Study Abroad Personal Essay (English)

I cannot remember the first time I visited France. My parents brought me along as a toddler to the millennium celebration in Paris, so I can't remember anything but the stories they told me. However, in all the times that I have come back, I have fallen more deeply in love with French culture, cities and people. From the beautiful beaches of Arcachon and the scenic oceanside walk in Nice, to the vast wineries in Bordeaux and the bustling streets of Paris, each place I have visited and each time I have gone there, the charms of France never fail to dazzle me. I would love to immerse myself within this culture and way of life, to revel in the good food, challenging academics, and friendly people from all around France.

At École Polytechnique, I would be taking classes that expand the scope of my education: a distributed algorithms class not offered at Caltech, a class about data structure and algorithm implementation, a class on low-level computer hardware for code efficiency and a class on modern networking. I would take these classes to improve my skills and my understanding of the subject, in order to explore the full breadth of Computer Science. Taking challenging courses would also require me to branch out and interact with more students, just as it does at Caltech, to be helping and asking for help from others. It would give me opportunity to adapt to different teaching and learning styles present in other countries to better communicate and understand the international community.

While working, talking and playing sports with other French students at Ecole, I plan to improve my conversational French. Although I have been learning it for many years, I haven't had much time in applying my skills for their improvement. While learning in classes at Ecole, as well as by travelling on weekends, I will speak more and understand more. I believe that language and culture are intertwined, so one doesn't come without the other. By immersing myself in the language, I will better understand the culture and vice-versa.

To study abroad in France, and at Ecole Polytechnique, to be surrounded by the best in the country, would be a tremendous opportunity for me. I believe I could share my own experiences as an international traveler, as well as learn more about the experience that people of different nationalities have and share. Most of all, I want to expand my worldview and perspective to encompass the everyday lives around the world.

Étudier en Échange: Rédaction Personnelle (Français)

Je ne me rappelle pas le premier temps que j'ai visité la France. Mes parents m'y ont amenée comme un enfant à la célébration du millénaire à Paris, donc je ne me rappelle que les histoires qu'ils m'ont dites. Néanmoins, chaque fois que je suis revenue, je suis tombée plus profondément amoureuse avec la culture, les villes et les gens Français. Des belles plages d'Arcachon et la promenade à côté de la mer en Nice, aux établissements vinicoles en Bordeaux et les rues animées en Paris, chaque endroit où j'ai visité et chaque fois j'y suis allée, les charmes de France ne manquent jamais de m'éblouir. J'voudrais de me plonger entre cette culture et cette mode de vie, de me délecter de le bien nourriture, l'académiques difficile, et les gens amicaux autour de France.

À l'École Polytechnique, je prendrais les cours qui étendent le scope de mon éducation : un cours des algorithmes distribuée pas offre à Caltech, un cours atour structures de données et algorithmes et leurs implémentations, un cours de matériel informatique de bas niveau pour le code efficace, et un cours du réseau moderne. Je prendrais ces cours pour améliorer mes compétences et ma compréhension du sujet, afin d'explorer tout l'étendue de l'Informatique. Quand je prends les cours stimulants, il me demanderait de me diversifier et interagir avec l'autre étudiants, comme je dois faire à Caltech, pour aider et pour demander l'aide des autres. Il me donnerait l'opportunité d'adapter aux styles différents d'apprendre et d'enseignement qui sont présent en l'autre pays pour mieux communiquer et comprendre la communauté internationale.

En travaillant, en parlant, et en faisant du sport avec les autres étudiants Français à l'X, j'ai l'intention d'améliorer mon Français conversationnel. Bien que je l'aie appris pour beaucoup d'années, je n'ai pas eu plusieurs de temps pour appliquer mes compétences pour leur amélioration. En apprenant en classes à l'X, en plus de voyager sur le weekend, je parlerai plus et comprendrai plus. Je crois que la langue et la culture sont entrelacer, donc une des choses ne peut pas viens sans l'autre. En immersion dans la langue, je comprendrai mieux la culture et vice-versa.

D'avoir la chance d'étudier en échange en France, et à l'École Polytechnique, et d'être entouré par les mieux dans le pays serait une opportunité incroyable pour moi. Je crois que je peux partager mes expériences d'un voyageur internationaux, en plus d'apprendre plus atour l'expérience des gens de nationalités différents. Le plus important, je veux développer ma vision du monde pour qu'il inclue la vie quotidienne autour du monde.

Program Fit: Ecole Polytechnique

The classes I'm taking are all classes with no equivalent at Caltech. Fundamentals of Modern Computer Networking and Distributed Computing have no similar classes. While Practical C & Java Programming, Algorithms and Data Structures is similar to our class CS 2 – Introduction to Programming Methods – the content will not be the same. In addition, Computer Architecture and Operating Systems is most similar to CS 24 – Introduction to Computing Systems – but will also focus on different things. However, this will not be a problem as Computer Science is a very flexible option. The classes can be used in requirements for "Higher level CS courses" or in "Electives in Ma, ACM or CS".

