4th Year Plan

Information

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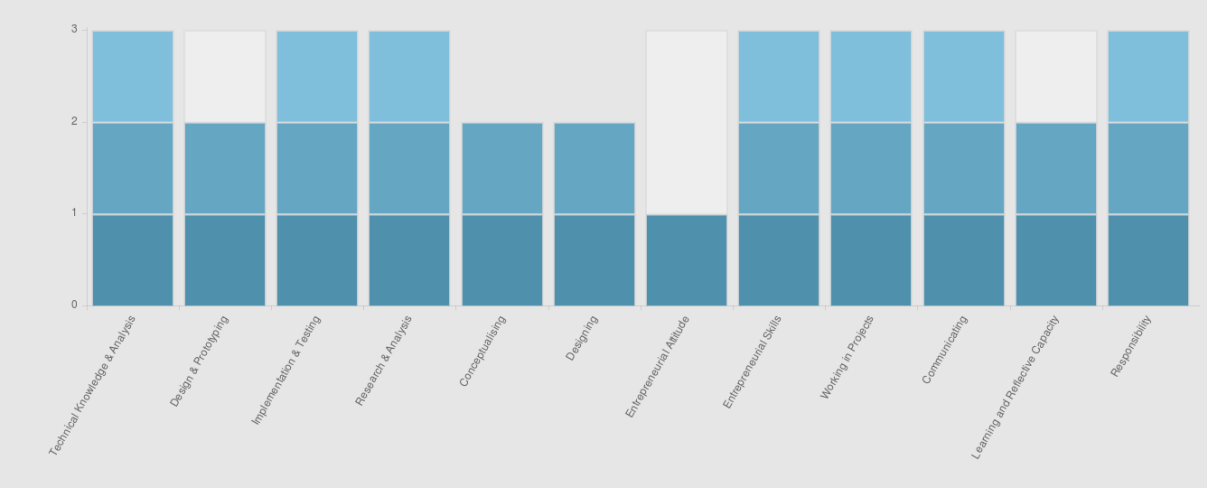
Date:	28-09-2016
Credit status:	141 credits
Starting block:	A/~~B/C/D~~
Supervisor preferred choice:	Fernando Cabello Domingo

Please indicate which option you have chosen for the current semester of your Graduation year:

- ~~Work placement~~
- Personal Project
- ~~Own company~~
- ~~Echange (First half of your 4th year)~~
- ~~Minor (Block A & B only)~~

Personalised learning plan

A. Competency profile:



B. **Identify the objectives you wish to address during this year in order to progress your competency profile (or complete if this is your final semester):**

Python 3 programming
Threading, asynchronous processes, regular expressions, classes, iterators and more.
Intimate familiarity with programming in Python 3.
Done through writing a series of programs demonstrating these concepts.

C# programming
Design patterns, iterators, interfaces, lambdas, asynchronous processes and more.
Intimate familiarity with programming in C#.
Done through writing a series of programs demonstrating these concepts.

F# programming
Lambdas, monads, asynchronous processes and more.
Done through writing a series of programs demonstrating these concepts.

Note: This objective was removed with the supervisor's permission
C++ programming
Providing Python 3 bindings for a basic C++ library.
Done through writing a library and demonstrating the Python 3 bindings with a script.

Analysis
Understanding empirical and complexity(Big O) analysis.
Lists, stacks, queues, hash tables, binary trees, graphs.
Elementary dynamic programming.
Studied using books and online articles. Notes demonstrated where available.

Note: Set theory / category theory removed with the supervisor's permission
Mathematics
Mathematical induction proof, basic set theory, basic category theory.
Studied using books and online articles. Notes demonstrated where available.

C. Planning

Complete and update this during your first 3 weeks.

The project did not start with a detailed planning due to the uncertainty of my new job's schedule. Instead of this, there has been regular contact with the supervisor about the project status and priorities.

Assignment Description
The aim of the project is to prepare for professionally teaching students selective aspects of computer science. I will be studying a variety of concepts in programming and mathematics, and demonstrate my understanding of them as described in the relevant sections of this document.

Background
Leading figures in relevant areas:

Python 3
Guido van Rossum
Author of the Python programming language.
Author of the web-based code review system Mondrian
Currently employed by Dropbox

Pieter Spronck
Author of "The Coder's Apprentice"
PhD from research into adaptive game artificial intelligence
Associate professor at Tilburg Center for Cognition and Communication

F#
Don Syme
Designer and architect of the F# programming language
Creator of generics in the .NET CLR
Co-author of the book "Expert F# 3.0"

C#
Anders Hejlsberg
Lead architect of the C# programming language
Core developer of TypeScript
Author of Turbo Pascal and chief architect of Delphi

Category theory
Giuseppe Longo & Andrea Asperti
Authors of "Categories, Types and Structures"

Bartosz Milewksi
PhD in Theoretical Physics
Co-designer and implementer of the D programming language
CEO of Reliable Software

Information sources relevant to the research area:
Longo & Asperti (1991). Categories, Types and Structures.
Excellent book on category theory for programmers.

Syme, Granicz & Cisternino (2015). Expert F# 4.0.
In-depth book about advanced F# programming.

Troelsen (2012). Pro C# 5.0 and the .NET 4.5 Framework.
In-depth book about advanced C# programming.

Spronck (2016). The Coder's Apprentice.
In-depth book about advanced Python programming.

Trudaeu (2003). Introduction to Graph Theory.
Introductory graph theory book.

Sedgewick & Wayne (2011). Algorithms.
In-depth book about algorithms.

Cormen, Stein, Rivest & Leiserson (2009). Introduction to Algorithms.
In-depth book about algorithms.

Current level of knowledge, interest and research
At the start of this project I have basic knowledge of Python 3, intermediate knowledge of C#, F# and C++, and limited knowledge of complexity analysis.

I'm interested in concurrent and asynchronous programming, as well as modern functional concepts. In addition, I want to learn about complexity analysis.

My work placement introduced me to category theory, functional programming with F# and design patterns in C#. Part of the project is a continuation of the research performed during my work placement.

Since I have limited knowledge of mathematics, the analysis aspect of the project will be the most challenging.

It is important to me that I gain an intimate understanding of the related concepts, so that I may improve as a computer scientist.

Assignment Learning outcomes and deliverables
Learning Outcomes:
Please consult the objectives section, which contains the subjects I intend to study. The goal is to gain a solid understanding of the mentioned concepts.

Final deliverables:
Python 3 programming
Several programs clearly and correctly demonstrating the mentioned concepts.

C# programming
Several programs clearly and correctly demonstrating the mentioned concepts.

F# programming
Several programs clearly and correctly demonstrating the mentioned concepts.

Note: This objective was removed with the supervisor's permission
C++ programming
A library and script demonstrating the Python 3 bindings.

Analysis
Documentation and scripts relating to empirical analysis experiments performed by me.
Personal notes demonstrated where available.

Mathematics
Personal notes demonstrated where available.