Master MIAGE 2IS
Innovative Information System

SYLLABUS BOOK

University of Toulouse Capitole

2021-2026

UNIVERSITÉ TOULOUSE CAPITOLE

FACULTÉ D'INFORMATIQUE

SYLLABUS

Master mention **MIAGE**
Méthodes Informatiques Appliquées à la Gestion des Entreprises

Parcours **2IS**
Innovative Information Systems

Formation **initiale**

Advanced Databases

Teachers: Manon Prédhumeau

Period: year 1, semester 1

Code apogee:

Number of contact teaching hours: 36

Estimation of individual work (total number of hours):

Language of the course: English

ECTS: 5

Course description

This course aims to provide a comprehensive understanding of database concepts and equip students with the skills to implement and query relational databases effectively. Students will consolidate and deepen knowledge of relational databases, and develop practical skills through guided and hands-on exercises.

Prerequisites

- Basic knowledge of relational model (data modelling course and basics of Entity-Relationship model)
- Proficiency in using an operating system (Windows, macOS, or Linux)
- Basic knowledge of what databases are and their purpose.

Competences acquired

At the end of the course, you will be able to:

- identify some challenges of data management,
- interpret and use relational data models,
- use Structured Query Language (SQL), the most common database manipulation language to build and query a relational database,
- have some experience with Oracle, the most pervasive database management system.

- gain skills in navigating interfaces of SQLDeveloper, building and running SQL statements and querying data.

Rough program

Note: the following schedule is given on an indicative basis.

The course is organised as follows:

1. Introduction to databases (3 hours)
2. SQL as a Data Query Language (21 hours)
    a. Primitive operators and aggregates
    b. Cartesian product, implicit join and set operators
    c. Joins
    d. Groups
    e. Nested queries
    f. Division
3. SQL as a Data Definition Language (5 hours)
4. SQL as a Data Manipulation Language (5 hours)

Evaluation method

The evaluation will involve take the following form:

- A short quiz every two weeks on concepts seen the weeks before (5 quiz, each 10% of final grade)
- A group project with a written report and an oral presentation (20 % of final grade)
- Final written examination (30% of final grade)

Specific course rules

Course material

Slides and exercises available on Moodle
Oracle, Oracle Express, SQLDevelopper, Oracle Live SQL

Bibliography / Webography

S. Sumathi and S. Esakkirajan. (2010). *Fundamentals of Relational Database Management Systems (1st. ed.*). Springer Publishing Company.

Patni, J. C. (2023). *A comprehensive study of SQL practice and implementation*.

DeBarros, A. (2022). *Practical SQL a beginner's guide to storytelling with data* (2nd ed.).

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Master mention **MIAGE**
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Parcours **2IS**
Innovative Information Systems

Formation **initiale**

Business Intelligence

Teachers: Ronan Tournier, Moncef Garouani

Period: year 1, semester 1

Code apogee:

Number of contact teaching hours: 36

Estimation of individual work (total number of hours):

Language of the course: English

ECTS: 5

Course description

The objectives of this course are to understand the concepts related to Business Intelligence as well as to design and implement the components of a decision support system. First, we study the components and the role of decision support systems. Second, we learn how to design and deploy a data warehouse. Third, we address the multidimensional modeling of data marts. Finally, we discuss some state-of-the-art solutions dedicated to data visualization.

The course is divided into four parts.

1. **Concepts and architecture of decision-support systems.** Firstly, we find answers to some frequently asked questions such as *why does a company implement a decision support system*, *for whom a decision support system is implemented* etc. Then, we will study the functional architecture of a decision-support system.

2. **Relational Databases and Data Warehouse.** Firstly, we study the role of relational databases in decision-making processes. Then, we focus on relational modeling and querying of data warehouses.

3. **Multidimensional Databases and Data Mart.** Firstly, we study the conceptual modeling of multidimensional databases. Then, we implement a multidimensional data mart

according to different logical and physical modeling solutions. Finally, we carry out some multidimensional analyses in well-known decision-making tools.

4. **Data Visualization.** Firstly, we discover principles and tools related to data visualization. Then, we apply some new-generation visualization tools to a concrete application case. Finally, we compare new-generation visualization tools with classical ones.

...

Prerequisites

Competences acquired

Rough program

Note: the following schedule is given on an indicative basis.

1. Concepts and architecture of decision-support systems (3 hours)
2. Relational Databases and Data Warehouse (12 hours)
3. Multidimensional Databases and Data Mart (15 hours)
4. Data Visualization (10 hours)

Evaluation method

The evaluation can involve the four parts of the course. It takes the following two forms:

- Individual exercises + one group project with oral presentation (40% of final grade)
- Final written examination (60% of final grade)

Specific course rules

Course material

Bibliography / Webography

- Kimball, R. (Ed.). (2008). The data warehouse lifecycle toolkit (2nd ed). Indianapolis, IN: Wiley Pub.
- Knaflic, C. N. (2015). Storytelling with data: a data visualization guide for business professionals. Hoboken, New Jersey: Wiley.
- Munzner, T. (2015). Visualization analysis and design. Boca Raton: CRC Press, Taylor & Francis Group, CRC Press is an imprint of the Taylor & Francis Group, an informa business.
- Oracle:

  https://docs.oracle.com/en/database/oracle/oracle-database/index.html

- SAP Business Objects: https://help.sap.com/viewer/p/SAP_BUSINESSOBJECTS_BUSINESS_INTELLIGENCE_PLATFORM

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Innovative Information Systems

Formation **initiale**

Software Design

Teachers: Umberto Grandi

Period: year 1, semester 1

Code apogee:

Number of contact teaching hours: 36

Estimation of individual work (total number of hours):

Language of the course: English

ECTS: 5

Course description

This course focuses on modelling software: it considers at first the structural and behavioral perspectives for analysing user needs; in a second step it focuses on requirements definition and finally overview classical patterns considered in the design stage. The class goes through the main UML diagrams and emphasizes the object paradigm for analyzing and designing a software system.

Prerequisites

Basic knowledge of programming and database modelling.

Competences acquired

- Being able to create diagrams representing the structural and behavioral models for analysing and designing a software (class, use-case, and sequence diagrams)
- Understand design pattern
- Understand the key concepts of the object-oriented paradigm and applying them during analysis and design activities

Rough program

- Introduction to UML
- Structural modelling and class diagram
- Behavioral modelling and sequence diagram
- Functional requirements and use case diagram
- Design principles and patterns

Evaluation method

Continuous assessment: two written evaluations and a presentation

Specific course rules

Attendance is compulsory

Course material

slides and exercices available on cours.ut-capitole.fr

Bibliography / Webography

The course follows closely the book:
UML@Classroom by Seidl, Scholz, Huemer, and Kappel
Springer, 2012
Chapters 1,2,3,4,6,8,9

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Innovative Information Systems

Formation **initiale**

Object Oriented Programming

Teachers: David Simoncini

Period: year 1, semester 1

Code apogee:

Number of contact teaching hours: 36

Estimation of individual work (total number of hours):

Language of the course: English

ECTS: 5

Course description

This course goes from basic concepts of object oriented programming to more advanced programming concepts and data structures, such as graphs or lambda functions.
The language JAVA will be used throughout the course.
Each session of 3 hours consists in a lecture focused on some specific programming concepts followed by a series of programming exercises.

Prerequisites

Basic knowledge of imperative programming : knowing what is a variable assignment, a conditional statement, a loop.

Competences acquired

- Being able to program efficiently following an object oriented paradigm
- Being able to design a graphical user interface in Java
- Master programming concepts such as exception handling, streams, and more

Rough program

- Basics of object oriented programming
- Abstract classes and interfaces
- Graphical user interfaces in Java
- Exceptions
- Map data structure
- Graphs
- Streams and lambda functions

Evaluation method

Continuous assessment: a minimum of two examinations, of which at least one evaluating each individual student.

Specific course rules

Course material

Slides, exercises and corrections are available on cours.ut-capitole.fr

Bibliography / Webography

Data Analysis and Visualisation

Teachers: Josiane Mothe

Period: year 1, semester 1

Code apogee:

Number of contact teaching hours: 36

Estimation of individual work (total number of hours): 60

Language of the course: English

ECTS: 5

Course description

Pedagogical objectives

Data analysis is crucial to help business and decision-making. Data analytics often serves as a precursor or complement to machine learning by providing insights that inform model development, while machine learning automates and scales the decision-making process based on those insights. Both are essential components of a broader data science workflow. This course aims at giving the students the keys to understand data analytics and associated concepts.

