KØBENHAVNS UNIVERSITET
UNIVERSITY OF COPENHAGEN

SØREN HOUGAARD MULVAD

cpr. 240596-[redacted]

har den 11. juli 2020	*has on 11 July 2020*
opnået	*been awarded the degree of*
bachelorgraden i	*Bachelor of Science in*
datalogi	*Computer Science*
og titlen	*and the title*

BSc i datalogi
Bachelor of Science in Computer Science

Katrine Krogh Andersen
Dekan/*Dean*

Karen Rønnow
Studiechef/*Director of Studies*

DET NATUR- OG BIOVIDENSKABELIGE FAKULTET
FACULTY OF SCIENCE

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This is a digital diploma. See www.diploma.ku.dk for further information regarding validation

KØBENHAVNS UNIVERSITET
DET NATUR- OG BIOVIDENSKABELIGE FAKULTET

Søren Hougaard Mulvad

Cpr.: 240596-[redacted]

har gennemført bacheloruddannelsen i
datalogi
11. juli 2020

Oversigt over prøver og bedømmelser side 1 af 2

Følgende resultater er opnået	**Resultat 7-trinsskala**	**Resultat ECTS-skala**	**ECTS point**
Bachelorprojekt			
Bachelorprojekt i datalogi.....	12	A	15,0
Caching Strategies for Image Processing - A Comparison of Standard Image Processing Algorithms and Caching Methods			
Eksamenssprog engelsk			
Grundforløb			
Programmering og problemløsning	Bestået		15,0
Diskret matematik og algoritmer.....	Bestået		15,0
Interaktionsdesign	12	A	7,5
Lineær algebra i datalogi	10	B	7,5
Softwareudvikling	10	B	15,0
Specialisering i data science			
Matematisk analyse og sandsynlighedsteori for dataloger	12	A	7,5
Modelling and Analysis of Data.....	12	A	7,5
Eksamenssprog engelsk			
Computersystemer.....	10	B	15,0

9. September 2020

Betina Kongsbak
SCIENCE Uddannelse

KØBENHAVNS UNIVERSITET
DET NATUR- OG BIOVIDENSKABELIGE FAKULTET

Søren Hougaard Mulvad

Cpr.: 240596-[redacted]

har gennemført bacheloruddannelsen i
datalogi
11. juli 2020

Oversigt over prøver og bedømmelser side 2 af 2

Følgende resultater er opnået	**Resultat** 7-trinsskala	**Resultat** ECTS-skala	**ECTS** point
Algoritmer og datastrukturer	12	A	7,5
Data Science *Eksamenssprog engelsk*	12	A	15,0
Randomiserede algoritmer til dataanalyse	12	A	7,5
Elements of Machine Learning *Eksamenssprog engelsk*	12	A	7,5
Datalogiens videnskabsteori	10	B	7,5
Programming Language Concepts *Meritoverført National University of Singapore* *Eksamenssprog engelsk*	Bestået		10,0
Computer Graphics *Meritoverført National University of Singapore* *Eksamenssprog engelsk*	Bestået		10,0
Principles of Economics *Meritoverført National University of Singapore* *Eksamenssprog engelsk*	Bestået		10,0

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11. juli 2020

Kompetenceprofil for uddannelsen

En bachelor i datalogi med specialisering i data science har efter endt uddannelse tilegnet sig følgende:

Viden om:
- Strukturering, lagring, behandling og visualisering af data.
- Simple algoritmer og datastrukturer.
- En computers opbygning som en kombination af hardware, software og kommunikationskanaler.
- Grundlæggende teori om computerens begrænsninger og databehandlingens rolle i samfundet.
- Grundlæggende anvendt matematik og statistik.
- Muligheder og begrænsninger i automatisk dataanalyse.
- Avancerede metoder til dataanalyse.
- Datastrukturer.
- Numeriske metoder.

Færdigheder i at:
- Løse problemer med databehandlingsmetoder og dokumentere løsningerne.
- Læse og forstå faglitteratur på dansk og engelsk.
- Programmering i forskellige programmeringssprogsparadigmer.
- Kommunikere om faget skriftligt og mundtligt.
- Løse programmeringsopgaver med hensyntagen til ressourceforbrug og korrekthed.
- Designe interaktionsmetoder mellem mennesker og computere.
- Bruge matematiske værktøjer til dataanalyse.
- Håndtere, visualisere og uddrage viden fra såvel struktureret som ustruktureret data.
- Anvende viden om data science til datadreven problemløsning.
- Analysere algoritmers tids- og pladsforbrug.

