Online TA

Master Project

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Chapter 1

Introduction

> *In any teaching of the application of computers it is essential to have the students do practical programming problems and to grade their results. Such grading should consider both the formal correctness and the performance of the programs and tends to become difficult and time consuming as soon as the teaching is beyond the most elementary level. The possibility of using the computer to help in this task therefore soon suggests itself.*
>
> — PETER NAUR, *BIT 4* (1964)

1.1 Reader Expectations

The reader is assumed to be familiar with the concept of a university, i.e. an institution of higher education and research, aimed at educating scholars and professionals, granting them degrees, signifying their accomplishments.

The reader is assumed to be familiar with Computer Science, i.e. the study of computable processes and structures, with the aid of of computers. Preferably, the reader should hold a Computer Science degree, be, or have been enrolled in a Computer Science university programme.

1.2 Dictionary and Grammar

Unless otherwise stated, the reader

1.3 Legal Disclaimer

This report references certain legal documents, including Danish laws and university curricula. As the author is not trained in law, there is no claim as to the legal soundness of the claims and references made in this report.

A solid attempt has been made at retaining the formulation of the referenced material, and referencing the most current legal documents, unless this was hindered by other legal references.

For instance, the shared section of the BSc and MSc curricula for study programmes at the Faculty of Science, University of Copenhagen [Curricula, 2013]

is based on Ministerial Order no. 819 as of June 29, 2010 [BEK 814]. This document is outdated and has been updated twice, most recently by Ministerial Order no. 1520 as of December 16, 2013 [BEK 1520]. In this particular case, it is the faculty curricula that was been deemed to mandate the relevant law to reference.

Chapter 2

Requirements Analysis

2.1 Purpose and Environment

The purpose of the OnlineTA is to aid traditional on-site education at the Department of Computer Science, University of Copenhagen, Denmark (DIKU).

Denmark is a signatory of the Bologna process, an international European agreement for the development of a common European Higher Education Area [EHEA, 1999]. The intent of the agreement is to further international cooperation, allow students and researchers to move freely across borders, and to make European universities more attractive worldwide.

To adhere to the agreement, an education at the University of Copenhagen is split into two main cycles: a 3-year Bachelor education, and a subsequent 2-year Master's education, and as the Danish law [BEK 814] mandates:

- **§ 6, part 1 & 2:** A Bachelor and Master's education is accredited using the European Credit Transfer System (ECTS).
- **§ 6, part 3:** 60 ECTS points corresponds to 1 year's worth of full time studies.
- **§ 11, part 1:** A Bachelor education is attributed 180 ECTS points.
- **§ 17, part 1:** A Master's education is attributed 120 ECTS points.

The Department of Computer Science is a subordinate of the Faculty of Science at the University of Copenhagen. As such, it adheres to the faculty-wide block structure [CND, 2004]. A study year is split into 4 blocks, each corresponding to 9 weeks worth of full time work and 15 ECTS credits. Most courses require half time work for 9 weeks, yielding 7.5 ETCS credits. Some courses span multiple blocks, or require full time work, yielding 15 ECTS credits, or more. Courses aside, students can also take up projects, write a Bachelor project, or a Thesis, but we will not concern ourselves with such matters here.

According to Danish law [BEK 814, §6, parts 1 & 2], a Bachelor and Master's education is built up of multiple modules. A module is a unit of study, providing the student with some qualifications and skills, yielding a certain number

of ECTS points, and completed by passing one or more exams. A DIKU course roughly corresponds to a module: every course is completed by passing an exam.

According to Danish law [BEK 666, §14, parts 1 & 4], a student enrolled for a course is automatically admitted to the exam in that course, unless the student throughout the course does not meet the requirements beforehand set by the university for being admitted to the exam. According to Danish law [BEK 666, §3, parts 2 & 3] this may be requirements of participation, requirements to submit written assignments during the course, or similar. The requirements are further specified by the university curriculum.

The Faculty of Science at the University of Copenhagen has both a shared BSc and MSc curricula for study programmes [Curricula, 2013], and programme-specific curricula.

According to the shared faculty curricula, the individual courses offered by the faculty, including the requirements to be met in order to be admitted to the exam, are described in the University of Copenhagen course catalogue, at `http://kurser.ku.dk`. This excludes the aforementioned projects, Bachelor project and Thesis, which are described in the faculty curricula itself.

Most courses at DIKU run for the aforementioned 9 weeks, and expect half time study. The first 7 of the weeks are used for teaching and various mandatory written assignments, one week is left for exam study, and the last week is left for the exams themselves. The written assignments serve as the basis for the judgement of whether the individual student should be admitted to the exam or not.

