

COMPUTING, DIGITAL AND HARDWARE TOOLS FIELD_10 ECTS

Introducing

Description

Évaluation

L'évaluation des acquis d'apprentissage est réalisée en continu tout le long du semestre. En fonction des enseignements, elle peut prendre différentes formes : examen écrit, oral, compte-rendu, rapport écrit, évaluation par les pairs...

Practical info

Location(s)

 Toulouse

Concepts and hardware for data transmission

Introducing

Description

- Description and programming in Arm and x86 assembly languages.
- Description and use of a standardized C compilation chain via scripts, as well as the use of associated debugging tools.
- Description and analysis of the main aspects of the software's lower layers (function calls, data storage, associated security aspects) at C and assembly language level.
- Description and optimization of the use of hardware resources, particularly memory.
- Description and analysis of hardware vulnerabilities.
- Study of DFT, setup DFT parameters (window, number of points) according to a given application, (MATLAB)
- Study of spectrum aliasing phenomena, then design of an anti-aliasing filter,
- programming on STM32 controller for the laser shooting game in ASM and C.

Objectives

The module is divided into two parts, one dealing with assembler language and associated hardware architectures, the other based on numerous practical sessions, combining signal, electronics and embedded programming in assembler and C on STM32 controller. At the end of the module assembly language and hardware architectures, students will be able to program in assembly language, identify and correct software problems (resource under-utilization, bugs) in C and assembly language, and identify potential

hardware vulnerabilities.

The aim of the second part composed of 11 practical sessions is to study a telecommunication-type transmission system (optical link) at all levels, from signal aspects to on-board programming in ASM and C, including a small-scale electronic implementation on a test plate. The supporting application is a multi-player laser shooting game with use of DFT to identify players

Necessary prerequisites

- Knowledge of computer architecture and internal functional description (processor, memory, caches).
- C language.
- electronics and signal basics strongly recommended

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Practical info

Location(s)

 Toulouse

Graphs

Introducing

Description

Outline :

- General definitions of graphs
- Some classic graph problems (traversal, connectedness, shortest path, spanning tree, flow) and various associated solving methods.

Practical Labs in Graphs :

- In this lab, the concepts and algorithms of graph theory will be used to solve a standard problem requiring the development of known algorithms. Secondly, we will be asked to design a new algorithm to solve a more innovative problem.
- The programming language is Java.

Objectives

At the end of this module, the student should have understood and be able to explain (main concepts):

- how to use the formalism of graphs for modeling various classical problems in computer science
- The principles of several graph-based problem-solving algorithms.

The student should be able to :

- develop a classical graph algorithm to solve a known problem, but with large datasets,
- develop and compare different implementations of a known algorithm, in order to understand the notions of algorithm complexity,
- propose adaptations of classic algorithms to solve a new problem,

- conduct relevant test campaigns to evaluate the performance of different algorithms.

Necessary prerequisites

- Programming (Ada, C, Python, Java, ...)
- Advanced Algorithms and Complexity (3rd year MIC)
- Algorithms and Data Structures (2nd year MIC and 1st year)

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Practical info

Location(s)

 Toulouse

Object oriented programming

Introducing

Description

The student should be able to :

- design the class diagram of a simple application
- translate it into Java code
- program a simple application in JAVA, using object-oriented programming concepts

Practical info

Location(s)

 Toulouse

Objectives

By the end of this module, the student should have understood and be able to explain (main concepts):

- The different programming paradigms
- The principle and advantage of object-oriented programming
- The principles and fundamental notions of object-oriented design and programming
- The principles of UML class diagrams to represent an application using an object-oriented approach, and the use of the object-oriented programming language Java to implement the model designed.

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Numerical culture and skills 2

Introducing

Description

The flow of Machine Learning
Data preparation
Machine Learning Terminology
Data types
Data visualization, quality and size
Reliability
Some activation functions
Model performance
Environmental impact

Objectives

At the end of this module, which follows the 2A module, the student will have consolidated his knowledge of the field of AI: accuracy, loss function, overfitting, batch size, visualization techniques... He will also have prepared and passed a PIX certification.

Necessary prerequisites

Basics of Python programming

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Practical info

Location(s)

 Toulouse