

3rd YEAR MIC_IR SPECIALITY SEMESTER 6

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

Évaluation

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Practical info

Location(s)

 Toulouse

System and Network Programming



ECTS

Hourly volume
59h

Introducing

Description

The unit is divided into three parts:

Part 1: "System Programming and Multithreading" (12.5 hours of lectures, 6.25 hours of tutorials, 11 hours of practical work)

The course teaches the concepts and techniques related to the use and manipulation of mechanisms on an operating system instance:

multi-programming (process, thread),

local communication (IPC),

process synchronization (signaling, semaphores, condition variables),
scheduling.

An introduction to parallel processing is also provided. The entire course is illustrated by practical exercises in multi-threaded programming using synchronization and scheduling functions.

Part 2: "Internet Applications and Socket Programming" (6.25 hours of lectures, 5.5 hours of practical work)

The first part of the course details the main distributed applications on the Internet: http, ftp, sftp, SMTP – POP3/IMAP4, Telnet, SSH + pooling/clustering techniques, P2P model, multimedia applications.

The second part presents the socket programming interface (socket API), the basic technology for coding a distributed application (in particular) on the Internet.

Two practical sessions are dedicated to the implementation (in C language) of concepts associated with distributed programming via UDP and TCP sockets (via the programming of a configurable traffic

generator/receiver).

Part 3: "Integration Engineering Department" (13.75 hours of practical work + 3.75 hours of tutorials)

A design office (DE) concludes the UF. Its objective is to design and develop a Transport-level protocol (TCP-level) in C language optimized for the transport of distributed video streams in real time. The optimization consists of developing a partially reliable loss recovery mechanism, taking advantage of the loss tolerance of video applications to minimize the transit time of application packets. The service offered is accessible through an API whose service primitive specifications are provided, and which students are required to develop. Managing asynchronism in communication between the application and the Transport service is also addressed, in conjunction with the system programming and multithreading course.

The objectives are assessed based on an integration project report and an assessment of student engagement during the practical sessions. Written exams and/or multiple-choice questions may supplement the validation of theoretical skills.

Objectives

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

concurrent programming with threads

possible interactions with operating systems (main system calls)

the main distributed applications on the Internet: HTTP, FTP, SFTP, SMTP – POP3/IMAP4, Telnet, SSH + pooling/clustering techniques, P2P model, multimedia

applications

fundamental concepts associated with programming
distributed applications on the Internet via the socket
API

the use of finite state machines (FSM) for protocol
specification

The student should be able to:

- use and program an operating system on single- and multi-processor (threaded) machines
- use the socket API to develop (in C language) a distributed client/server application on the Internet
- specify in FSM form and program in C language a transport-level protocol optimized for the transfer of real-time video
- manage asynchronism in communication between the application and the Transport service
- to develop and implement experimental scenarios (here aimed at proving the benefits of the optimized protocol compared to a traditional TCP-type protocol).

Location(s)

 Toulouse

Necessary prerequisites

Introduction to Operating Systems (3rd year MIC)

Introduction to Computer Networks (3rd year MIC)

C Language (3rd year MIC)

Assembly Concepts (3rd year MIC)

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Practical info

Telecommunications systems



ECTS



Hourly volume
68h

Introducing

Description

Random signals: random process, stationarity, correlation, ergodicity, covariance, spectral density.

Digital filters: fast Fourier transform, discrete signals and systems, structure and properties of recursive and non-recursive filters, design methods.

Telecommunications systems: data rates, eye diagrams, transmission lines, baseband coding, analog and digital modulation, constellation diagrams, frames, multiplexing, channel access (FDMA, TDMA, CDMA), spread spectrum. There will also be an introduction to mobile networks, space communications and securing wireless communications. The tutorials will go into greater depth on the concepts seen in class, and will focus on well-known applications of telecommunications systems (e.g. USB, Bluetooth, FM radio, etc.). Lab classes will address the design of analog and digital modulations using Software Defined Radio (SDR) tools and an implementation on Universal Software Radio Peripherals (USRP) to develop a wireless telecommunication system. An introduction to the topic of communications security will also be illustrated.

Objectives

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

- o Definitions related to random signals
- o Basics of spectral analysis
- o Structures and design modes of digital filters
- o Operating principles of telecommunication systems

The student will be able to design a simple digital filter and the architecture of a telecommunication system: choice of the modulation, choice of the media access type, etc.

Necessary prerequisites

Signal Process Course

Évaluation

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Practical info

Location(s)



Toulouse

Business Game

Introducing

Description

Simulation of 5 years of company life (decision making in production, finance, marketing) using the SIMGEST business game.

Objectives

The student must have understood and be able to explain the interdependence of the company's functions (production, commercial, financial, human resources) through decision-making and analysis of the company's economic and financial results. He will have to understand how a company operates, construct financial statements, calculate costs, create simple management tools, optimize resources to make the company profitable, present an oral report of activities (in English)

Necessary prerequisites

financial management cours in 3A

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Practical info

Location(s)

 Toulouse

Company Finance

Introducing

Location(s)

 Toulouse

Description

Income statement, Cash flow, Balance sheet. Elements on costs. The break-even point. Taking inventory into account in financial statements. Debt financing. Company profitability.

Objectives

The student must have understood and be able to explain the company's financial summary documents as well as the basics of cost calculation in the industrial company.

Évaluation

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Practical info

Business Communication

Introducing

None

Description

Students will create a fictitious start-up in a market of their choice, conducting market analysis and identifying competitors. They will produce a GoFUND Me video and practice holding meetings and solving business challenges in English. The final presentation will be a “Shark Tank”-style competition, where students pitch their business idea to a panel of investors.

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Practical info

Location(s)

 Toulouse

Objectives

This course aims to equip students with essential business communication skills. Students will learn to understand a simple business plan and market research, conduct meetings, and use key business vocabulary. They will develop skills to describe graphs and create high-impact presentations. Students will also practice pitching to investors, introducing a company, and discussing social and environmental responsibility in the workplace.

Necessary prerequisites

Physical Education

Introducing

Description

Évaluation

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Practical info

Location(s)

 Toulouse

Professional Path Initiative 3rd Year

Introducing

Description

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Practical info

Location(s)

 Toulouse

Societal Openness Modules

Introducing

Description

- Openness to societal issues (Energy transition, Ecological transition, Digital society, Health global, Mobility and infrastructure)
- Themes with interdisciplinary approaches, mixing Sciences & Techniques and Human Sciences and Social or Thematic in SHS complementary to the base proposed by INSA Toulouse.

Each year, the Opening Modules Commission draws up the list of MOs which will be offered in the 2nd semester. Students then choose the MO they wish to experience via a wish phase on a dedicated application. Students are informed of the MO they will follow during the month of January.

- Offered in the 2nd semester of 3A, Monday afternoon from 2 p.m. to 4:45 p.m.
- Open to all specialty pre-orientations (PO)
- Duration: 30 hours student (NB: additional personal work of around 30 hours is expected)

Educational format:

- Active pedagogies
 - Face-to-face, hybrid or fully remote
 - ECIU+ Challenge Based Learning possibility
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Objectives

The Societal Openness Modules are courses open to the 5 societal issues addressed by INSA Toulouse, allowing complex situations to be understood and covering themes not covered in INSA courses.

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Practical info

Location(s)

 Toulouse