Electives catalogue for Computer Science

Appendix to the curriculum for Computer sience (AP) approved 31-08-2018

cphbusiness

COPENHAGEN BUSINESS ACADEMY

cphbusiness

CONTENTS

1. FRAMEWORK

This electives catalogue is an appendtix to the curriculum for Computer Science, which is composed in compliance with the ministerial order [bekendtgørelse] by the Danish institutions of higher education approved to offer the particular programme. The electives catalogue is an institution specific part of the curriculum.

1.1. Elective Educational Elements

The elective educational elements areas cover a range of education elements that correspond to 30 ECTS credits. Students can choose three of the following elective elements:

Fullstack JavaScript
Timing: 4th semester
Scope: 10 ECTS, comprised of: •
Contents: The purpose of this module is to provide students with a solid background in JavaScript, necessary to implement full stack JavaScript Systems and evaluate the pros & cons of such a strategy up against alternatives.

Learning Objectives:
Knowledge
The graduate will possess knowledge of:
• JavaScript, and how it differs from compiled languages like Java or C#
• nodeJS and how to use it to implement server-side JavaScript
• NoSql databases, mainly focused on the document database MongoDB
• how to write full stack JavaScript designs involving (but not limited to)
  ○ Mobile Apps
  ○ Servers
  ○ Web Client Applications
  ○ (Stand-alone Clients)
• the newest technologies and trends, with and around, JavaScript
 	
Skills
The graduate will be able to:
• Write JavaScript code, using the newest versions of JavaScript and/or Typescript
• Implement Server side JavaScript, backed up by a MongoDB database
• Use a relevant framework, to implement simple JavaScript based Mobile Apps
• Use the newest versions of JavaScript involving, when necessary, a transpiler + build/package tools
• Write simple proof of concept examples, demonstrating the features of TypeScript
• Use a modern Client Side Framework to implement Single Page Applications
• Use geolocation features, both on servers and on clients
• Use and design with modern state of the art features like Progressive Web Apps and or GraphQL

Competencies
The graduate will be able to:

- How to implement Full Stack JavaScript Systems and evaluate such a strategy up against alternatives
- The Pros & Cons in using JavaScript everywhere, and that "everywhere" itself is not a goal
- How, when, and when not, to use a NoSQL database

Exam
Form: .. 30 minutes oral examination without preparation
The student draws a question at the start of the examination.
The period descriptions + the student hand-ins for the period hand-ins form the basis for the exam.
Each period will form the basis for one or two exam questions. Each question will include a series of sub-questions involving, both theory and practical issues, related to the period hand-ins
All questions will be published (as learning goals) at the start of each period.
Assessment: The grade is based upon an overall. One grade is given according to the Danish 7-point scale.
Admission requisite: A student must obtain 80% study points in the elective.
Examination basis:
Consequences of not passing: Reexam.

Python
Timing: 4th semester
Scope: 10 ECTS

Contents:
The purpose of this subject is a) to teach the students the programming language Python 3 and b) to apply the language, its features, and third party libraries to "get things done". That is, the course aims to enable the students to collect, process, and visualize data using various techniques. The main goal is to allow the students to use Python as a tool in their later careers to quickly analyse problems, find answers to business questions, etc.

Learning Objectives:
Knowledge
The graduate will possess knowledge of:
Basics
We will learn about Python's basic data types, basic data structures, control structures, expressions, statements, operators, and program operation.
Additionally, we will learn how to use "Jupyter Notebooks", as interactive programming environment and its application for knowledge presentation.
Data Collection
We will learn how to automatically download files from the web, scrape text and images from web pages, and how to read and write various file formats, such as text files, CSV files, JSON files, Excel files, etc.
Data Visualization

We will learn how to plot data into various plot styles, such as, line plots, scatter plots, bar plots, on maps, etc. using different technologies, such as "matplotlib", "pygal", and "bokeh".
Data Science
We will apply some common algorithms in data science, such as "KMeans", "Mean Shift", "Page Rank", etc. Additionally, we will learn how to make use of the most prominent science libraries "NumPy" and "Pandas" for effective and efficient data processing.
Image Processing
We will have a look at basic image processing tasks, such as, reading image files, morphological operations, colour spaces, and the application of "OpenCV" to process images and streams of images automatically.
Automation
On top of automatic web scraping, we will have a look at UI automation and the "Selenium" framework to let computers perform the boring and repetitive tasks.

Skills
The graduate will be able to:

- Write Python scripts and programs using common language constructs in the read-eval-print-loop (REPL), "Jupyter Notebooks", as well as separate self-contained programs.
- Download files from the web programmatically, as well as reading most common file formats programmatically.
- Create various types of plots programmatically to share insight into data.
- Apply Python's scientific libraries and some of the most prominent algorithms in data science for problem solving and complexity reduction.
- Programmatically, process images and streams of images.
- Automate repetitive and boring tasks for example for data collection or UI testing.

Competencies
The graduate will be able to:

- collect various types of data
- formulate problems about this data
- implement solutions to given problem statements
- present results on an abstract as well as technical level
- gain experiences in code reviews by reviewing Python code of their fellow students

Exam Form: Group presentation of 10 minutes followed by 10 minutes of questions per student (minimum 30 minutes). The exam is based on a presentation of the student's group project and it is facilitated by an interactive programming environment. Additionally, this includes a discussion of the project's solutions with respect to the main topics of the course. For the main topics questions will be known to the students in advance.

Assessment: The grade is based on the overall assessment of the group project and the student's knowledge of the curriculum. One grade is given according to the Danish 7-point scale.

Admission requisite: A student must obtain 80% study points in the elective.
Examination basis:
Consequences of not passing: Reexam.

