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) **NEW**
• Algorithmics (30 ECTS)
• Cryptology (30 ECTS)
• Data-Intensive Systems (30 ECTS)
• Human-computer Interaction (30 ECTS)
• Logic, Semantics and Verification (30 ECTS) **NEW**
• Programming Languages and Software Security (30 ECTS) **NEW**
• Ubiquitous 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**

We expect to offer the 3 new specializations from Autumn 2021.
Details will be available around April 2021.
ADVANCED MACHINE LEARNING AND DATA SCIENCE

| 1st Sem (Fall) | Computational Learning Theory (10 ECTS) (NEW from 2021) | CA |
| 2nd Sem (Spring) | Cluster Analysis (10 ECTS) (NEW from 2022) | CS |
| 3rd Sem (Fall) | Algorithms, Incentives, and Data (10 ECTS) (NEW from 2022) | IC |

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

**Algorithms and Data Structures**
- Chris Schwiegelshohn
- Gerth Stølting Brodal
- Kasper Green Larsen
- Peyman Afshani

**Data-intensive Systems**
- Cigdem Aslay
- Davide Mottin
- Ira Assent
- Panagiotis Karras

**Mathematical Computer Science**
- Ioannis Caragiannis
- Kristoffer Arnsfelt Hansen
- Srikanth Srinivasan
ALGORITHMS

<table>
<thead>
<tr>
<th>Semester</th>
<th>Course</th>
<th>Instructor(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1st Sem (Fall)</td>
<td>Computational Geometry: Theory and Experimentation (10 ECTS)</td>
<td>PA</td>
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<tr>
<td>2nd Sem (Spring)</td>
<td>Randomized Algorithms (10 ECTS)</td>
<td>KGL, IC</td>
</tr>
<tr>
<td>3rd Sem (Fall)</td>
<td>Theory of Algorithms and Computational Complexity (10 ECTS)</td>
<td>KAH</td>
</tr>
</tbody>
</table>

- 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 and Data Structures**
- Chris Schwiegelshohn
- Gerth Stølting Brodal
- Kasper Green Larsen
- Peyman Afshani

**Mathematical Computer Science**
- Ioannis Caragiannis
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### CRYPTOLOGY

<table>
<thead>
<tr>
<th>Semester</th>
<th>Course</th>
<th>Credits</th>
<th>Notes</th>
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</thead>
<tbody>
<tr>
<td>1st Sem (Fall)</td>
<td>Cryptology (10 ECTS)</td>
<td></td>
<td>IBD</td>
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<tr>
<td>2nd Sem (Spring)</td>
<td>Cryptologic Protocol Theory (10 ECTS)</td>
<td></td>
<td>IBD + JBN</td>
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<tr>
<td>3rd Sem (Fall)</td>
<td>Cryptographic Computing (10 ECTS)</td>
<td></td>
<td>CO + PS</td>
</tr>
<tr>
<td></td>
<td>OR Systems Security (10 ECTS) (NEW from 2021)</td>
<td></td>
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</tbody>
</table>

- 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
DATA-INTENSIVE SYSTEMS

<table>
<thead>
<tr>
<th>1st Sem (Fall)</th>
<th>Advanced Data Management and Analysis (10 ECTS)</th>
<th>IA+PK+CA</th>
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</thead>
<tbody>
<tr>
<td>2nd Sem (Spring)</td>
<td>Data Mining (10 ECTS) *</td>
<td>DM</td>
</tr>
<tr>
<td>3rd Sem (Fall)</td>
<td>Data Visualization (10 ECTS) OR Deep Learning for Visual Recognition (10 ECTS)</td>
<td></td>
</tr>
</tbody>
</table>

- 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 Ubiquitous Computing and Interaction group

Data-intensive Systems
- Cigdem Aslay
- Davide Mottin
- Ira Assent
- Panagiotis Karras
HUMAN-COMPUTER INTERACTION

<table>
<thead>
<tr>
<th>Semester</th>
<th>Course Title</th>
<th>Instructor</th>
</tr>
</thead>
<tbody>
<tr>
<td>1st Sem (Fall)</td>
<td>Interactivity and Computer Mediation - Concepts, Theories, Methods, Cases (10 ECTS)</td>
<td>OB</td>
</tr>
<tr>
<td>2nd Sem (Spring)</td>
<td>Designing Interactive Technologies (10 ECTS)</td>
<td>SB</td>
</tr>
<tr>
<td>3rd Sem (Fall)</td>
<td>Multimodal Interaction (10 ECTS)</td>
<td>EH</td>
</tr>
</tbody>
</table>

• Semesters are independent – can be taken in any order

Computer Mediated Activity
• Eve Hoggan
• Olav Bertelsen
• Susanne Bødker
PROGRAMMING LANGUAGES AND SOFTWARE SECURITY