In this course, we focus on descriptive analysis as well as related topics that computer scientists should consider when analysing data: data representation, data visualisation and result interpretation. The main methods for data analysis and unsupervised machine learning methods are introduced as well as the contexts of applications. This course does not aim at going deep in the mathematical formulation of the methods.

Course content and activities

The course is composed of lectures, exercises and practical work.

Short exercises (on paper or computer) are direct applications that are used to illustrate and understand the concepts and use the methods presented in the lectures.

Practical work aims at applying the various concepts and methods learnt during lectures and exercises. Depending on the applications, practical work may use R, Python.

Prerequisites

Basics in programming and languages.
This is not a course on programming thus when needed some code will be given to the students.

Competences acquired

- *Know the concepts related to supervised and unsupervised machine learning*
- *Know how to use different data analytics methods*
- *Know to use R for machine learning*
- *Know how to analyse data*
- *Know how to pre-treat data: information extraction, information representation for textual data*

Rough program

Lectures and exercises:

Introduction to data analytics

Big data

Data representation

Variable

Descriptive analysis of 1 variable

Correlation

Unsupervised classification methods: agglomerative clustering and k-means

Interpretation of results and visualisation

Evaluation of results

Practical work:

First practical work use small data sets and help in understanding the main concepts.

A project will be developed in teams on a real case application and data set.

Evaluation method
Continuous assessment: a minimum of two examinations, of which at least one evaluating each individual student.
Specific course rules
Course material
Bibliography / Webography
Exploring Textual data by Ludovic LEBART, Kluwer (1998) *Data Analysis with Python, by David Taieb. Released December 2018. ISBN: 9781789950069* *R for Data Science by Garrett Grolemund, Hadley Wickham. 2015*

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Innovative Information Systems

Formation **initiale**

Project Management

Teachers: Benoit Marsa

Period: year 1, semester 1

Code apogee:

Number of contact teaching hours: 36

Estimation of individual work (total number of hours):

Language of the course: English

ECTS: 5

Course description

The objective of this course is to introduce the fundamental concepts of project management, with particular attention to information system projects.

As announced, this course is structured in two parts.

A first part dedicated to traditional Project Management Methods, because it is important to understand the basics of traditional Project Management in order to appreciate the benefits of adopting innovative techniques. Traditional Project Management methods are based on deterministic approaches that use detailed plans, Gantt charts, work schedules….

A second part dedicated to Agile methods. Such methods promote a value-driven approach that allows the Project Manager to deliver high-priority, high-quality work. It is based on iterative and incremental development in which requirements and solutions evolve through collaboration.

Prerequisites

Competences acquired

The traditional Project Management part covers the main processes and knowledge area related to project management:

- Define a project scope management,
- Manage project time and costs management,
- Identifiy project risk and quality management
- Define a WBS
- Build a planning using a Critical Path Method
- Monitor and control a project during its whole life.

The Agile part is based on the main agile processes: XP, Scrum and RAD. The first part covers : Values and Principles which are common to all agile processes. Main notions about collaboration, cooperation and hierarchy are inspected. This course does not give a catalog of the different agile processes, but is constructed in order to take a step back.

- How to manage and lead an agile team:
- Identify the right organization
- Organize a daily Meeting as a Scrum Master
- Organize a retrospective as a Scrum Master
- Organize a Sprint Planning Session
- Organize a common and collective estimation

Rough program

Project Management

The course is composed of theoretical lecture sessions and of workshops during which students have to solve in small groups, through activities and serious games, different case studies implementing the topics covered during the classes:

- Brainstorming activity and WBS development,
- Workload estimation, critical path identification, planning construction, introduction to MS Project
- Risk management through Ishikawa method

Agile Project Management

One lesson is always composed of a theoretical input which is immediately accompanied by an application : serious game, case study, research and collaborative work. We try to apply agile principles in the way of learning like in eduScrum.

Evaluation method

Evaluation of the case studies solved during the workshops. We use a Kanban case study, and we the main agile principles, rituals and organization in an agile planning workshop. (50%)

Final written examination (50%)

Specific course rules

Course material

All the course material is on Moodle

Bibliography / Webography

- A Guide to the Project Management Body of Knowledge: PMBOK Guide, Project Management Institute
- Information Technology Project Management, Kathy Schwalbe, Cengage Learning
- Be fast or Be gone, Racing the Clock with Critical Chain Project Management, Andreas Scherer
- Lean and Agile Project Management, Terra Vanzant Stern
- Agile Project Management, Gary Chin
- Agile Project Management, Ken Schwaber
- How Stella saved the farm, a tale about making innovation happen, Vijay Govindarajan & Chris Trimble
- Guide pratique des 5S et du management visuel, Christian Hohmann, Eyrolles
- Gestion de projet, vers les méthodes agiles, Véronique Messager-Rota, Eyrolles
- Coacher une équipe Agile, Véronique Messager, Eyrolles,

- Développer l'agilité dans l'entreprise, J; Barrand et J. Degaline, collection formation permanente
- Agile retrospectives, Esther Derby, Diana Larsen, Ken Schwaber, Broché, 2004
- Rapid software development through team collocation, Covi, L.A. ; Krishnan, M.S. ; Olson, J.S., Software Engineering, IEEE Transactions on (Volume:28 , Issue: 7)

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Formation **initiale**

Research Workshop 1

Teachers: David Simoncini

Period: year 1, semester 1

Code apogee:

Number of contact teaching hours: 15

Estimation of individual work (total number of hours):

Language of the course: English

ECTS: 2

Course description

Lectures are be organised around three activities:

1.Webpage and discussion platform (Activity 1): students have to create a webpage of the course, containing the minutes of each class, the program of past and future lectures, as well as a sharing or discussion forum where ideas for individual and group presentation are discussed and voted, as well as a suitable platform to share and present the material created in class.

2.Group presentations (Activity 2): each week the teacher together with the students selects a group of 3 or 4 students and a topic for next week's lecture, choosing among those discussed on the webpage. The group is then responsible to prepare a 30 minutes presentation on the chosen topic.

3.Individual presentations (Activity 3): topics can be proposed by single students on the discussion platform and can be voted by the other students. Once a month the most voted proposal is selected and a 30 minutes individual presentation is prepared by the student behind the proposal.

Prerequisites
Competences acquired
Contemporary job market requires a dynamic adaptation to new technologies and practices. The first objective of this weekly workshop is to acquire the capabilities for personal development to be used for life-long personal and group training: information search, elaboration, and presentation (Objective 1). A second objective is to share knowledge and experiences among the group of students to obtain an homogeneous group (Objective 2). Finally, the third objective is to learn how to work in a team, putting in practice what is being learned in the soft skills course (Objective 3). Critical thoughts and constructive attitude will be encouraged
Rough program
Every course lasts 1 hour and 20 minutes, and will be structured as follows: •10 minutes of questions and answers on urgent issues concerning the course development •30 minutes of group or individual presentation •20 minutes of discussion •10 minutes of preparation of the next class (deciding topic and assignments) A secretary will be chosen during each session to take minutes of the decisions taken, post them on the webpage together with the material presented in class. Here are some examples of topics for the first student presentations: •The startup environment in France and in Toulouse. Describe the opportunities for IT graduates, the most successful startups, the lessons that can be learned from those that failed, as well as the resources available locally in Toulouse. •IT companies in Toulouse. Describe which are the largest or most interesting IT companies in the local area, and what technologies do they use and develop. •Research in IT and CS in Toulouse. Present the research environment in computer science and information technology in Toulouse, the research labs, the main topics studied, and focus on the achievements of one research group. •How to find an internship in France and Europe in general. What are the main companies in IT that hire interns (like you next year), what kind of contract should be expected, and what are the best practices and strategies to find a challenging internship. •The social and economic consequences of IT technologies. Plenty of possible avenues, for instance the consequences on the job market, their psychological effects, and possible ways to cope with them.
Evaluation method

