

## **Essay:**

Ever since I was a small child, I've dreamed of adventure. I would imagine traveling the world and seeing everything there is to see, meeting new people all along the way. And ever since I knew of the possibility, I've dreamed of one day being able to study abroad.

Despite my long-standing dreams of travel, I've lived in the same environment most of my life: Sunny LA, where not even the unpredictability of changing seasons or snow could be expected. Unlike many, I've never had to step out of my comfort zone and learn to live in a new area – be that country, state, or even city. My move to college was a 45-minute drive to Caltech.

For me, I feel that getting the opportunity to study abroad would greatly enhance my personal growth. Studying abroad would truly put me in a unique environment where I would be face-to-face with difference and forced to adapt to a new environment in a way that I've never had to before. Rather than be afraid of this new challenge, I would relish the opportunity and meet the challenge as a new adventure to explore, rather than an obstacle to be overcome.

While I've wanted to study abroad for a long time, the experience that cemented this desire was in high school, when I was able to spend a week in Cuba on a journalism trip. This was one of the only times I'd left the country on any sort of trip, and was the only trip that wasn't merely for tourism. While in Cuba, we had the opportunity to stay in homestays and to interview Cubans about their experiences. For the first time, I actually had the opportunity to experience a new culture in a way beyond simply visiting tourist destinations, and I wanted more. Being able to live and go to school in Europe for a semester would be the ultimate opportunity to experience what life is really like there.

I think that academically, this opportunity would also be incredibly valuable. Due to Caltech's size, there simply aren't the resources to cover every possible topic in Computer Science, a large and ever-growing field, and studying abroad would give me the opportunity to expand my horizons and take classes I wouldn't be able to here. Additionally, I would be able to experience the different teaching style of another university and have the opportunity to learn at a much larger school than Caltech, which would help broaden my horizons and give me more perspective on my education. Overall, studying abroad would be an amazing experience for me, and one that I have dreamed of throughout my entire life.

## **Program Fit: DTU**

Studying at DTU would allow me to take classes in Computer Science that contain a lot of practical content – a valuable balance to the often theory-heavy coursework found at Caltech. The classes I would be taking are advanced classes which would help fulfill by degree requirements for advanced classes in Computer Science.

## **DTU Proposed Course List**

**Total ECTS: 30**

**Total CIT Units: 45**

**Course by Correspondence/Units: 0**

### **1. Data Security 02239**

Christian D. Jensen

Department of Applied Mathematics and Computer Science

MSc/4<sup>th</sup> year

Autumn Semester

Block 5B

13 weeks

7.5 ECTS

9 Caltech units

Caltech evaluator: Thomas Vidick

Option Credit

#### **Course description:**

A student who has met the objectives of the course will be able to:

- identify all major factors that have to be addressed in a security analysis of a particular system;
- define operational security goals for a given computing system;
- analyse an application scenario and identify common threats, vulnerabilities and risks;
- identify possible countermeasures against threats and vulnerabilities in a given security scenario;
- compare and contrast the underlying security mechanisms needed to implement security countermeasures;
- define operational security policies to achieve specific security goals using specific security mechanisms;

- design a security infrastructure that implements an operational security policy;
- use contemporary tools to analyse and implement (part of) a security infrastructure;
- evaluate (informally) a given set of security policies and mechanisms in a given application context in order to determine whether they are likely to satisfy a given list of security goals;
- document their work with the security process in a clear and concise report.

Security concepts: confidentiality, integrity, authenticity, availability etc. Symmetric and asymmetric cryptography and their uses; key distribution and digital signatures; discretionary and mandatory access control policies for confidentiality and integrity. Communication protocols for authentication, confidentiality and message integrity; network security; system security, intrusion detection and malicious code. Security models and security evaluation. Administration of security. Legal aspects of computer security.

## **2. Process Mining 02269**

Andrea Burattin

Department of Applied Mathematics and Computer Science

MSc/4<sup>th</sup> year

Autumn Semester

Block 5A

13 weeks

5 ECTS

9 Caltech units

Caltech evaluator: Thomas Vidick

Option Credit

### **Course description:**

The aim of the course is to enable the students to understand and create formal representation of business processes (e.g., Petri net) and to understand the purpose and potential of process mining. The students will be able to understand and analyze the differences among the state-of-the-art process mining techniques and which are the ideal application conditions for each of them. Additionally, the students will be able to formulate relevant and meaningful questions, useful to analyze behavioral aspect of the process and to test these hypotheses on event logs. Finally, students will be able to independently extract and analyze event logs with commercial and open-source process mining tools available in order to answer process-related questions and test hypotheses.

