Master’s Degree Programme
Computer Science

Revised 5 March 2019
Master’s Degree Programme
Computer Science

- Website
  http://kandidat.au.dk/en/computerscience/
- Admission requirements and prerequisites
- Structure of the Master’s Degree Programme
- Contact
Admission requirements and prerequisites

- Prerequisite: a bachelor degree that in level, extent and contents corresponds to a bachelor degree in computer science from Aarhus University

- Minimum requirements for the bachelor programme
  - 20 ECTS programming, including object-oriented programming, functional programming and software architecture.
  - 20 ECTS computer systems, including databases, computer architecture, networks, operating systems, distributed systems and security.
  - 20 ECTS theoretical computer science, including algorithms and data structures, logic and computability, formal languages and compilers, optimization and complexity theory.
  - 10 ECTS human-machine interaction and experimental system development.
  - 20 ECTS basic subjects in mathematics, probability theory and statistics.

- The course basis for admission must reflect contemporary theory and practice.
Admission requirements and prerequisites

- Interpretation:
- If a few topics is missing in the bachelor programme it is up to an individual assessment whether admission is possible.
- However, all prerequisites for a majority of the specializations offered must be satisfied.
For comparison:

**Bachelor’s degree in Computer Science at AU**

<table>
<thead>
<tr>
<th>Semester</th>
<th>Course 1</th>
<th>Course 2</th>
<th>Course 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>1st sem</td>
<td>Introduction to Programming (10 ECTS)</td>
<td>Foundations of Algorithms and Data Structures (10 ECTS)</td>
<td>Calculus beta (10 ECTS)</td>
</tr>
<tr>
<td>2nd sem</td>
<td>Introduction to Databases (5 ECTS)</td>
<td>Programming Languages (10 ECTS)</td>
<td>Linear algebra (10 ECTS)</td>
</tr>
<tr>
<td>3rd sem</td>
<td>Software Engineering and Architecture (10 ECTS)</td>
<td>Introduction to Human-Computer Interaction (10 ECTS)</td>
<td>Introduction to Probability Theory and Statistics (10 ECTS)</td>
</tr>
<tr>
<td>4th sem</td>
<td>Computer Architecture, Networks and Operating Systems (10 ECTS)</td>
<td>Experimental Systems Development (10 ECTS)</td>
<td>Computability and Logic (10 ECTS)</td>
</tr>
<tr>
<td>5th sem</td>
<td>Compilation (10 ECTS)</td>
<td>Distributed Systems and Security (10 ECTS)</td>
<td>Elective (recom: Machine Learning) (10 ECTS)</td>
</tr>
<tr>
<td>6th sem</td>
<td>Philosophy of Information Tech (5 ECTS)</td>
<td>Bachelor Project (15 ECTS)</td>
<td>Optimization (10 ECTS)</td>
</tr>
</tbody>
</table>

- Taught in **Danish**, except for courses marked | **Mathematics**
- Bachelor in cs or similar is prerequisite for **Computer Science** master level cs courses | **Elective**
Structure of Master’s Degree Programme

- Specialization:
  - 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
  - Algorithmics (30 ECTS)
  - Cryptology (30 ECTS)
  - Data-Intensive Systems (30 ECTS)
  - Human-computer Interaction (30 ECTS)
  - Programming Languages (30 ECTS)
  - Ubiquitous Computing and Interaction (30 ECTS)
  - Bioinformatics (30 ECTS)
    - For more than a single specialization in bioinformatics apply for the special Master’s Degree Programme in Bioinformatics
Algorithmics

<table>
<thead>
<tr>
<th>Semester</th>
<th>Course Title</th>
<th>Credits</th>
<th>Lecturers</th>
</tr>
</thead>
<tbody>
<tr>
<td>1st Sem (Fall)</td>
<td>Computational Geometry: Theory and Experimentation (10 ECTS)</td>
<td>LA + PA</td>
<td>Lars Arge, Gerth Stølting Brodal, Peyman Afshani, Kasper Green Larsen, Kristoffer Arnsfelt Hansen</td>
</tr>
<tr>
<td>2nd Sem (Spring)</td>
<td>Advanced Data Structures (10 ECTS)</td>
<td>GSB + KGL</td>
<td></td>
</tr>
<tr>
<td>3rd Sem (Fall)</td>
<td>Theory of Algorithms and Computational Complexity (10 ECTS)</td>
<td>KAH</td>
<td></td>
</tr>
</tbody>
</table>

- Semesters have progression
  - First semester is prerequisite for second semester
  - Third semester may be replaced with Advanced Data Management and Analysis (10 ECTS) from the Data-intensive Systems group

Algorithms and Data Structures

- Lars Arge
- Gerth Stølting Brodal
- Peyman Afshani
- Kasper Green Larsen
- Kristoffer Arnsfelt Hansen
# Cryptology