Students will be evaluated according to the following three criteria: •Participation in class (evaluating Objectives 1 and 3), evaluated by the teacher with a point system (40% of final grade). •Participation in group activities (evaluating Objective 1 and 3), evaluated by the students with peer-grading on Spliddit.org (40%). Participation to the webpage and the sharing platform (evaluating Objective 2), evaluated by the teacher with the help of a tool proposed by the students (20%) One of the first assignment to a group of students will be to create a tool that assess the workload of each student and her or his attitude towards the group, and a website and sharing platform that fit the requirements needed for the course activities.
Specific course rules
Course material
Bibliography / Webography

Personal Development

Teachers: Michael Evgi

Period: year 1, semester 1 and 2

Code apogee:

Number of contact teaching hours: 15

Estimation of individual work (total number of hours): 10

Language of the course: English

Course description

As the trends evolve towards automation and artificial intelligence, and as many technical skills could become obsolete in the coming years, companies are showing an increasing interest in skills that cannot be delegated to a robot: Soft skills, or behavioral skills, are the most sought-after skills by recruiters, in addition to technical know-how. If creativity, interpersonal skills and team spirit have always been part of the marketing and communication professional's panoply, the soft skills expected by the sector are evolving towards emotional intelligence (empathy, listening) to understand others, efficiency and organization in the face of the speed inherent in business, boldness and an entrepreneurial spirit oriented towards the search for solutions, the ability to create meaning in daily professional life, curiosity and openness to allow one's own skills to evolve and to learn to learn during one's career.

Prerequisites

No prerequisite

Competences acquired

- Awareness and knowledge of intercultural specificities
- Emotional and relational intelligence and a sense of otherness (empathy, listening). Open-mindedness and observation skills (informal monitoring...).
- Time and stress management, organization and professional efficiency through tools and methods (work routines...).
- Ability to visualize a path to reach an objective and development of the meaning brought to the professional action to reinforce motivation and confidence.
- Audacity, proactivity, entrepreneurship, disruption and self-learning skills.
- CV ant motivation letter, applications, interviews

Rough program

#1 Intercultural Team building
#2 Soft skills & motivation
#3 Emotional intelligence Stress Management
#4 CV, letter, application
#5 Theater
#6 Theater
#7 Working in a group, collaboration
#8 CV, letter 2, interviews, professional project
#9 Professional posture
#10 Closing

Evaluation method

Continuous assessment:
Per semester: A live klaxoon quizz about contents of 5 sessions, and a written production based on 5 questions of self assessment et knowledge of oneself,

Specific course rules

A group contract is build by and with the students

Course material

Bibliography / Webography

Term Project 1

Teachers: Sylvie Doutre

Period: year 1, semester 1

Code apogee:

Number of contact teaching hours: Project week

Estimation of individual work (total number of hours):

Language of the course: English

ECTS: 2

Course description

This is a group project. Each group is made of 3 or 4 graduates. The composition of the groups is decided by the teachers of the first semester.

The project consists in an analysis of the problem presented in the subject, and in the proposal of a practical, implemented, solution to this problem. A presentation of the problem and of its solution by the graduates is done during a poster and demonstration session.

Prerequisites

The other courses taught during the first semester.

Competences acquired

The Term Project aims at applying knowledge and understanding of information systems on a broad sense, as taught during the first semester of the degree, to a practical problem. As a group project, it promotes the development and the demonstration of interdisciplinary, transferable skills, with an emphasis on project management, and presentation skills.

The Term Project extends over a week. Its subject stems from suggestions of the teachers of the first semester of the degree; it is linked to their research or industrial activities on information systems. Over the week, each group of graduates has to propose an innovative solution to this problem.

This project aims to provide graduates with practical experience of value to their future careers and with the ability to address problems related to information systems with confidence.

Rough program

The project runs over a week (5 days). A typical course schedule:

- Day 1: Presentation of the subject of the project, and appropriation by the students
- Day 2: Conception of a solution product
- Day 3: Prototype creation
- Day 4: Product completed
- Day 5: Delivery during a Poster and demonstration session; teachers of the degree, and students and teachers from other degrees of the Faculty of Computer Science, participate in this session.

Each day, meetings with the project coordinator take place, to validate the advances.

Evaluation method

The evaluation is a group evaluation. It relies more precisely on: 1) the group advances all over the week, 2) on the presentation of the problem, thanks to the Poster, and on the demonstration of the solution product during the delivery session, and 3) on the documents related to the project that the group produced. The project coordinator is involved in the whole evaluation process; the teachers of the degree are involved in part 2 of the evaluation.

Specific course rules

Course material

Bibliography / Webography

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Formation **initiale**

Business Process Intelligence

Teachers: Chihab Hanachi

Period: year 1, semester 2

Code apogee:

Number of contact teaching hours: 36

Estimation of individual work (total number of hours): 86

Language of the course: English

ECTS: 5

Course description

Business Processes (BPs) are widely recognized as an essential component of Information Systems given the growing need for organizations to both cooperate with others and coordinate their activities inside their own structure.
This course will cover the BP life-cycle including process design and analysis, its enactment as a workflow and also advanced topics around process mining: process discovery, conformance checking and predictive monitoring. Both theoretical backgrounds and tools will be presented to allow students to build Process Aware Information Systems.

Prerequisites

Software Analysis and Design course (Master 1).

Competences acquired

Students will learn how to :

- Position BPM within Information System Area
- Model Business Processes with the standard BPMN notation
- Build Business Information Systems on top of Process Management Systems such as YAWL, Bonita or IteropSuite
- Discover process from log files
- Measure and improve the quality of a process.
- Identify deviations between a normative behavior (model) and its real execution
- Making predictions about ongoing processes

Rough program

1 - Intuitive approach, motivation and positioning

- Process through an example
- Process as a mean to support coordination in collaborative systems
- Process as a first class citizen component of information systems
- Application domains

2 - Foundation: models, languages and architecture

- Terminology: ontology of the concepts involved in business process area
- Process life-cycle
- Workflow Management System architecture
- Conceptual models to describe a process: data, organizational and control perspectives
- Language and formalism for modelling processes: Petri nets, BPMN
- Process Orchestration and Choregraphy
- Inter-organizational processes

3 - Process mining and quality measuring

- Discovering process from log files : alpha algorithm
- Indicators for flexibility, efficiency and robustness
- Analyze through Simulation

4. Conformance checking and predictive monitoring

- Conformance checking
- Deviation detection
- Predicitve monitoring

4. AI powered BPI

We will illustrate the course with five tools:

- TINA for Petri nets representation and analysis of processes
- BIPM for simulation
- Bizagi for BPMN models design and simulation
- Prom for process mining, conformance checking and deviation detection
- Iterop Suite for process enactment

Evaluation method

Exercises and a group project (40%) and individual test (60%).

Specific course rules

Course material

Course slides and exercise sheets are available on Moodle platform; Tools to be downloaded: process management system Iterop, process mining tool ProM ; Petri Net Editor TINA ; Bizagi process modelers
Bibliography / Webography
Marlon Dumas,Marcello La Rosa,Jan Mendling,Hajo A. Reijers: Fundamentals of Business Process Management. Springer 2013. Wil M. P. van der Aalst, Process Mining - Data Science in Action, Second Edition. Springer 2016. Josep Carmona, Boudewijn F. van Dongen, Andreas Solti, Matthias Weidlich:Conformance Checking - Relating Processes and Models. Springer 2018, ISBN 978-3-319-99413-0, pp. 1-263. Marlon Dumas, Business Process Analytics: From Insights to Predictions. DB&IS 2018: 15-20

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Formation **initiale**

Web Programming

Teachers: Benoit Gaudou

Period: year 1, semester 2

Code apogee:

Number of contact teaching hours: 36

Estimation of individual work (total number of hours): 89

Language of the course: English

ECTS: 5

Course description

Web programming attempts to cover all the skills required for a Full-stack web developper. It aims to start from the bases of front-end development (HTML, CSS, Javascript), before presenting back-end programing (using the framework SpringBoot) and the use of a framework to developer the front-end.
The course objective is to let the students to build a dynamic website (both on front and back-end parts) that build pages from data stored in a database (or from external API).

Prerequisites

Advanced skills in Java programming, Databases, and basic knowledge of the internet are necessary.