The purpose of the OnlineTA is to aid in the judgement of whether a student is to be admitted to the exam as well as aid in the evaluation of the student's exam performance itself.

2.2 Notes

Bestået/ikke bestået. Mødepligt.

This is the main decision to be made in the course of the first 7 weeks, individually for every student. The purpose of the OnlineTA is to aid in this judgement.

The purpose of the eduction is, in part, to develop competence in computable processes and structures. This typically involves both theory and practice, i.e. both reasoning about computable processes and structures, and implementing them on a computer. The two approaches reinforce each other, providing insight both into what is reasonable, and what is feasible.

Computer Science is not a unimodal science. There are many different topics, and many different areas of interest, all of which cannot fit into the head of any one student.

A course spans a period of time, has a curriculum, and demands the student to complete some sort of individual work. It is the student's individual work that forms the basis for the evaluation of the student's performance. It is the accumulative performance of the students in all their courses that form their degrees.

All courses may either be passed or not passed by a student.

Most courses are graded on a 7-grade scale, but some are merely pass or no pass

which will be used as the basis for the assessment of a student's work.

A course is a something that spans a

The education involves the student participating in various courses. A course spans a period of time, has a particular curriculum, and particular problems that the student is asked to solve. The performance of the student is then judged on the basis of their work.

The system should aid the teaching staff in their judgements of individual students.

Of particular interest are programming courses, i.e. courses that involve the writing of programs to be executed by a computer.

Chapter 3

Feature Specification

3.1 Users

The online TA is to be made available on the World Wide Web. The set of users therefore, includes a wide range of principals of which only a very small subset will ever access the system, and even fewer are likely to use it as intended.

The system should be safeguarded against malicious users, yet provide all the relevant capabilities to authentic users with sufficient permissions.

3.1.1 User Roles

For an online TA there are two principal user roles: *system administrators* and *stakeholders* (students, teachers, and the general public). (TODO: is the general public really a stakeholder?) (TODO: how limited is the general public?)

System administrators have complete control of the servers running the service, including the mechanisms that enforce the security policies of the service. (They can, in principle, change anything.) System administrators are also responsible for monitoring the service for abnormal or abusive behaviour.

Stakeholders access the system through a secure online interface. They set up, enroll participants, and participate in courses — where a course is a collection of programming assignments for the students to solve.

There are four principle course-specific stakeholder roles: *instructors*, *assistants*, *students*, and *non-participants*. That is, for each course, every stakeholder has exactly one of these four roles.

Instructors are the principle course administrators. They can enroll other participants as either instructors, assistants, or students. Their primary role is to define the elements of a course.

Assistants are second-level course administrators. They can enroll other participants as either assistants or students. Their primary role is to assist the instructors in defining the elements of a course, and to provide feedback to students.

Students are the basic users of a course. They cannot enroll other participants, or tamper with the elements of a course. Their primary role is to submit solutions to the programming assignments of a course. Student submissions

are individual or group-based, and so not visible to other students in general. Student submissions are visible to instructors and assistants for the sake of evaluation.

Non-participants can see the elements of a course, but they cannot participate in the course in any way. The reasoning here is that there is no implicit trust relationship among the participants of a course, that does not exist among all the stakeholders of an institution. Providing access to non-participants allows them to get a feel for the course, which is useful for both encouraging participation and course evaluation.

NOTES:

- Only instructors and assistants can define the elements of a course.
- Only students can make submissions to programming assignments.
- Course contents is open for everyone in the system to see.

3.1.2 User Data

The system must retain sufficient information to securely authenticate and authorise all the users of the system.

3.1.3 System Administrators

3.1.4 Stakeholders

Stakeholders have to be identifi

- Name
- E-mail
- KU username

3.2 Courses

3.2.1 Course Data

Programming Assignments

- Assignment text. Everyone may see. Probably requires some pretty printing.
- Static submission analyses. Only instructors and assistants.
- Input data generator. Only instructors and assistants may see the actual program, everyone may see the resulting generated data. Resources limited to instructors and assistants.

3.3 Source Code and Documentation

3.3.1 OSS/FS

Open Source Software / Free Software (OSS/FS) programs are programs whose licenses give users freedom to run the program for any purpose, to study and modify the program, and to redistribute copies of either the original or modified program [Wheeler, 2007].

To fully reap the benefits of OSS/FS, it is necessary to ensure that there is an active community around it, devoted to bug tracking and fixing, as well as developing new features (unless the product can be deemed feature-complete).

If such a community is absent, the worst fears of the sceptics of OSS/FS may well be true: vulnerabilities may be known to adversaries.

Developing software that later

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