Security

Timing: 4th semester

Scope: 10 ECTS

Contents:

-

Learning Objectives:

Knowledge

The graduate will possess knowledge of:

- The top 10 Application Security Risks as described by OWASP
- the fundamentals in how to set up a secure web site
- the basics of SSL
- The rules for data protection compliance
- how to handle password, and how
- the security consequences from a selected deployment strategy
- Organizational aspects and responsibilities related to security
- Basic understanding of the TCP/IP-protocol, focused on security issues

Skills

The graduate will be able to:

- Perform simple "ethical" hacks
- Know how to setup a simple Intrusion Detection System
- Setup a simple Intrusion detection system
- Know how to set up a security certificate for a Web-application
- Implement and choose between different authorization and authentication strategies
- Perform security related network monitoring tasks

Competencies

The graduate will know how to:

- secure, and validate security measures taken for, a modern web application
- Take part in a dialog, focusing on Security questions in a modern web company
-

Exam

Form:

A 30 minutes oral exam including two parts as outlined below:

- A prepared presentation based on the semester project.
- The students answer to a number of questions,"drawn" after the presentation. These questions will be based on the learning goals for each lesson/topic, and will be published in their final form before the exam

Assessment: The grade is based upon an overall. One grade is given according to the Danish 7-point scale.

Admission requisite: A student must obtain 80% study points in the elective.

Consequences of not passing: Reexam

App development with Kotlin
Timing: 4th semester
Scope: 10 ECTS
Contents: The goal of this course is to increase the student's skill in learning new techniques on another technological platform. Also, it aims to give an insight on developing meaningful applications for mobile units, in this case apps for the Android platform. Traditionally Android apps are developed in Java, but very recently, the people behind JetBrains have come up with a new language, Kotlin that focuses on robustness and clarity of use. Kotlin compiles to the Java VM and can use all Java library classes.
Learning Objectives: *Knowledge* The graduate will possess knowledge of: • the Android architechture in general • the life cycles of apps and services • the overall constructs and use in Kotlin • where to find additional information on app development *Skills* The graduate will be able to: • Write basic apps for the Android platform in Java and Kotlin • Set up graphical user interfaces • Access sensors and actuators • Use the build-in database SQLite on the phone • Implement 2D/3D content into apps
Exam Form: .. 30 minutes oral examination. A mobile app is presented by the student (app. 10 minutes) further discussions will be based on the presentation but can include all aspects of the curriculum. The presentation should focus on the mobile app. **Assessment:** The grade is based upon an overall assessment. One grade is given according to the Danish 7-point scale. **Admission requisite:** A student must obtain 80% study points in the elective. Synopsis for the exam project must have been approved. **Examination basis:** A mobile app published on Google Play **Consequences of not passing:** Reexam.

Intenet of things
Timing: 4th semester
Scope: 10 ECTS
Contents:

The course will have introductory lectures on subjects, but the main focus is experimenting and building real working IoT things.
There will be four minor assignments:

- Basic electronics and Digital logic,
- C and C++
- NodeRed assignment
- 3D modeling

And a major project of building an IoT thing and connect it. The project is made in groups. The project should be based on a synopsis written by the students and approved by the teachers.

In this course we will:

- Understand digital logic and binary numbers
- Use breadboards to experiment and understand basic electronics
- Use Arduinos with bread boards and sensors and actuators to create development prototypes
- Use C and C++ to create embedded software
- Use 3D software and 3D printers to create production prototypes
- Use Node-RED and/or IFTTT to connect to other devices

Learning Objectives:
Knowledge
The graduate will possess knowledge of:

- Basic electronics and digital logic
- The fundamentals of C and C++
- The principles of 3D models and printing

Skills
The graduate will be able to:

- set up an electronic circuit with sensors, activators, and a processing unit
- create embedded software using C and C++
- connect a custom IoT thing to another devices

Competencies

Exam
Form: .Internal 30 minutes Oral examination without preparation where the student present the product from the project.
Assessment: The grade is based upon an overall. One grade is given according to the Danish 7-point scale.
Admission requisite: A student must hand in a project synopsis, which should be approved and obtain 80% study points in the elective.
Examination basis: A project with an Arduino (or similar) with sensors and actuators must be handed-in. 3D printed objects are expected to be a part of the project.
Consequences of not passing: Reexam

Games

Timing: 4th semester

Scope: 10 ECTS

Contents:

The student must:

- Learn to use the Unity IDE
- Learn basic game design methodologies
- Learn various tricks that are relevant for game development
- Understand game engines, game physics, game simulation
- Use C# to implement his/her own game project alone or in groups

Learning Objectives:

Knowledge

The graduate will possess knowledge of:

- Basic game development dos and don'ts.
- Basic game design knowledge
  - Theory and practice in creative parts of game development: Finding the fun factor, making it beautiful, monetization and marketing strategies.
- Component based programming
- Cross platform development and game release.

Skills

The graduate will be able to:

- Use the Unity IDE
- Implement a game using C# in Unity.
- Utilize game specific algorithms / game optimization strategies.
- Export a Unity game to a mainstream platform.

Competencies

The graduate will be able to:

- Contribute to minor game development teams.
- Implement a game from idea to release.
  - designing, prototyping, iterating, testing and deploying games

Exam

Form: .. 30 minutes oral examination.

Assessment: The grade is based upon an overall assessment including the complexity/depth/width of the project and the student's display of curriculum knowledge at the exam. One grade is given according to the Danish 7-point scale.

Admission requisite: A student must obtain 80% study points in the elective.

Examination basis: A unity project

Consequences of not passing: Reexam.