Prerequisites: Object Oriented Programming and Advanced Databases classes.

Competences acquired

During this Web programming module, you will learn:

- Bases of HTTP protocol
- Front-end development (using HTML, CSS, and Javascript)
- Back-end programing using the SpringBoot framework and routing, templating and creating page from databases sources.
- Basis of Rest Web service
- how to design and implements web services (using the Spring framework)
- how to consume web services
- Develop front-end website using a framework

Rough program

Part 1: front-end bases
1 Introduction to HTML, CSS and Javascript
2 Introduction to Javascript

Part 2: backend development
3 Introduction to Springboot
4 Routing and templating with Springboot
5 Building pages from databases using Spring/Springboot
6 ReST Full web services and Open API Specification

Part 3: frontend development using a framework (React.js or Angular)
7 Introduction to the framework and creation of a first website
8 Connection between front-end and back-end (how to consume a webservice)

Evaluation method

Continuous assessment: a minimum of two examinations, of which at least one evaluating each individual student:
- Evaluation of individual tutorials
- Evaluation of a group (2 students) project

Specific course rules

Course material

Course slides and exercise sheets are available on the Moodle platform.
Tools can be freely downloaded on their dedicated website (SpringBoot, React, Node.js….)

Bibliography / Webography

https://spring.io/

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Formation **initiale**

Marketing and Innovation

Teachers: Cyrielle Vellera, and Julien Grobert
Period: year 1, semester 2

Code apogee:

Number of contact teaching hours: 36

Estimation of individual work (total number of hours):

Language of the course: English

ECTS: 5

Course description

This course trains students to marketing and innovation/entrepreneurship approaches and methods. Students will be able to conceive and develop marketing strategies and tools (SWOT, PORTER analysis, Boston box…). Teaching methods used in this program include theory, case studies, practitioner conferences and a real company project. Students will take part in an innovation journey and build the most relevant and innovative concept on an exclusive topic given by an industrial group. Students will pitch their idea in front of a jury of managers and representatives.

At the end of the lectures students will also understand major issues and methods regarding entrepreneurship such as: acknowledge start up specificities, describe Business Model Canevas, understand what innovation is. This course also trains students to ideation techniques and creativity management. This course puts the emphasis on a good complementarity between academic and practical insights.

This course stresses on basic marketing for innovation technics and tools. Our lessons are divided in three majors parts (introduction to marketing, strategical part and operational part). We are using theory and real examples of companies or brands. Furthermore, students apply their knowledge to concrete business situations.
In addition, students will learn how to handle and solve a management case study focused on innovation and entrepreneurship. This activity enables students to develop their verbal and non-verbal communication skills.

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Prerequisites

Competences acquired

Rough program

Typical lecture is realized during 3 hours. A large part of the lecture is on the theory and the second part is on the own reflection of students and we are using real examples to stimulate students and push them to react.

Evaluation method

Students will receive a presentation grade and an exam grade:
- Presentation of a marketing case study (100% of final grade): students are required to work in team to analyze and propose relevant solutions to an exclusive case.

Specific course rules

Course material

Bibliography / Webography

- Vernette E., 2016, L'essentiel du marketing 3.0, 4ème édition, Eyrolles.
- Lendrevie J. et Levy J., 2014, Mercator, 11ème édition, Dunod.
- Solomon M.R., 2015, Consumer behavior, buying, having and being, Peason.

- Bairnes P., Fill C., Rosengrend S., Antonetti P., 2017, Fundamentals of marketing, Oxford press.
- Osterwalder, A., Pigneur, Y., 2013, Business Model Generation Hoboken, NJ: Wiley.
- Ries, E., 2014, The lean start-up principles. The Lean Startup, theleanstartup.com/principles
- Ulrich K.et Eppinger S.,2015, Product Design and Development, Mc Graw Hill Education
- Crawford M. et Di Benedetto A., 2014, New Product Management, Mc Graw Hill Education
- http://www.businessmodelgeneration.com/canvas/bmc

UNIVERSITÉ TOULOUSE CAPITOLE

FACULTÉ D'INFORMATIQUE

SYLLABUS

Master mention **MIAGE**
Méthodes Informatiques Appliquées à la Gestion des Entreprises

Parcours **2IS**
Innovative Information Systems

Formation **initiale**

Artificial Intelligence

Teachers: Camilo de la Torre, Umberto Grandi

Period: year 1, semester 2

Code apogee:

Number of contact teaching hours: 36

Estimation of individual work (total number of hours):

Language of the course: English

ECTS: 5

Course description

The course is structured in two parts.

1. Machine learning: building on the "Data Analytics" course proposed in the first semester, students will learn the basics of supervised machine learning such as SVM, linear classifiers, deep learning, and bayesian inference. At the same time, students will be asked to complete a group project in 5 weeks, selecting one of the techniques presented during the course and implementing it (typical example: a classification problem).

2. Reasoning: the second part of the course will cover classical AI techniques such as exploration and search algorithms, game playing, and constraint satisfaction. A set of exercises to be solved individually on paper will be proposed, as well as a second project based on modeling and solving a constraint satisfaction problem, with the objective of winning the end-of-course tournament.

Each part of the course lasts for 6 weeks, with the first 2 weeks dedicated to lectures by the teachers, and the remaining weeks consisting of tutoring sessions in the lab and student presentations. These two aspects are completed with an introductory session on

AI in the form of a world coffee and two lectures on the history and ethics in AI.
Prerequisites
The courses of Advanced Programming and Data Analytics in semester 1.
Competences acquired
The purpose of this course is to provide students with a broad overview of different techniques in AI, focusing on machine learning and reasoning with two separate projects. In implementing different techniques, students will get first-hand experience with AI and a detailed knowledge about certain techniques (objective 1). By explaining their choice of technique, and comparing it with other options presented during the course, students will also acquire a broad knowledge of AI tools and a critical approach to their practical application (objective 2). The projects will use classification and scheduling as mediums to test and explore algorithms, which will expose students to the major challenges and common benchmarks used in modern AI. The two projects will be developed in Python programming language, which the students will need to learn adapting their knowledge of Java to a new language (objective 3).
Rough program
Week 1 – 2 lectures. Word coffee on AI, introduction to machine learning, data representation, unsupervised learning (k-means, clustering), separability. Presentation of first project. Week 2 – 4 lectures. Supervised learning, regression and graded descent, bayesian models, SVMs, boosting, perceptron, backpropagation, kernels, neural networks, deep learning. Week 3 – 1 lecture and 1 supervision session. Ethics and AI: data. Week 4 – 3hrs project supervision Week 5 – 3hrs project supervision Week 6 – project deadline and 1h30 presentations by the groups Week 7 – 3 lectures. Exploration and search algorithms, computational complexity, non-informed search. WINTER BREAK Week 8 – 4 lectures. A* and informed search, heuristics, local/global optima. Game trees (MINMAX and alpha/beta pruning). Constraint satisfaction and constraint programming. Week 9 – Supervision session + Ethics and AI (the job market) + exercises check. Week 10 – 3hrs project supervision Week 11 – 3hrs project supervision Week 12 – project deadline and 1h30 presentation + tournament Projects will be done in groups of 3. For the first project, a different technique needs to be picked by each group, to make sure that all techniques covered in class gets implemented. Individual reports need to be handed in comparing the techniques developed with the other ones presented in class. Guidelines on the project supervision will be provided together with the project description.
Evaluation method

Continuous assessment: a minimum of two examinations, of which at least one evaluating each individual student.

Students will receive a project grade and an exam grade:

1. Two group projects and individual exercises (40% of final grade): the evaluation will take into consideration the performance of the algorithm developed by the students with respect to a benchmark given by the teachers, as well as with respect to the algorithms proposed by other groups; the quality of the code and the difficulty of the algorithm implemented; the student participation in the tutoring sessions; the individual report detailing the choice of techniques done by the group and an individual assessment and justification of these choices.

1. Final written examination (60% of final grade): two or more exercises will be proposed in a 3-hour long written exam, on machine learning and on reasoning. Students will have to choose and describe the appropriate techniques they would implement to solve the problem, analyse such methods with the techniques learned in class, propose innovative combinations of known techniques, and justify their choice with respect to the other techniques presented in class.