<table>
<thead>
<tr>
<th>Semester (Fall)</th>
<th>Course</th>
<th>Credits</th>
<th>Candidates</th>
</tr>
</thead>
<tbody>
<tr>
<td>1st Sem (Fall)</td>
<td>Program Analysis (10 ECTS) (NEW from 2021)</td>
<td>AM + MM</td>
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<tr>
<td>2nd Sem (Spring)</td>
<td>Language-based Security (10 ECTS)</td>
<td>AA</td>
<td></td>
</tr>
<tr>
<td>3rd Sem (Fall)</td>
<td>Advanced Topics in Programming Language Theory (10 ECTS) (NEW from 2022)</td>
<td>BS + AP + AT</td>
<td></td>
</tr>
</tbody>
</table>

- Semesters are independent – can be taken in any order

Logic and Semantics
- Amin Timany
- Aslan Askarov
- Bas Spitters
- Jaco van de Pol
- Lars Birkedal

Programming Languages
- Anders Møller
- Andreas Pavlogiannis
- Magnus Madsen
LOGIC, SEMANTICS AND VERIFICATION

<table>
<thead>
<tr>
<th>Semester (Fall)</th>
<th>Course Title</th>
<th>ECTS</th>
<th>Instructor(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1st Sem (Fall)</td>
<td>Formal Software Verification (10 ECTS)</td>
<td>10</td>
<td>BS</td>
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<tr>
<td>2nd Sem (Spring)</td>
<td>Algorithmic Model Checking (10 ECTS)</td>
<td>10</td>
<td>JvdP + AP</td>
</tr>
<tr>
<td>3rd Sem (Fall)</td>
<td>Program Logics (10 ECTS)</td>
<td>10</td>
<td>LB + AT</td>
</tr>
</tbody>
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- Semesters are independent – can be taken in any order

Logic and Semantics
- Amin Timany
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- Bas Spitters
- Jaco van de Pol
- Lars Birkedal

Programming Languages
- Anders Møller
- Andreas Pavlogiannis
- Magnus Madsen
Ubiquitous Computing and Interaction

- Hans Gellersen
- Hans-Jörg Schultz
- Kaj Grønbæk
- Marianne Graves Petersen
- Niels Olof Bouvin

Semesters are independent – can be taken in any order

<table>
<thead>
<tr>
<th>Semester</th>
<th>Course</th>
<th>Instructor</th>
</tr>
</thead>
<tbody>
<tr>
<td>1st sem (Fall)</td>
<td>Building the Internet of Things with P2P and Cloud Computing (10 ECTS)</td>
<td>NOB</td>
</tr>
<tr>
<td>2nd Sem (Spring)</td>
<td>Augmented Reality (5 ECTS)</td>
<td>KG</td>
</tr>
<tr>
<td></td>
<td>Advanced Augmented Reality Project (5 ECTS)</td>
<td>KG</td>
</tr>
<tr>
<td>3rd Sem (Fall)</td>
<td>Data Visualization (10 ECTS) OR Deep Learning for Visual Recognition (10 ECTS)</td>
<td>H-JS</td>
</tr>
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**SPECIALIZATIONS FROM MASTER’S DEGREE PROGRAM IN BIOINFORMATICS**
(OFFERED BY BIOINFORMATICS RESEARCH CENTRE)

### Algorithms and Programming

<table>
<thead>
<tr>
<th></th>
<th>Recommended order of courses</th>
<th>Alternative order of courses</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>1st Sem (Fall)</strong></td>
<td>Genome-Scale Algorithms (10 ECTS)</td>
<td>Tree of Life (10 ECTS)</td>
</tr>
<tr>
<td><strong>2nd Sem (Spring)</strong></td>
<td>Algorithms in Bioinformatics (10 ECTS)</td>
<td>Algorithms in Bioinformatics (10 ECTS)</td>
</tr>
<tr>
<td><strong>3rd Sem (Fall)</strong></td>
<td>Tree of Life (10 ECTS) OR Projects in Bioinformatics (10 ECTS)</td>
<td>Genome-Scale Algorithms (10 ECTS)</td>
</tr>
</tbody>
</table>

### Statistics and Data

<table>
<thead>
<tr>
<th></th>
<th>Data Science in Bioinformatics (10 ECTS)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>1st Sem (Fall)</strong></td>
<td></td>
</tr>
<tr>
<td><strong>2nd Sem (Spring)</strong></td>
<td>Statistical and Machine Learning in Bioinformatics (10 ECTS)</td>
</tr>
<tr>
<td><strong>3rd Sem (Fall)</strong></td>
<td>Tree of Life (10 ECTS) OR Genome-Scale Algorithms (10 ECTS) OR Projects in Bioinformatics (10 ECTS)</td>
</tr>
</tbody>
</table>

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

Contact: Christian Storm Pedersen cstorm@birc.au.dk
ELECTIVE COURSES (CS)

Elective courses (apart from specialisations):

Fall
- Interdisciplinary Digital Entrepreneurship (10 ECTS)
- Machine Learning (10 ECTS) (bachelor course)

Fall & Spring:
- Project work in Computer Science (5 or 10 ECTS)
- Vocational Training Project at Department of Computer Science (10 ECTS)
GUIDANCE/QUESTIONS

Guidance for your personal study program?
Questions about rules for composition of the study program?

Please contact
• Gudmund Skovbjerg Frandsen
  • gudmund@cs.au.dk