<table>
<thead>
<tr>
<th>Semester (Fall)</th>
<th>Course</th>
<th>ECTS</th>
<th>Professors</th>
</tr>
</thead>
<tbody>
<tr>
<td>1st</td>
<td>Cryptology (10 ECTS)</td>
<td>IBD</td>
<td>Ivan Bjerre Damgård, Jesper Buus Nielsen, Claudio Orlandi</td>
</tr>
<tr>
<td>2nd (Spring)</td>
<td>Cryptologic Protocol Theory (10 ECTS)</td>
<td>IBD + JBN</td>
<td></td>
</tr>
<tr>
<td>3rd</td>
<td>Cryptographic Computing (10 ECTS)</td>
<td>CO</td>
<td></td>
</tr>
</tbody>
</table>

- Semesters have progression
  - First semester is prerequisite for the other semesters
  - Second and third semester can be taken in any order

## Cryptography and Security

- Ivan Bjerre Damgård
- Jesper Buus Nielsen
- Claudio Orlandi
### Data-Intensive Systems

<table>
<thead>
<tr>
<th>Semester</th>
<th>Course</th>
<th>Instructor(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1st Sem (Fall)</td>
<td>Data Visualization</td>
<td>H-JS</td>
</tr>
<tr>
<td>2nd Sem (Spring)</td>
<td>Data Mining (*)</td>
<td>IA+PK+DM</td>
</tr>
<tr>
<td>3rd Sem (Fall)</td>
<td>Advanced Data Management and Analysis (10 ECTS)</td>
<td>IA+PK+DM</td>
</tr>
</tbody>
</table>

- Semesters are independent – can be taken in any order
- (*) Machine Learning is a prerequisite for Data Mining
- Data Visualization is taught by Hans-Jörg Schultz from the Ubiquitous Computing and Interaction group

**Data-intensive Systems**

- Ira Assent
- Panagiotis Karras
- Davide Mottin
## Human-Computer Interaction

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

- Semesters are independent – can be taken in any order

### Computer Mediated Activity

- Susanne Bødker
- Olav Bertelsen
- Eve Hoggan

### Use, Design and Innovation

- Morten Kyng
## Programming Languages

<table>
<thead>
<tr>
<th>Semester</th>
<th>Course</th>
<th>Credits</th>
<th>Tutors</th>
</tr>
</thead>
<tbody>
<tr>
<td>1st Sem (Fall)</td>
<td>Program Analysis and Verification</td>
<td>10 ECTS</td>
<td>AM + LB</td>
</tr>
<tr>
<td>2nd Sem (Spring)</td>
<td>Language-based Security</td>
<td>10 ECTS</td>
<td>AA</td>
</tr>
<tr>
<td>3rd Sem (Fall)</td>
<td>Functional Programming</td>
<td>10 ECTS</td>
<td></td>
</tr>
</tbody>
</table>

- Semesters are independent – can be taken in any order

### Programming Languages
- Anders Møller
- Magnus Madsen

### Logic and Semantics
- Lars Birkedal
- Aslan Askarov
- Bas Spitters
- Jaco van de Pol
# Ubiqitous Computing and Interaction

<table>
<thead>
<tr>
<th>Semester</th>
<th>Course Name</th>
<th>Credits</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>
<td></td>
</tr>
<tr>
<td>2nd Sem (Spring)</td>
<td>Augmented Reality (5 ECTS)</td>
<td>KG</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Advanced Augmented Reality Project (5 ECTS)</td>
<td>KG</td>
<td></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>
<td></td>
</tr>
</tbody>
</table>

- Semesters are independent – can be taken in any order

## Ubiqitous Computing and Interaction

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

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CS Exchange Programme
Specializations from Master’s degree Programme in Bioinformatics (offered by Bioinformatics Research Centre)

Contact: Christian Storm Pedersen — Thomas Mailund—

Algorithms and Programming

<table>
<thead>
<tr>
<th>Semester (Fall)</th>
<th>Course Title</th>
<th>Credits</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>1st</td>
<td>Algorithms in Bioinformatics (10 ECTS)</td>
<td>CSP</td>
<td></td>
</tr>
<tr>
<td>2nd</td>
<td>Genome-Scale Algorithms (10 ECTS)</td>
<td>CSP+TM</td>
<td></td>
</tr>
<tr>
<td>3rd</td>
<td>Advanced Programming in Bioinformatics (10 ECTS) OR Tree of Life (10 ECTS)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Statistics and Data

<table>
<thead>
<tr>
<th>Semester (Fall)</th>
<th>Course Title</th>
<th>Credits</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>1st</td>
<td>Data Science in Bioinformatics (10 ECTS)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2nd</td>
<td>Statistical and Machine Learning in Bioinformatics (10 ECTS)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3rd</td>
<td>Algorithms in Bioinformatics (10 ECTS) OR Tree of Life (10 ECTS)</td>
<td></td>
<td></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)
Elective Courses (CS)

- Elective courses (apart from specialisations) offered in Computer Science in 2019/20:
  - Fall
    - Interdisciplinary Digital Entrepreneurship (10 ECTS)
    - Machine Learning (10 ECTS) (bachelor course)
  - Fall & Spring:
    - Project work in Computer Science (5 or 10 ECTS)
  - Summer
    - (29 July - 16 August 2019): Identity and Privacy (5 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