Specific course rules

Course material

Course slides, exercises and past exams available on the online platform https://cours.ut-capitole.fr/course/view.php?id=10050

Bibliography / Webography

Russell and Norvig. Artificial Intelligence, Third edition. Prentice Hall. 2009

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Parcours **2IS**
Innovative Information Systems

Formation **initiale**

Research Workshop 2

Teachers: Umberto Grandi

Period: year 1, semester 2

Code apogee:

Number of contact teaching hours: 15

Estimation of individual work (total number of hours):

Language of the course: English

ECTS: 2

Course description

Lectures will be organised around three activities:

1. Reading, understanding, and presenting scientific papers (Activity 1): each student will pick one article from a set proposed by a teacher, and prepares a short presentation (15-20 minutes) to explain it to the group, contextualising it to a particular problem.
2. Interview with researchers (Activity 2): each student selects a researcher in Toulouse who works in the topic of the scientific paper chosen, and interview her/him on the latest finding in her/his field, her/his motivation to become a researcher, and her/his connections to industry.

3. Conceiving and writing a group position paper (Activity 2): four groups of students will research on four topics (privacy, job market, inequalities, warfare), producing each a position paper and a final presentation suggesting policies to tackle the social consequences of innovation in IT.

4. Individual presentations (Activity 3): topics can be proposed by single students on the discussion platform and can be voted by the other students. Once a month the most voted proposal is selected and a 30 minutes individual presentation is prepared by the student

behind the proposal.

Prerequisites

Competences acquired

Innovation in information technology goes fast. The techniques and softwares learned during a master programme can quickly be outdated – some would even argue that when a technology gets to the classroom it is already outdated. To be able to function effectively in a rapidly changing technological environment, you need to be able to understand the relevance of scientific papers to the problems you will be facing, comprehend the structure and the functioning of scientific research, and communicate your findings to the rest of your team (Objective 1).

Innovation in IT is affecting more and more our societies, and companies and public bodies will soon need take a stance on the social consequences of innovative information technologies, such as the disappearance of privacy and the transformation of the job market.

The second objective of this course is to make you aware of these social transformations, by learning how to construct and defend a solid opinion, and making recommendation for future policies (Objective 2).

Finally, the third objective is to learn how to work in a team, putting in practice what is being learned in the soft skills course (Objective 3). Critical thoughts and constructive attitude will be encouraged.

Rough program

Evaluation method

Students will be evaluated according to the following three criteria:

•Individual presentation and reports (evaluating Objectives 1), evaluated by the teacher (40% of final grade).

•Participation in group activities (evaluating Objective 1 2), evaluated by the teachers and the students with peer-grading on Spliddit.org (40%).

•Participation in class, to the webpage and the sharing platform (evaluating Objective 3), evaluated by the teacher with the help of a tool proposed by the students (20%)

Specific course rules

Course material

Bibliography / Webography

Term Project 2 or Internship

Teachers: David Simoncini

Period: year 1, semester 2

Code apogee:

Number of contact teaching hours: 1-month project

Estimation of individual work (total number of hours):

Language of the course: English

ECTS: 3

Course description

This is a group project or an individual internship that lasts 4 to 6 weeks at the end of the first year master program.

Prerequisites

Having completed the first two semesters of the Master 2IS.

Competences acquired

At the end of this period, your professional skills will be improved. This includes team work, presentation and writing skills, but also time management. Depending on the topic chosen, you will improve your competencies and get a first understanding of whether a certain subject fits your career plans.
Rough program
The projects/internships start at the beginning of May. At the end of June there are final presentations and a report to be submitted.
Evaluation method
Final presentation and report.
Specific course rules
Course material
The project topics are proposed by teachers of the master, and will be advertised around a month in advance on the courses platform. Internships have to be found at least two weeks before the start of the project.
Bibliography / Webography

French as a Foreign Language (FLE)

Teachers: Isabelle Kawa-Topoor

Period: year 1, semester 1 and 2

Code apogee:

Number of contact teaching hours: 60

Estimation of individual work (total number of hours):

Language of the course: French

ECTS: 6

Course description

The French course is aimed at students who wish to start, improve or perfect their French language skills in a university context. This involves working on the 4 skills described by the Common European Framework of Reference for Languages (reading, writing, listening and speaking) and thus to enhance students' chances of pursuing their studies in a French university.

The purpose of this course is to provide students a content adapted to their level so that «basic users »(it means students with an A1 or A2 level) could be able to reach the level B1 or B2, as independent users after 3 semesters.

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Prerequisites

Competences acquired
Class activities give priority to speaking in front of a group, understanding authentic documents related to current affairs with the aim of introducing students to Francophone culture, written expression and grammar.
Rough program
Evaluation method
Continuous assessment: a minimum of two examinations, of which at least one evaluating each individual student.
Specific course rules
Course material
TV5 Monde, apprendre le français. RFI, langue française. La grammaire des premiers temps, PUG. Moodle Space
Bibliography / Webography

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Master mention **MIAGE**
Méthodes Informatiques Appliquées à la Gestion des Entreprises

Parcours **2IS**
Innovative Information Systems

Formation **initiale**

Innovative Data Management

Teachers: Jean-Marc Thevenin and Julien Aligon

Period: year 2

Code apogee:

Number of contact teaching hours: 45

Estimation of individual work (total number of hours):

Language of the course: English

ECTS: 6

Course description

Considering the large volume and the variety of data that companies have to manage and analyze, this course reviews the different architectures proposed by database manufacturers to take advantage of parallelism and to ensure reliability as well as scalability. Indexing strategies for optimizing data retrieval are also reviewed.
Many lab sessions allow students to get know-how on the Cloudera CDH distribution, Oracle and SQL Server. A week-long project concludes this course.

Prerequisites

Basics in Java programming and more generally Object Oriented Programming.
Students should also know the Relational data model, data models used in Business Intelligence and the SQL query language.

Competences acquired

The purpose of this course is to identify the techniques for managing high volumes of data.
At the end students should be able to :

- Understand how these techniques allow to
  - improve performances,
  - fault tolerance and
  - Scalability
- Select a proper architecture or tool to analyse high volumes of data efficiently.
- Write parallel programs for analysing data using languages from different abstraction levels such as Map/Reduce in Java over Hadoop, Map/reduce in Scala over Spark, and PIG
- Select the proper language according to the problem to be solved using paralellism.

Students also get knowledge to select a NoSQL DBMS for a specific purpose.

Rough program

This module is composed in two parts.

Part 1:

Part one is related to parallel architectures proposed to handle high volumes of data. In this part we review parallel relational DBMS architectures first and then detail Hadoop and Spark architectures developed to analyse Big Data efficiently. We also review the main models used by NOSQL DBMS to handle large volumes of data which do not respect a specific schema.

Several lab sessions are dedicated to the Hadoop ecosystem using the CDH distribution of Cloudera. Along these lab sessions students learn how to:

- Use the HDFS storage system of Hadoop as well as the Hive and Impala relational DBMS running over HDFS and which are good candidate to handle a large Data Warehouse;
- Build regular expressions, very useful to split unstructured data such as Log files in order to import them into structured relational tables in Hive, or to analyse them using Map/Reduce programs;
- Write Map/Reduce programs in Java, taking advantage of the Hadoop parallel architecture;
- Write Map/Reduce programs in Scala, a functional object oriented programming language allowing to write concise programs taking advantage of the Spark parallel architecture;
- Write Pig programs, Pig being a high level language generating Map/Reduce programs.

Part 2:

The second part is related to the optimization of multidimensional databases. The concepts of database indexing are studied through the most popular methods : BTree, B+Tree, Bitmap, Join indexes. The materialized views are also addressed in the specific context of a multidimensional database for speeding up the computation of query aggregations. Strategies to optimize a set of typical multi dimensional queries using these concepts are benchmarked on the SSB large database implemented on two majors RDBMS, namely Oracle and SQL Server.

Evaluation method

Continuous assessment: a one week project for groups of two students and one evaluation evaluating each individual student.