Kompetencer til at:
- Opdele større problemer i mindre, lettere tilgængelige delproblemer.
- Systematisk analysere problemer, designe løsningsmetoder, implementere metoderne og reflektere over resultatet og processen.
- Vurdere en løsnings korrekthed, effektivitet og hensigtsmæssighed.
- Arbejde sammen med andre, også fra andre fagområder, for i fællesskab at løse en opgave.
- Diskutere samfundsmæssige og menneskelige konsekvenser af brug af IT i forskellige sammenhænge.
- Løse problemer, der kræver kombination af datalogisk viden med viden fra andre fagområder, og tilegne sig den nødvendige viden evt. gennem dialog med mennesker fra andre fagområder.
- Anvende og tilpasse metoder til at løse et konkret dataanalyseproblem.
- Vælge hensigtsmæssige datastrukturer og algoritmer til løsning af konkrete beregningsproblemer.
- Designe systemer til behandling af store datamængder.

9. September 2020

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SCIENCE Uddannelse

UNIVERSITY OF COPENHAGEN
FACULTY OF SCIENCE

Søren Hougaard Mulvad
Cpr. : 240596-[redacted]

has completed the Bachelor's programme in
Computer Science
11 July 2020

Summary of examinations and grades page 1 of 2

The following grades were awarded	Grade 7-point scale	Grade ECTS scale	ECTS credits
Bachelor Project			
Bachelor Project in Computer Science ..... *Caching Strategies for Image Processing - A Comparison of Standard Image Processing Algorithms and Caching Methods* *Exam language English*	12	A	15,0
Basic Study Programme			
Programming and Problem Solving.....	Passed		15,0
Discrete Mathematics and Algorithms	Passed		15,0
Interaction Design	12	A	7,5
Linear Algebra in Computer Science	10	B	7,5
Software Development	10	B	15,0
Specialisation in Data Science			
Mathematical Analysis and Probability Theory for Computer Scientists.....	12	A	7,5
Modelling and Analysis of Data..... *Exam language English*	12	A	7,5
Computer Systems.....	10	B	15,0

9 September 2020

Betina Kongsbak
SCIENCE Study Administration

UNIVERSITY OF COPENHAGEN
FACULTY OF SCIENCE

Søren Hougaard Mulvad
Cpr. : 240596-[redacted]

has completed the Bachelor's programme in
Computer Science
11 July 2020

Summary of examinations and grades page 2 of 2

The following grades were awarded	Grade 7-point scale	Grade ECTS scale	ECTS credits
Algorithms and Data Structures	12	A	7,5
Data Science *Exam language English*	12	A	15,0
Randomized Algorithms for Data Analysis	12	A	7,5
Elements of Machine Learning *Exam language English*	12	A	7,5
Philosophy of Computer Science	10	B	7,5
Programming Language Concepts *Credit transferred National University of Singapore* *Exam language English*	Passed		10,0
Computer Graphics *Credit transferred National University of Singapore* *Exam language English*	Passed		10,0
Principles of Economics *Credit transferred National University of Singapore* *Exam language English*	Passed		10,0

9 September 2020

Betina Kongsbak
SCIENCE Study Administration

UNIVERSITY OF COPENHAGEN
FACULTY OF SCIENCE

Søren Hougaard Mulvad
Cpr.: 240596-[redacted]

has completed the Bachelor's programme in
Computer Science
11 July 2020

Skills profile for the programme

On completion of the study programme, a BSc in Computer Science with a specialisation in data science will have acquired the following:

Knowledge about:
- Structuring, storing, processing and visualising data.
- Simple algorithms and data structures.
- The structure of a computer as a combination of hardware, software and communication channels.
- Basic theory of the computer's limitations and the role of data processing in society.
- Basic applied mathematics and statistics.
- The possibilities and limitations of automated data analysis.
- Advanced methodologies for data analysis.
- Data structures.
- Numerical methodologies.

