Computer Science

Organisation: Face to face: 57 hours  Homework: 57 hours  total load: 114 h

ECTS: 6

Objectives: Capacity to develop a large variety of software applications. Knowledge on operating system architecture and functions. C programming capacity.

Keywords: Unix, C programming language, Algorithmics.

Prerequisites: None

Program: This module aims at providing the fundamental knowledge in computer science, especially for operating system usage (mainly Unix) and programming development (using the C programming language). A special emphasis is made on algorithmic and data structures.

Content:
The course « Unix »: This course aims at presenting the goal of operating systems, and especially Unix. The first part of the teaching is mainly devoted to filesystem and process management. The second part focusses on script shells and the development of small Unix applications. During the last part, we introduce the LaTeX word processing suite and how to use makefiles.

The course « C programming language »: The goal of this course is to introduce not only the C programming language but also the concepts associated to programming in a more general way. As a result, the first part of the teaching is devoted to the presentation of the compilation steps required to transform a human-readable program into an executable program. Then, the second part presents the different aspects of the C programming language (control instructions, functions, arrays, pointers, structures...);

The course « Algorithmics »: This set of lectures presents first the different data structures a programmer may need to develop applications (like stacks, queues, lists, trees...) and second the most important algorithms (especially the use of recursion and sorting algorithms).

Evaluation: Grading is as follows
The final exam, that includes all three courses, will count for 100%. There is no extra credit or make-up work.

Lecturers: Eric Renault

Coordinator: Eric Renault
Eric.renault@telecom-sudparis.eu
Effective Communication

**Organisation:**  
Face to face: 30 hours  
Homework: 30 hours  
total load: 60 h

**ECTS:** 3

**Objectives:**
- Acquire and develop the academic skills and language required to give an oral presentation in a professional/academic context
- Acquire and develop the academic skills and language required to carry out some basic academic tasks, including an article abstract and a biodata presentation
- Achieve an understanding of basic issues involved in scientific communication

**Prerequisites:** None

**Program:** The module “Effective Communication” is a core requirement for students in the MSc programme.

We aim to consolidate academic study skills and in particular equip students with the communicative skills & practices required of a doctoral student and a professional engineer. Practice is provided in the following: oral presentations, academic writing and inter-cultural awareness. This module does include preliminary lectures but the majority of class time is spent on interactive exercises, discussion and hands-on experience.

Preparation and follow-up assignments encourage students to draw conclusions from personal experience inside and outside the classroom.

**Content:**

- **Academic writing**
  - Advice and practice in « academic writing »
  - Study of « article abstract » and « biodata » genres, with feedback on assignments
  - Study of different academic registers

- **Oral Presentations**
  - Preparation and planning a workshop presentation for a mock international conference
  - Organisations and delivery of talk, slide design, interaction with the audience, oral presentation techniques
  - Styles of presenting: cultural specificities; disciplinary specificities

- **Intercultural awareness**
  - Recognizing and dealing with situations where intercultural competence is required, avoiding Misunderstandings. Developing awareness of one’s own « cultural identity

**Evaluation:** Grading is as follows

- **50% continuous assessment:** This includes presence in class, completion of all tasks set, not only participating in exercises (oral presentations etc) but actively preparing for exercises and where necessary preparing outside class time. It also includes the evaluation of assignments set for outside class time (i.e. homework) and actively taking part in feedback sessions and discussions. Students participate in a panel at a mock conference on different aspects of HCI (groupwork)
- **50 % final exam:** A three-hour written exam on different aspects of the course

**Lecturers:** Shirley Carter-Thomas, Katherine Maillet

**Bibliography & References:**

- **Oral Presentations:**
  - http://www4.caes.hku.hk/epc/presentation/

- **Academic Writing:**

**Coordinator:** Shirley Carter-Thomas  
Shirley.Thomas@imt-bs.eu
French as Foreign Language I

**Organisation:**  
Face to face: 33 hours  
Homework: 33 hours  
**total load:** 66 h

**ECTS:** 3

**Objectives:**
Courses are based on the communicative approach and action-oriented approach recommended in the CEFR. Students will carry out projects, tasks activities and exercises linked to the objectives of their language level. The intercultural approach is an integral part of courses. In addition learners are accompanied in developing learner autonomy. Classes use ICT, authentic documents and multimedia. Besides class, significant engagement and personal work are required to make efficient progress.

**Prerequisites:** None

**Program:**
French courses aim to develop language skills, intercultural skills and learner autonomy. They are organized by level. Each course aims to reach one of the CEFR levels:
- Level A0 = complete beginner
- Level A1 = introductory or discovery level
- Level A2 = intermediate or survival level
- Level B1 = basic operational level
- Level B2 = advanced level or independent user
- Level C1 = advanced or experienced, autonomous user
For more information see the Common European Framework Reference for Languages (CEFR):  
http://www.coe.int/t/dg4/linguistic/cadre1_en.asp

**Content:** ---

**Evaluation:** Assessment aims to determine what has been acquired, what is in the process of being acquired and what has not been acquired. It also takes into account class participation and personal work (continuous assessment). The final grade out of 20 is based on continuous assessment (60%) and the final exam (40%).

**Lecturers:** Nicoline Lagel, Ohayon Nathalie, Bertaux Lucile, Massey Jean-Claude, Zaim Mounajed Jalal.

**Bibliography & References:**

**Coordinator:** Nicoline Lagel
nicoline.lagel@imt-bs.eu
French as Foreign Language II

**Organisation:**  
Face to face: 33 hours  
Homework: 33 hours  
**total load:** 66 h

**ECTS:** 2

**Objectives:**
Courses are based on the communicative approach and action-oriented approach recommended in the CEFR. Students will carry out projects, tasks, activities and exercises linked to the objectives of their language level. The intercultural approach is an integral part of courses. In addition learners are accompanied in developing learner autonomy. Classes use ICT, authentic documents and multimedia. Besides class, significant engagement and personal work are required to make efficient progress.