Specific course rules
3 absences in class = 0.
Course material
Cours slides and Lab Sessions material available on cours.ut-capitole.fr*, or exercise sheets distributed in class…*
Bibliography / Webography
“Hadoop The Definitive Guide”, Tom White, O'Reilly editions http://bradhedlund.com/2011/09/10/understanding-hadoop-clusters-and-the-network/ “Principles of Distributed Database Systems”, Özsu, M. Tamer, Valduriez, Patrick, Springer 2020 Database Systems : the complete book (Garcia-Molina et al.) Database Systems : Design, Implementation and Management (Coronel et al.) Physical Database Design (Lightstone et al.)

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Master mention **MIAGE**
Méthodes Informatiques Appliquées à la Gestion des Entreprises

Parcours **2IS**
Innovative Information Systems

Formation **initiale**

Innovative Software Methods

Teacher: Chauvin Mathieu

Period: year 2

Code apogee:

Number of contact teaching hours: 45

Estimation of individual work (total number of hours): 70

Language of the course: English

ECTS: 6

Course description

This flipped course is organised as a multi-sprint collaborative project where students will be trained to agile software development as they develop in teams a web application. The course includes an exploration to gamification techniques, with practical integration to the developed application.

Prerequisites

Following this course assumes the student possesses a good understanding of client/server applications, is experienced in database modelling and management, and is ideally familiar with client-side web programming (HTML, css frameworks, etc.)

Competences acquired

At the end of the program, the student will demonstrate abilities in designing and planning the development of a productivity application given a product backlog. On top of his/her technical mastery of modern web architectures and techniques (ajax, web frameworks, etc.) he/she will show a good experience with maintaining a professional communication with the Product Owner. In addition, he/she will be trained to enhance applications with gamification for the purpose of better achieving the objectives of the client.

Rough program

- Introduction to Gamification
- Introduction to software quality
    - Software quality criterias
    - Technical Debt
- Product Backlog
    - User stories, technical stories
    - Debt : US rectification, Technical Debt
- Agile software engineering
    - Pair Programming
    - Coding rules, norms and standards
    - Code Review
    - Continuous Integration
- CSS/JS frameworks

Evaluation method

The evaluation includes an oral examination of the project. Deliverables can also be graded at the end of specific sprints.

Specific course rules

Attendance is mandatory

Course material

All material is available on cours.ut-capitole.fr

Bibliography / Webography

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Méthodes Informatiques Appliquées à la Gestion des Entreprises

Parcours **2IS**
Innovative Information Systems

Formation **initiale**

Strategy & Innovation

Teacher : Azzam Jamal, Mirc Nicola and Rouane Sihem

Period: year 2

Code apogee:

Number of contact teaching hours: 45

Estimation of individual work (total number of hours):

Language of the course: English

ECTS: 5

Course description

Corporations (large, medium and small-sized) play a central role in the economic activity of most developed countries. To survive and outperform their rivals, corporations must acquire and sustain competitive advantage mainly through innovation in terms of products, process, organization and/or business models.

The course is meant to introduce students to key challenges and choices regarding innovation strategies that technological companies typically face. The objective is to provide an overview of the basics of innovation management, with a particular focus on challenges related to digital transformation and intellectual property management.

The course is organized in three distinct albeit intertwined modules:

Module 1 "Strategizing for innovation" addresses key strategic challenges and choices firms face when seeking for remaining competitive through innovation. A specific focus is put on challenges related to digital transformation.

- Product vs Process vs Business Model innovation
- Technology push vs pull and the innovation diffusion S-curve
- Innovation through growth: buy, ally or Do-it-Yourself?

Module 2 "Business Game 'Global Challenge'" puts students in the situation of running their own tech company.

- Building an innovation strategy and managing R&D operations
- Adopting Marketing strategies to different markets internationally
- Making investment decisions and managing financial resources

Module 3 "Intellectual Property" focuses on the recent developments of the strategic management of patents in modern digital economies.

- Role of the patent system in modern economies
- How technological companies try to protect their innovations and to use their patent portfolios in service of their business strategies in a digital era
- Internal strategies and ways to organize for managing patent and licensing strategies as well as patenting in collaborative arrangements.

Prerequisites

Although there are no specific prerequisites for this course, all students are expected to have a sound mastery of the English language. Having taken some earlier course on strategic management and management of innovation will be useful, but is not strictly needed.

Competences acquired

Upon completing this course, students should be able to :

- ***Professional competence** : Acquire the basics of innovation and business strategy ; understand the links between innovation, digital transformation, strategic choices, strategic implementation and intellectual property ; apply conceptual tools and models to case studies to analyze innovation and strategic problems •*
- ***Methodological competence** : Transfer theory directly into application and formulating managerial recommendations*
- ***Social competence :** Communication and team work skills as basically integrated.*

Rough program

***Course organization** : A total of 45 hours organized in three modules of each 15h taught in the classroom.*

Evaluation method

Module 1 "Strategizing for innovation" (33%)
Written individual test (1h30) during 5th session

Module 2 "Business Game 'Global Challenge'" (33%)
Group end-of-the-game ranking and oral group presentation in 10th session)

Module 3 "Intellectual Property" (33%)

- In teams of 2, students summarize and discuss an assigned text. 1-2 pages to be handed in to the instructor (after the end of the course) and shared with the whole group.

- 10-15 minutes presentation during class (1-3 slides, dates will be communicated in december).
Specific course rules
Course material
All the slides presented and readings for each session will be made available right after on the specific students' Drive.
Bibliography / Webography
Schilling, Melissa A. – **Strategic Management of Technological Innovation**, 6th Edition – Mc Graw-Hill Johnson, Whittington, Scholes, Angwin, Regner – **Exploring Strategy**, 11th edition –Pearson – Text & Cases F.T. Rothaermel – **Strategic Management** – Mc Graw-Hill

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Master mention **MIAGE**
Méthodes Informatiques Appliquées à la Gestion des Entreprises

Parcours **2IS**
Innovative Information Systems

Formation **initiale**

Internet of Things and Web Development

Teachers: Laurent Marsan and Benoit Gaudou

Period: year 2

Code apogee:

Number of contact teaching hours: 45

Estimation of individual work (total number of hours):

Language of the course: English

ECTS: 6

Course description

The goal of this course is two-fold: first, study foundations of server-side scripting and second study internet of things. To do so, we consider an end-to-end perspective: starting from sensors and actuators, next information diffusion, next information storing and finally visualisation with web-based applications.

Prerequisites

Programming and object programming (Python, Java)
HTML and web site
Database (SQL-based)

Competences acquired

Being able to create a web application querying an SQL or a noSQL Database
Being able to build an application gathering data from physical sensors or activating actuators.
Being able to deploy a hardware architecture gathering data, based on Raspberry Pi.

Rough program

Part 1: server-side scripting
- Introduction to node.js and route definition
- Page engine and page template
- Building script querying relational and noSQL database
- Front-end framework: Angular.JS

Part 2
- Introduction to Internet of things
- Using sensors
- Using actuators
- Communication through MQTT
- Storing data in a database

Evaluation method

1 assignment, a 1 or 2 weeks group project and a final exam

Specific course rules

Attendance is mandatory

Course material

slides and exercice sheet available on cours.ut-capitole.fr

Bibliography / Webography

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Parcours **2IS**
Innovative Information Systems

Formation **initiale**

Advanced Topics in Artificial Intelligence

Teachers: Benoit Gaudou, Yuri Lavinas, Umberto Grandi

Period: year 2

Code apogee:

Number of contact teaching hours: 45

Estimation of individual work (total number of hours):

Language of the course: English

ECTS: 6

Course description

The purpose of this course is to give students in-depth knowledge in three advanced areas of artificial intelligence: complete the training in learning techniques with the use of deep learning architectures (part 1), provide students with the tools to set up a multi-agent simulation from modelling, data integration to the final analysis (part 2), model the rational behaviour of autonomous agents and analyse the algorithmic properties of socio-economic applications (part 3).

The course is structured in three parts which will be taught in sequence:

1. Deep learning. This part will first detail the functioning of artificial neural networks and inner mechanisms used to optimize synaptic weights. Practical sessions will be given in order to build deep neural networks to image analysis and to natural language processing. The framework Keras in Python will be used in this class.

2. Multiagent Simulations. We will introduce the modelling and simulation of complex systems (social systems in particular) using multi-agent simulation and will detail the main steps of this process, from data analysis, agent-based modelling, programing on a simulation platform (Netlogo or Gama), simulation exploration (using Open-mole) to the analysis of the results. The course will alternate theoretical approaches and practical issues.