A student who has met the objectives of the course will be able to:

- Explain the behavior of a Petri net (e.g., "token game") and corresponding basic properties (e.g., deadlock-free, bounded)
- Model a given business process using Petri nets in a correct way

- Compare the different process mining family of techniques (e.g., control-flow discovery and conformance checking) and select which fits given scenarios
- Interpret the quality criteria for evaluating process mining outcomes, in particular concerning control-flow discovery algorithms
- Compare the available algorithms and tools for process mining techniques and determine which fits given problems
- Utilize the state-of-the-art of available technologies, both commercial products and open source tools
- Construct event logs starting from raw data recordings or as simulations of process models preserving certain properties (to be used in controlled environments)
- Extract the control-flow of the activities recorded in an event log with commercial and open source tools
- Calculate the conformance of an event log with respect to a given reference process model
- Assess (business) related questions using process mining techniques
- Explain the current trends in process mining research

### **3. Introduction to Computer Game Prototyping 02823**

Michael Rose

Department of Applied Mathematics and Computer Science

MSc/4<sup>th</sup> year

Autumn Semester

Block 4A

13 weeks

5 ECTS

9 Caltech units

Caltech evaluator: Thomas Vidick

Option Credit

#### **Course description:**

The purpose of this course is to give an introduction to computer game development and rapid prototyping techniques using object-oriented dynamic programming languages. These will be applied by the students to develop and evaluate prototypes of computer games. The emphasis will be on casual games, though other genres will also be considered.

A student who has met the objectives of the course will be able to:

- classify games according to genres
- classify the types of digital media technologies applied in games
- describe the functional requirements for several types of games
- describe techniques for rapid prototype development
- develop computer programs utilizing tools of dynamic late-binding languages
- construct and implement unit testing techniques

- design and implement a rapid prototype of their own game
- evaluate the playability and technical implementation of their game

#### **4. Introduction to Cognitive Science**

Tobias Andersen

Department of Applied Mathematics and Computer Science

MSc/4<sup>th</sup> year

Autumn Semester

Block 3A

13 weeks

5 ECTS

9 Caltech units

Caltech evaluator: Thomas Vidick

Option Credit

#### **Course description:**

Humans and computers alike process information. Many computing problems, such as face recognition, language understanding and content-based search, are trivial for humans but difficult to implement in machines. Vice versa, many computing problems are simple for machines but difficult for humans. This is because humans and computers process information in different ways.

An understanding of cognition, i.e. how humans process information, can be helpful when developing new algorithms and when designing systems in which humans and computers interact. It is also useful for understanding the human brain and cognition in general.

The course introduces several methods for studying how humans process information and interaction socially. Behavioral measures, such as response time and accuracy is the main focus but physiological measures such as EEG and fMRI are also introduced.

The course describes how cognition can be divided into modules such as perception, attention and memory. The function of these modules is then described in relation to major theories of cognition both quantitative and qualitative. The results from key experiments are integral to the course.

A student who has met the objectives of the course will be able to:

- Be able to describe the most important theories in cognitive science
- Be able to discuss the fundamental concepts in cognitive science
- Carry out a predefined psychological experiment
- Quantitatively analyze results from psychological experiments
- Evaluate the theoretical importance of a psychological experiment
- Explain in own words the principles behind some of the basic mathematical models of human cognition

- Analyze some basic mathematical models of human cognition using Matlab or similar analysis tools
- Identify and discuss areas where cognitive science is relevant for information technology and vice versa
- Be able to discuss advantages and disadvantages of different paradigms and methods for studying social cognition

## **5. Danish Language**

Department of Nordic Studies and Linguistics (KU)

Beginners' Level 1

Autumn Semester

Monday & Wednesday or Tuesday & Thursday 19:00-21:35

7.5 ECTS

9 Caltech units

Caltech evaluator: Christopher Hitchcock

Humanities Credit

### **Course description:**

The courses in Danish as a Foreign Language for International Students at the University of Copenhagen consist of intensive language instruction classes. Danish is studied and taught as a foreign language for communicative as well as academic purposes. In accordance with a discursive view of language and a primarily cognitive view of language acquisition the courses integrate theoretical knowledge of lexicon, grammar and phonology in the process of developing communicative competences in modern Danish, spoken and written.