**Prerequisites:** None

**Program:**
French courses aim to develop language skills, intercultural skills and learner autonomy. They are organized by level. Each course aims to reach one of the CEFR levels:
- Level A0 = complete beginner
- Level A1 = introductory or discovery level
- Level A2 = intermediate or survival level
- Level B1 = basic operational level
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- Level C1 = advanced or experienced, autonomous user
For more information see the Common European Framework Reference for Languages (CEFR): http://www.coe.int/t/dg4/linguistic/cadre1_en.asp

**Content:** ---

**Evaluation:** Assessment aims to determine what has been acquired, what is in the process of being acquired and what has not been acquired. It also takes into account class participation and personal work (continuous assessment). The final grade out of 20 is based on continuous assessment (60%) and the final exam (40%).

**Lecturers:** Nicoline Lagel, Ohayon Nathalie, Bertaux Lucile, Massey Jean-Claude, Zaim Mounajed Jalal.

**Bibliography & References:**

**Coordinator:** Nicoline Lagel
nicoline.lagel@imt-bs.eu
**Fundamentals of Probability and Statistics**

**Organisation:** Face to face: 27 hours  
Homework: 27 hours  
**total load: 54 h**

**ECTS : 3**

**Objectives:** Capacity to model an operational process, architecture... through queuing theory.

**Prerequisites:** None

**Program:** This standard probability and statistics refresher module is essentially intended for giving the tools for the modelling of queuing processes.

**Content:**
- General theorems of probability;
- Random variable, change of variables;
- Distributions derived from Poisson and Gaussian distributions;
- Convergence of sequences of random variables;
- Markov processes, Markov chains;
- Random variable simulation;
- Parameter estimation;
- Introduction to the asymptotic theory;
- Least mean square estimation.

**Evaluation:** Grading is as follows
Homeworks given at the issue of each of the 10 classes No written exam.

**Lecturers:** Prof. Jean-Pierre Delmas

**Coordinator:** Prof. Jean-Pierre Delmas  
[Jean-pierre.delmas@telecom-sudparis.eu](mailto:Jean-pierre.delmas@telecom-sudparis.eu)
Signal Processing and Statistical Data Analysis

**Organisation:** Face to face: 47 hours  
Homework: 47 hours  
**total load: 94 h**

**ECTS:** 5

**Objectives:** Emphasize and apply the concepts studied in Probability and Statistics to fundamentals engineering problems such as spectral analysis, array processing, data science, pattern recognition, etc.

**Keywords:** Estimation theory, Maximum Likelihood, Bayesian Estimators, Cramér-Rao bounds, Time series analysis, ARMA processes, Markov processes, Dimension reduction, Linear Subspace Methods, Clustering, Regression, Classification.

**Prerequisites:** Probability and statistics (Core courses S1), Linear Algebra

**Program:**

I Estimation

2.1 Estimation of deterministic parameters - Bias, variance, Cramér-Rao bounds, Maximum Likelihood estimator.  
2.2 Estimation of random parameters - Conditional Mean estimator, Maximum a Posteriori estimator, Bayesian Cramér-Rao bound

II Detection

III Random signals

3.1 Temporal representations - Mean and correlation function  
3.2 Main classes of random signals - Stationary signals, Theoretical white noise, Gaussian processes.  
3.3 Spectral representations - Power spectral density, Filtering  
3.4 Random signal models - Autoregressive processes, Moving average processes, ARMA processes.

IV Dimension Reduction

4.1 Linear Subspace Methods (Principal component analysis, Linear Discriminant Analysis)  
4.2 Feature Selection

V Clustering

5.1 k-means  
5.2 Hierarchical Clustering  
5.3 Gaussian Mixture Models

VI Regression

6.1 Linear Regression  
6.2 Multilinear Regression  
6.3 Logistic regression

VII Classification

7.1. Decision Trees  
7.2. Random Forests

**Evaluation:** Grading is as follows
Cours 24h TP 8h TD 15h Contrôle Final 3h  
Mounim El Yacoubi (50%) Cours 12h TP 4h TD 7.5h  
Alexandre Renaux (50%) Cours 12h TP 4h TD 7.5h

**Lecturers:** Alexandre Renaux/Mounim El Yacoubi

**Coordinator:** Alexandre Renaux/Mounim El Yacoubi  
mounim.el_yacoubi@telecom-sudparis.eu  
alexandre.renaux@u-psud.fr
Scientific Project

Organisation: Face to face: 12 hours  Homework: 140 hours  total load: 152 hours

ECTS: 8

Objectives:

Datapac and TNM Track:
- To carry out a bibliographical study and provide a real research work related to statistical modeling on specific databases.
- The student will be evaluated in terms the technical quality of their proposals, relying on their bibliographical study.

EOE and MIE Track:
In this project, students are expected to develop a first experience in research, i.e. their ability to be innovative and to compare results with others.

Prerequisites:
First Semester

Evaluation: Grading is as follows:

Datapac and TNM Track: Evaluation is based on a report but might also be based on program sources, or a demonstration or an oral presentation.

EOE and MIE Track: In addition to a classical report, an oral presentation will be given in front of a jury of Professors. The experimental validation part is of uppermost importance.

Lecturers: Sonia Garcia (Datapac), Nel Samama (EOE)

Coordinator:
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