3. Economics and Computation. We will introduce the main algorithms used in socio-economic activities, with a strong accent on those studied in the area of multiagent systems. The theoretical and practical aspects of these algorithms and mathematical models will be analysed. Topics varies each year and can include: introduction to game theory (strategic,
extensive, repeated), auction and mechanism design, online advertising markets, matching mechanisms, human computation and crowdsourcing, social choice and voting, reputation systems, social network analysis and diffusion on networks, and digital currencies.

Prerequisites

First year M1 2IS courses: Data Analytics, Artificial Intelligence

Competences acquired

From the technical point of view, students will advance in programming techniques, use of deep learning libraries in the cloud, conception and design of a simulation, and mathematical modelling. From the conceptual point of view, the course will stimulate the analytic capacity of the students in the understanding of social (multiagent) phenomena, collecting and synthesising information from multiple disciplines, being able to formulate and test hypotheses on socio-economic applications.

Rough program

Evaluation method

Students will receive a one final grade composed of:

● Individual grades on exercises, mini-projects, or written examinations.
● A final group project federating parts of the course on a real-word situation. The group project takes place during a project week, in groups of 3 students. Examples include modelling a strategic decisions (eg. deciding on various vaccination policies during an epidemics), simulating the process on small data, and then use deep learning to build a surrogate model and draw conclusions on larger instances.

Specific course rules

Course material

Course material available on cours.ut-capitole.fr

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Parcours **2IS**
Innovative Information Systems

Formation **initiale**

Cybersecurity

Teachers: Pierre-Yves Bonnetain-Nesterenko

Period: year 2

Code apogee:

Number of contact teaching hours: 24

Estimation of individual work (total number of hours):

Language of the course: English

ECTS: 2

Course description

Introduction to cybersecurity and defense in depth of computer systems.
The course is organized around six lessons and three hands-on lab session (2 lessons/1 lab session, and repeat).

Prerequisites

Student should be familiar with (basic+ level requested, except for networks) :

Computer networks, including low-level protocols (IP, TCP, ICMP, etc.)
Operating systems principles
Databases/SQL
Programming languages

Competences acquired

Perform a risk analysis of a computing system
Understand system vulnerabilities
Avoid most common security errors in architectures/software.

Rough program

Introduction to computing systems security failures
Cybersecurity strategies (defense in depth, identity and access management, monitoring, risks analysis)
Cryptography
Hands-on lab sessions

Evaluation method

Each lab session will be evaluated.

Specific course rules

Missed lab session (or no report) = 0

Course material

Slides available on cours.ut-capitole.fr, and exercise sheets distributed in class…

Bibliography / Webography

SYLLABUS
Master mention **MIAGE**
Méthodes Informatiques Appliquées à la Gestion des Entreprises

Parcours **2IS**
Innovative Information Systems

Formation **initiale**

Sustainable Information Systems

Teacher: Maria-José PRESSO

Period: year 2

Code apogee:

Number of contact teaching hours: 24

Estimation of individual work (total number of hours):

Language of the course: English

ECTS: 2

Course description

This course takes the form of short presentations, numerous hands-on activities, group and individual projects.
Web development notions are very useful but only the basics will suffice.
To better understand how to make a digital service more sustainable, we will consider some services that students use on a regular basis.
As a group project, students will have a whole application to design.

Prerequisites

Web development notions are very useful but only the basics will suffice.

Competences acquired

Digital is not as sustainable as we may think. The goal of this course is to understand what makes digital unsustainable and how to fix it. The first step is to analyze where the environmental footprint of digital comes from and how this relates to accessibility, cybersecurity, personal data, ethics, inclusive design and the attention economy. Then, we will learn how to fix this, through technical optimization, design best practices and a new mindset. Finally, all this will lead to innovation, which is only a part of the benefits expected from sustainability for an enterprise.
Rough program
Week 1 (1⁄2 day) : introducing digital sustainability. Week 2 (1 day) : from the assessment of the environmental footprint of digital to eco-designing a digital service Week 3 (1 day) : accessibility and cybersecurity on the web Week 4 (1 day) : creating a sustainable digital service (hands-on project) Week 5 (1⁄2 day) : project delivery & evaluation.
Evaluation method
The final grade consists of two items : ● group presentation of the designed sustainable application ● individual written examination, similar in structure to the activities and projects given during the course. The point here is to determine if the student understands the basics of digital sustainability and how they interact with each other.
Specific course rules
Course material
Slides will be made available en cours.ut-capitole.fr
Bibliography / Webography
Sustainable IT MOOC : https://www.isit-academy.org/ Sustainable Web Design : https://sustainablewebdesign.org/

SYLLABUS
Master mention **MIAGE**
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Parcours **2IS**
Innovative Information Systems

Formation **initiale**

User Interface and User Experience

Teachers: Camille FAYOLLAS

Period: year 2

Code apogee:

Number of contact teaching hours: 6 hours + Project week

Estimation of individual work (total number of hours):

Language of the course: English

ECTS: 2

Course description

In this course you will learn how to design and prototype user interfaces following User experience concepts and the principles of Universal Design. You will learn how to design for specific populations and situations, and you will apply the concepts to an interactive prototype.

Prerequisites

Competences acquired

At the end of the week the student will:

- Know the key concepts of Human centered design and usability of User interfaces;
- Know the Universal design principles;
- Apply the concepts and principles to the design of a specific solution for a target group;
- Design wireframes and prototypes adapted to the specific needs of a target group;
- Apply the principles of beta testing to the designed solution.

Rough program

Session1: Human Centered Design and User interfaces
Session2: Universal design
Session3: Design of a solution for a specific target group (inclusivity in all its aspects)
Session4: Low Tech
Session5: Design of a wireframe/interactive prototype of the solution
Session6: Projects presentations

Evaluation method

The final grade consists of 3 items :

- The mock/up for the specific target group
- group presentation of the designed application, explaining the used principles
- individual written examination, on the topics addressed during the more theoretical classes.

Specific course rules

Course material

All the material used during the class will be available on moodle.

Bibliography / Webography

https://www.nngroup.com/articles/ten-usability-heuristics/

Jacob O. Wobbrock, Shaun K. Kane, Krzysztof Z. Gajos, Susumu Harada, and Jon Froehlich. 2011. Ability-Based Design: Concept, Principles and Examples. ACM Trans. Access. Comput. 3, 3, Article 9 (April 2011), 27 pages. DOI:https://doi.org/10.1145/1952383.1952384

UNIVERSITÉ TOULOUSE CAPITOLE

FACULTÉ D'INFORMATIQUE

SYLLABUS

Master mention **MIAGE**
Méthodes Informatiques Appliquées à la Gestion des Entreprises

Parcours **2IS**
Innovative Information Systems

Formation **initiale**

Research Workshop 3

Teachers: Chihab Hanachi

Period: year 2

Code apogee:

Number of contact teaching hours: 15

Estimation of individual work (total number of hours):

Language of the course: English

ECTS: 2

Course description

The objectives of this course are :

- make students aware of the research world (laboratories, professions, funding, publications, PHD process and funding, evaluation...);
- expose students to various research methods such as feasibility studies, comparative studies, surveys, formal models, simulation…through the reading and presentation of research papers from the Information System and computer science fields (e.g. CAISE conference papers)
- develop students' skills in evaluating, presenting and writing research papers
- Develop methodologies skills to investigate a hot topic and present their findings (oral or writing)

…

Prerequisites

Previous research workshop courses (research workshop 1, research workshop 2).