Skills to:
- Solve problems using data processing methods and document the solutions.
- Read and understand academic literature in Danish and English.
- Program in different programming language paradigms.
- Communicate about the subject, both in writing and orally.
- Solve programming tasks while taking resources and correctness into account.
- Design methods of interaction between people and computers.
- Use mathematical tools for data analysis.
- Handle, visualise and extract knowledge from both structured and unstructured data.
- Apply knowledge of data science to data driven problem-solving.
- Analyse the time and space consumption of algorithms.

Competences to:
- Divide major problems into smaller, more accessible sub-problems.
- Systematically analyse problems, design solution methods, implement the methods and reflect on the result and the process.
- Evaluate the correctness, effectiveness and relevance of a solution.
- Collaborate with others, also from other subject areas, on jointly solving a task.
- Discuss the social and human consequences of using IT in different contexts.
- Solve problems requiring the combination of computer science knowledge with knowledge from other subject areas, and acquire the necessary knowledge, possibly through a dialogue with people from other subject areas.
- Apply and adapt methods to solve a particular data analysis problem.
- Select appropriate data structures and algorithms for solving specific calculation issues.
- Design systems for handling large amounts of data.

9 September 2020

Betina Kongsbak
SCIENCE Study Administration

UNIVERSITY OF COPENHAGEN
FACULTY OF SCIENCE

Diploma Supplement

This Diploma Supplement follows the model developed by the European Commission, Council of Europe and UNESCO/CEPES. The purpose of the supplement is to provide sufficient independent data to improve the international 'transparency' and fair academic and professional recognition of qualifications (diplomas, degrees, certificates etc.). It is designed to provide a description of the nature, level, context, content and status of the studies that were pursued and successfully completed by the individual named on the original qualification to which this supplement is appended. It should be free from any value judgements, equivalence statements or suggestions about recognition. Information in all eight sections should be provided. Where information is not provided, an explanation should give the reason why.

1. INFORMATION IDENTIFYING THE HOLDER OF THE QUALIFICATION

1.1. Family name(s): Mulvad

1.2. Given name(s): Søren Hougaard

1.3. Date of birth: 24 May 1996

1.4. Danish civil registration number: 240596-[redacted]

2. INFORMATION IDENTIFYING THE QUALIFICATION

2.1. Name of qualification and title conferred *(in Danish):* BSc i datalogi

Name of qualification and title conferred *(in English)***:** Bachelor of Science in Computer Science

2.2. Main fields of study: Computer Science

2.3. Name and status of awarding institution: Københavns Universitet, University of Copenhagen (officially abbreviated KU) is a state-financed higher education institution, regulated according to the Ministry of Higher Education and Science University Act no. 960 of 14 August, 2014.

2.4. Name and status of institution administering the studies (See 2.3.)**:** Same as above

2.5. Language(s) of instruction/examination: Primarily Danish and to some extent English

3. INFORMATION ON THE LEVEL OF THE QUALIFICATION

3.1. Level of qualification: Second Stage research-based tertiary education.

3.2. Official length of programme: 3 years = 180 ECTS credit points ECTS

3.3. Access requirements: Entrance to Bachelor's degree programmes is subject to the regulations contained in order no. 257 of 18 March 2015 issued by the Danish Ministry of Higher Education and Science.

4. INFORMATION ON THE CONTENTS AND RESULTS GAINED

4.1. Mode of study: Full time study

4.2. Programme requirements: The Bachelor's degree programme is subject to the regulations contained in order no. 257 of 18 March 2015 issued by the Danish Ministry of Higher Education and Science.

4.3. Programme details and individual grades/marks/credits obtained: Please refer to the enclosed grade transcript.

4.4. Grading scheme and if applicable grade distribution information: Please refer to the enclosed explanation of the Danish education system and the grading scale.

4.5 Overall classification of the qualification: Not applicable for Danish qualifications.

5. INFORMATION ON THE FUNCTION OF THE QUALIFICATION

5.1. Access to further study: A Bachelor degree in a given subject area qualifies graduates to apply for entrance to the Master Programme in the area concerned.

5.2. Professional status: The particular aim of the BSc programme in Computer Science is for the graduate to enrol on an MSc programme, but the programme may also be targeted at the following job functions and/or areas: software development, IT project management, consulting activities, IT teaching activities. In the course of their studies, students have the opportunity to acquire academic competences in teaching computer science at upper-secondary schools.

