. Sem (Spring)	Randomized Algorithms (10 ECTS)	Cryptologic Protocol Theory (10 ECTS) OR Systems Security (10 ECTS)	Optimization (10 ECTS)
3. Sem (Fall)	Theory of Algorithms and Computational Complexity (10 ECTS)	Cryptographic Computing (10 ECTS)	Quantum Information Processing (10 ECTS)
4. Sem (Spring)	Thesis (30 ECTS)		

EXAMPLE 5:

Formal Methods for Security

1. Sem (Fall)	Formal Software Verification (10 ECTS)	Cryptology (10 ECTS)	Elective 1
2. Sem (Spring)	Language-based Security (10 ECTS)	Cryptologic Protocol Theory (10 ECTS)	Elective 2
3. Sem (Fall)	Advanced Topics in Programming Language Theory (10 ECTS)	Cryptographic Computing (10 ECTS)	Elective 3
4. Sem (Spring)	Thesis (30 ECTS)		

OR

1. Sem (Fall)	Compilation (10 ECTS)	Cryptology (10 ECTS)	Distributed Systems and Security (10 ECTS)
2. Sem (Spring)	Language-based Security (10 ECTS)	Cryptologic Protocol Theory (10 ECTS)	Computability and Logic (10 ECTS)
3. Sem (Fall)	Advanced Topics in Programming Language Theory (10 ECTS)	Cryptographic Computing (10 ECTS)	Formal Software Verification (10 ECTS)
4. Sem (Spring)	Thesis (30 ECTS)		

GUIDANCE/QUESTIONS

Guidance for your personal study program?

Questions about rules for composition of the study program?

Please contact

- UA@cs.au.dk

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