Competences acquired

Students will:

- Understand how a big laboratory (such as IRIT) is organized;
- Be aware of the hot fields of research in computer science and information systems;
- Learn the processes of conducting a thesis and the different actors involved ;
- Be able to choose, apply and drive a research oriented internship,and then a PHD thesis;
- Understand the life cycle of research paper and how to write, evaluate and present a technical/scientific paper;

Rough program

- 1. Organization, functioning and evaluation of the research area in France and the IRIT laboratory.
  - *Production of a laboratory data model (researchers, topics, projects, publications…and their links)*
  - *Discovering, Positioning and Presenting a researcher (topics, team, publications, google scholar, h-index…)*

  2. Historical and thematic landmarks in computer science and information System Research (ACM classification, Visualizing cloud topics)
  3. Conducting a doctoral thesis illustrated by students' t*estimonials*
  4. Research methods (feasibility studies, comparative studies, surveys, formal models, simulation…) through the reading and presentation of research papers
  5. Evaluating and presenting research papers (from Caise and RCIS conferences)
  6. Exploring and synthesizing an existing project proposal (ANR) from our lab
  7. Investigate a hot topic (technic, theory, applications, tools) and present it simply but scientifically to the classmates (including a short state of the art, a demo if appropriate).
  Examples of topics in 2024: AI and journalism, LLM in education (challenges, limitations, risks, ethics).

Evaluation method

Continuous assessment: individual and group presentations in a conference format.
Several reports. Participation in group discussions.

Specific course rules

Course material

Exercise and course material available on moodle.

Bibliography / Webography

Some Hints to Improve Writing of Technical Papers, Patrick Valduriez, 1994, https://cs.stanford.edu/people/chrismre/cs345/rl/writing-hints.pdf

Research Methods in Computer Science, Serge Demeyer
https://win.uantwerpen.be/~sdemey/Tutorial_ResearchMethods/ResearchMethds01_MethodsOvervw.pdf

SYLLABUS
Master mention **MIAGE**
Méthodes Informatiques Appliquées à la Gestion des Entreprises

Parcours **2IS**
Innovative Information Systems

Formation **initiale**

French as a Foreign Language (FLE)

Teachers: Isabelle Kawa-Topoor

Period: year 2

Code apogee:

Number of contact teaching hours: 30

Estimation of individual work (total number of hours):

Language of the course: French

ECTS: 3

Course description

The aim of the course is to help students in their search for an internship by several activities in French while improving their French skills.
...

Prerequisites

First year M1 2IS courses

Competences acquired

Rough program
- - - CV reading and Analysis - CV writing - Mock interview - conducting interview
Evaluation method
Continuous assessment: a minimum of two examinations, of which at least one evaluating each individual student. Students will receive a one final grade composed of: ● Individual grades on exercises, mini-projects, or written examinations. ● A final group project : Alumni’s interviews with oral and written feedbacks
Specific course rules
Course material
TV5 Monde, apprendre le français. RFI, langue française. La grammaire des premiers temps, PUG. Moodle Space
Bibliography / Webography

English and English Writing Workshop

Teachers: Maxime Petit (English) - Maxime Petit & Sara Brennan (Writing workshop)

Period: year 1 and 2

Code apogee:

Number of contact teaching hours: 60 (English) + 10 (Writing workshop)

Estimation of individual work (total number of hours): 30

Language of the course: French

ECTS: 6

Course description

English:

The goal of this course is threefold. The first part of the course aims at developing fluency and students' confidence in their speaking skills. The second part of the course will focus on a crowdfunding term project involving writing, listening, reading & speaking activities. The third part of this course will focus on professional English and is designed to help students navigate the intricacies of job applications in English.

Throughout the semester, we will also go through a number of activities aimed at improving students' knowledge of English grammar.

Writing workshop:

This workshop is designed to provide students with tips and tricks to improve their academic writing skills. Instructors will provide advice on how to structure & clarify academic essays.

Prerequisites

English (B2 level; at the very least)

Competences acquired

English:

- Presenting one's professional project
- Describing one's education & work background
- Drafting a CV or a cover letter
- Answering job interview questions in a relevant and convincing way
- Giving presentations with confidence
- Communicating with confidence in a professional context
- Presenting a project in a (semi-)professional context
- Writing a report outlining the main steps in the development of a project

Writing Workshop:

- Organising one's thoughts
- Drafting the plan for an essay
- Adapting one's writing style to the task at hand
- Structuring arguments and providing examples illustrating claims
- Writing clear, concise and grammatically correct sentences
- Proofreading a text efficiently

Rough program

English:
Each part of the course described above (see 'Course description' section) will roughly correspond to one third of the course.

Writing workshop:
The writing workshop is structured as follows:

- 3h of class with all students (attendance compulsory). Basic principles of academic writing + practice
- 7h dedicated to one-on-one sessions (optional): students make an appointment by email with instructors at least 24h in advance and make sure to attach the paper they are writing for the Research workshop.

Evaluation method

Continuous assessment: two examinations.

Specific course rules

3 absences TD = 0

Course material

Course material handed out in class and available on Moodle

Bibliography / Webography

Writing Workshop (also available on Moodle):

Online resources:
https://writingcenter.fas.harvard.edu/
https://owl.purdue.edu/owl/general_writing/index.html
http://www2.port.ac.uk/media/contacts-and-departments/student-support-services/ask/downloads/Better-essays---signposting.pdf
http://owll.massey.ac.nz/pdf/studyup-essays-2-handout.pdf
https://portal.uea.ac.uk/documents/6207125/7632456/Using+signpost+words+and+phrases.pdf/4347566d-8b81-49ed-b715-e98d28467fed

Bibliography:

The Penguin Guide to Punctuation. London: Penguin Books, 1997.

Balistreri, Maggie. *The Evasion-English Dictionary*. Brooklyn: Melville House, 2003.

Colman, Ruth. *The Briefest English Grammar and Punctuation Guide Ever*. Sydney: University of New South Wales Press, 2005.

Kirkman, John. *Punctuation Matters: Advice on Punctuation for Scientific and Technical Writing*. London: Routledge, 2006.

Kirkman, John. *Good Style: Writing for Science and Technology*. London: Routledge, 2005.

Marquardt, Anne-Kathrin. *Exercices pratiques pour mieux rédiger en anglais dans le supérieur.* Paris: Ellipses, 2019.

Savage, Alice, and Mayer, Patricia. *Effective Academic Writing 2: The Short Essay*. Oxford: Oxford University Press, 2005.

Savage, Alice, and Shafiei, Masoud. *Effective Academic Writing 1: The Paragraph.* Oxford: Oxford University Press, 2007.

Smith, Ken. *Junk English*. New York: Blast Books, 2001.

Straus, Jane. *The Blue Book of Grammar and Punctuation*. San Francisco: Jossey-Bass, 2008.

Woods, Geraldine. *Punctuation: Simplified and Applied*. Hoboken, NJ: Wiley, 2006.

Internship

Teachers: Chihab HANACHI
Period: year 2
Code apogee:

Number of contact teaching hours:

Estimation of individual work (total number of hours):

Language of the course: English

ECTS: 20

Course description

The internship is 5 months long, usually taking place from mid-March to the end of August. The Internship could be carried out in a company or a research laboratory. The internship is completed with a written report and an oral defense. The subject of the internship must be described precisely in the form of an internship proposal (organizational and technical context, objective, subject, approach to be followed and expected deliverables). It must be validated by the internship supervisor before signing an agreement and starting the internship.

The internship will be assessed in two ways:

- Content: this is mainly evaluated by the company/laboratory tutor. It includes the quality and difficulty of the assignment;

- Reporting: this is mainly evaluated by the academic tutor. It consists of a report (dissertation) and an oral presentation in front of a jury (3 participants).

In a company, the subject of the internship must include a substantial element of design and analysis, as well as an innovative part linked with the content of the 2IS master. The assignment should not be a simple execution, but should be a mission including the following activities: planning the mission, specifying the problem to be solved and its objective, designing a solution and implementing it.

In a laboratory, the subject should be linked to innovative topics taught in 2IS (Sustainable Information System, Advanced Topics in AI, IoT, UIX, Data and Process Mining…). It should include research methods such as feasibility studies, comparative studies, surveys, formal models, simulation. Each year IRIT laboratory provides several internship proposals.

During the professional week (November) meetings with companies and researchers are also organized to help students in their internship seeking.

Competences acquired

Students will have the capability to:

- Solve real world problems under constraint;
- Deepen a research topic;
- Collaborate in a team;
- Present, in written report and oral form, a complex problem and its solution (method, contributions, innovative aspects…) in an understandable way for the target audience (peers, end-users…).

Rough program

Evaluation method

The final grade consists of 3 items :

- The work achieved
- The report
- The oral defense

Specific course rules

Course material

Examples of reports are available in moodle.

Bibliography / Webography