Ecole Polytechnique Proposed Course List

Total ECTS: 19
Total CIT Units: 45
Course by Correspondence/Units: 0

1. **INF530 - Practical C & Java prog., Algo and Data Structures**

Informatique/ Computer Science
ECTS: 4
Caltech Units: 9
Caltech Evaluator: Thomas Vidick
Caltech Credit: Option
Equivalent Course: N/A
Description: This course is a mandatory part of the M1 Graduate Degree Internet of Things: Innovation and Management Program (IoT-IM)
(No further description is provided)

2. **INF557 - From the Internet to the IoT: Fundamentals of Modern Computer Networking**

Informatique/ Computer Science
ECTS: 4
Caltech Units: 9
Caltech Evaluator: Thomas Vidick
Caltech Credit: Option
Equivalent Course: N/A
No course description
(Taken by Tristan Nee this past Fall quarter)

3. **INF559 - Architecture des ordinateurs et systèmes d'exploitation (Computer Architecture and Operating Systems)**

Informatique/ Computer Science
ECTS: 4
Caltech Units: 9
Caltech Evaluator: Donnie Pinkston
Caltech Credit: Option
Equivalent Course: N/A
Description:
We will explain the enduring concepts underlying all computer systems, and show the concrete ways that these ideas affect the correctness, performance, and utility of any application program.

This course serves as an introduction to the students who go on to implement systems hardware and software. But this course also pushes students towards becoming the rare programmers who know how things work and how to fix them when they break. It is not a course reserved to geeks, it is a course for all programmers!

This course will cover most of the key interfaces between user programs and the bare hardware, including:

The representation and manipulation of information

We cover computer arithmetic, emphasising the properties of unsigned and two's complement number representations that affect programmers. A solid understanding of computer arithmetic is critical to writing reliable programs: for instance, arithmetic overflow is a common source of programming errors and security vulnerabilities.

Machine-level representation of programs

We learn how to read the x86-64 machine code generated by a C compiler. We cover the basic instruction set, and the implementation of procedures, including stack allocation, register usage conventions and parameter passing. We cover how different data structures are allocated and accessed. We also use the machine-level view of programs as a way to understand common code security vulnerabilities, including buffer overflow.

Processor architecture

We cover basic combinational and sequential logic elements, and then show how these elements can be combined in a datapath that executes a simplified subset of the x86-64 instruction set. We begin with the design of a single-cycle datapath, very simple but not very fast, and then introduce pipelining, where the different steps required to process an instruction are implemented as separate stages and can be executed in parallel. The final five-stage processor pipeline will be closer to modern architectures, and we will show how a programmer can speed up his code by by increasing the instruction parallelism hidden in his programs.

The memory hierarchy

The memory system is not a linear array with uniform access times. In practice, a memory system is a hierarchy of storage devices with different capacities, costs, and access times. We cover the different types of RAM and ROM memories and the geometry and organisation of magnetic-disk and solid state drives. We describe how these storage devices are arranged in a hierarchy, and how this hierarchy is made possible by locality of reference. We will show you how to improve the performance of application programs by improving their temporal and spatial locality.

Exceptional Control Flow

Here we step beyond the single-program model by introducing the general concept of exceptional control flow. We cover examples of exceptional control flow that exist at all levels of the system, from low-level hardware exceptions and interrupts, to context switches between concurrent processes, to abrupt changes in control flow caused by the receipt of kernel signals, to the nonlocal jumps in C that break the stack discipline.

Virtual memory

Virtual memory space is just an array of bytes that the program can subdivide into different storage units. However we will show how different simultaneous processes can each use an identical range of addresses, sharing some pages but having individual copies of others. This helps the programmer to

understand the effects of programs containing memory referencing errors such as storage leaks and invalid pointer references.

TDs

The TDs are the heart of the course and will illustrate how to put the above at work in everyday programming practice. Among other things we will reverse-engineer a binary program, implement a buffer overflow attack, optimise a processor design, and implement our own memory allocator.

4. INF 571 – Distributed Computing

Informatique/ Computer Science
ECTS: N/A (4)
Caltech Units: 9
Caltech Evaluator: Thomas Vidick
Caltech Credit: Option
Equivalent Course: N/A
Description:

Distributed systems are composed of several computational units, classically called processes, that run concurrently and independently, without any central control. Additional difficulties are introduced by asynchrony (processes and channels operate at different speeds) and by limited local knowledge (each process has only a local view of the system and has a limited amount of information).

Distributed algorithms are algorithms designed to run in this quite challenging setting. They arise in a wide range of applications, including telecommunications, internet, peer-to-peer computing, blockchain technology...

This course aims at giving a comprehensive introduction to the field of distributed algorithms. A collection of significant algorithms will be presented for asynchronous networked systems, with a particular emphasis on their correctness proofs. Algorithms will be analyzed according to various measures of interest (eg., time and space complexities, communication costs). We will also present some "negative" results, i.e., impossibility theorems and lower bounds as they play a useful role for a system designer to determine what problems are solvable and at what cost.

Content:

- Modelling of distributed networked systems
- Wave and traversal algorithms
- Leader election
- Logical time and global snapshots
- Detection of stable properties
- Synchronizers
- Link reversal algorithms

5. LAN511FLE – Francais Langue Etrangere Niveau Debutant

Francais Langue Etrangere
ECTS: 3
Caltech Units: 9
Caltech Evaluator: Catherine Jurca
Caltech Credit: General Credit
Equivalent Course: N/A
Course Description: This is a French language class for foreigners. Students will be tested to see which level of French they are at and will be placed in the class appropriate for their level.