6. ADDITIONAL INFORMATION

6.1. Additional information: Founded in 1479 by the Danish King Christian I, the University of Copenhagen is Denmark's oldest and largest institution of research and higher education. More than 37,000 students are enrolled in undergraduate and graduate programmes, plus an additional 2,500 PhD students. Staff members number 9,000. The University is divided into six faculties: Theology, Law, Social Sciences, Health and Medical Sciences, Humanities and Science; all situated in the capital of Denmark.

6.2. Further information:

Faculty of Science
Bülowsvej 17
DK - 1870 Frederiksberg C

Phone +4535332828
E-mail: science@science.ku.dk

General information on higher education in Denmark can be obtained from the following two homepages: Ministry of Science, Technology and Innovation: www.vtu.dk, or Danish Rectors Conference: www.rks.dk

7. CERTIFICATION OF THE SUPPLEMENT

7.1. Date: 9 September 2020

7.2. Betina Kongsbak

7.3. SCIENCE Study Administration

UNIVERSITY OF COPENHAGEN

8. INFORMATION ON THE DANISH HIGHER EDUCATION SYSTEM

June 2016

Public higher education institutions in Denmark are regulated by national legislation concerning degree structures, teacher qualifications and examinations. Accreditation in higher education is undergoing transition from programme-based accreditation to institutional accreditation. Programmes and institutions are accredited by national, independent accreditation agencies and the Accreditation Council.

Higher education institutions

Higher education is offered by five types of higher education institutions:

1. Business academies (Erhvervsakademi) offering professionally oriented short cycle and first cycle degree programmes.
2. University Colleges (Professionshøjskole) offering professionally oriented first cycle degree programmes.
3. Maritime Education and Training Institutions offering professionally oriented short cycle and first cycle degree programmes.
4. General and specialised research universities (Universitet) offering first, second and third cycle degree programmes in academic disciplines.
5. University level institutions offering first, second and third cycle degree programmes in subject fields such as architecture, design, music, and fine and performing arts.

Most higher education institutions are regulated by the Ministry of Higher Education and Science (type 1-5).

The Ministry of Culture regulates a number of higher education institutions offering programmes within fine and performing arts (type 5).

Qualification framework

The qualification levels form the basis for the Danish National Qualifications Framework for Higher Education, which is certified in accordance with the overarching Bologna Framework according to the principles adopted by the European Ministers of Higher Education. Danish higher education qualifications at levels 5-8 of the Danish Qualifications Frame-work for Lifelong Learning (NQF) correspond with levels 5-8 of the European Qualifications Framework (EQF).

Admission and progression

General access to higher education in Denmark requires an Upper Secondary School Leaving Certificate or comparable qualifications. Admission to some particular programmes requires entrance examination or submission of a portfolio of artistic work. Holders of an Academy Profession degree can obtain a Professional Bachelor's degree within the same field of study through a top-up programme. Completion of a first cycle degree qualifies students for admission to the second cycle.

Ordinary Higher Education degrees

The Academy Profession degree is awarded after 90-150 ECTS and includes a period of work placement of at least 15 ECTS. The programmes are development-based and combine theoretical studies with a practical approach. Programmes are, among others, offered within Marketing Management, Computer Science and Chemical and Biotechnical Science. The Danish title is field of study followed by the abbreviation AK and the English title is AP Graduate in [field of study].

Overview of degrees in the Danish Higher Education System

Danish higher education institutions use the European Credit Transfer System (ECTS) for measuring study activities. 60 ECTS correspond to one year of full-time study.

Danish qualifications levels	**Ordinary higher education degrees**	**Adult/Continuing higher education degrees**	**Qualifications Framework for the European Higher Education Area – Bologna Framework**	**European/National Qualifications Framework for Lifelong Learning – EQF/NQF**
Academy Profession level	Academy Profession degree (90-150 ECTS)	Academy Profession degree (60 ECTS)	Short cycle	Level 5
Bachelor's level	Professional Bachelor's degree (180-240 ECTS)*	Diploma degree (60 ECTS)	First cycle	Level 6
	Bachelor's degree (within fine arts) (180 ECTS)			
	Bachelor's degree (180 ECTS)			
Master's level	Master's degree (within fine arts) (120-180 ECTS)	Master degree (60-90 ECTS)	Second cycle	Level 7
	Master's degree (120 ECTS)**			
PhD level	PhD degree (180 ECTS)		Third cycle	Level 8

** Can be obtained through a full regular bachelor's programme (180-240 ECTS) or a top up bachelor's programme (90 ECTS) following an Academy Profession degree. A few Professional Bachelor programmes are 270 ECTS.*
*** A few Master's programmes are up to 180 ECTS.*

The Professional Bachelor's degree is awarded after 180-270 ECTS and includes a period of work placement of at least 30 ECTS. The programmes are applied programmes. They are development-based and combine theoretical studies with a practical approach. Examples of professional bachelor's degree holders are nurses, primary and lower secondary school teachers and certain types of engineers. The Danish title is Professionsbachelor i [field of study] and the English title is Bachelor of [field of study].

The Bachelor's degree from a university is awarded after 180 ECTS. The programmes are research-based and are offered in all scientific fields. The Danish title is Bachelor (BA) i [field of study] or Bachelor (BSc) i [field of study] and the English title is Bachelor of Arts (BA) in [field of study] or Bachelor (BSc) of Science in [field of study].

The Bachelor's degree (within fine arts) is awarded after 180 ECTS. The programmes are based on research and artistic research. Programmes are offered within the fine arts. The Danish title is Bachelor (BA) i [field of study], Bachelor i musik (BMus) [field of study] or Bachelor i billedkunst (BFA) [field of study] and the English title is Bachelor of Arts (BA) in [field of study], Bachelor of Music (BMus) [field of study] or Bachelor of Fine Arts (BFA) in [field of study]. A higher education degree within theatre or filmmaking is awarded after 3-4 years of study (180-240 ECTS).

The Master's degree is awarded after 120 ECTS. The programmes are research-based and are offered in all scientific fields. The Danish title is abbreviated to Cand.[latin abbreviation of academic area] i [field of study]. The English title is Master of Arts (MA) in [field of study] or Master of Science (MSc) in [field of study].

The Master's degree (within fine arts) is awarded after 120-180 ECTS. The programmes are based on research and artistic research. The Danish title is abbreviated to Cand.[latin abbreviation of academic area] [field of study]. The English title is Master of Arts (MA) in [field of study], Master of Music (MMus) [field of study] or Master of Fine Arts (MFA) in [field of study]. Music Academies offer a specialist degree of 2 to 4 years following the master's degree.

The PhD degree is awarded after 180 ECTS. PhD programmes are offered by the universities and some university level institutions offering degrees in the artistic and cultural field.

Detailed descriptions of degree levels can be found in the Danish Qualifications Framework at www.nqf.dk. Please consult the relevant Diploma Supplement for information about the learning outcome of any specific degree.

Adult and continuing higher education

- The programmes normally consist of 2 years of part-time study, equivalent to 1 year of full-time study (60 ECTS credits). Certain master programmes require 1½ years of full-time study (90 ECTS credits). Admission requirements are a relevant educational qualification and at least 2 years of relevant work experience.
- Adult and continuing education is available at levels corresponding to qualifications of the ordinary higher education system.
- The Further Adult Education degree (videregående voksenuddannelse/akademiuddannelse) is awarded after studies at short cycle level and gives access to diploma programmes.
- The Diploma degree (diplomuddannelse) is awarded after studies at first cycle level and gives access to master programmes.
- The Master degree (masteruddannelse) is awarded after studies at second cycle level.

The 7-point grading scale

The grading system used in all state-regulated education programmes as of September 2007 is the 7-point grading scale. Apart from the 7-point grading scale, pass/fail assessment may also be used. 02 is the minimum grade for passing an exam.

Description of grades: 12: For an excellent performance displaying a high level of command of all aspects of the relevant material, with no or only a few minor weaknesses; 10: For a very good performance displaying a high level of command of most aspects of the relevant material, with only minor weaknesses; 7: For a good performance displaying good command of the relevant material but also some weaknesses; 4: For a fair performance displaying some command of the relevant material but also some major weaknesses; 02 For a performance meeting only the minimum requirements for acceptance; 00: For a performance which does not meet the minimum requirements for acceptance; -3 For: a performance which is unacceptable in all respects.