Institution: Université de Lorraine

Specialization: Computer Science

First Semester

Algorithmics
The module introduces the methods designing efficient algorithms, the high-level data structures, the building and analysing algorithms. Main parts of the course are: • Execution time of an algorithm, efficient algorithms and data structures • Building methods of efficient algorithms: divide et impera, dynamic programming, greedy algorithms • Efficient data structures: balanced search binary trees, B-trees • Graph algorithms: problem of minimal cover trees (Prim, Kruskal)
Examination: written

6 ECTS	4 hours/week	Semester 1

Object Oriented Programming
The module aims to acquire the basics of object-oriented programming using the C++ and Java languages. The main parts of the module are: • Introduction to structural programming and object oriented programming • Basic C/C++ syntax (instructions, functions, control structures) • Compilation and link edition • Basic types (arrays, strings, structures, unions, enumerations, bitvectors) • The C/C++ pre-processor • Implementation of UML models using Java and C++
Examination: written

6 ECTS	4 hours/week	Semester 1

System Programming
The module aims to a better programming knowledge under Linux/Unix environments and of operating systems in general. The main parts of the module are: • Managing processes and resources by operating systems • Solving synchronisation and critical races problems by semaphores and monitors. • Mastering POSIX programming for creating a process, sending and receiving of signals. The IPC System V. Threads.

Examination: written		
3 ECTS	2 hours/week	Semester 1

Database Systems and Web Programming

The module aims to understand the principles of database management systems (DBMS) and their applications, and to have a deeper knowledge of concepts and mechanisms of conceptual data modelling. The module also aims to acquire the basics for creating and managing a dynamic website, and to master the development techniques.

The main parts of the module are:
- Functional architectures of DBMSs. Place and role of DBMSs in logical architectures.
- Transactions, concurrent accesses, and recover from incidents
- Query processing in relational DBMSs.
- Confidentiality and access rights
- Dynamic integrity constraints and derived data (triggers)
- Advanced conceptual modelling

- Architecture and general principles of dynamic websites
- The HTTP protocol, web servers, URL
- Developing web applications from the `server side'
- Languages for web development (e.g., PHP)
- Data exchange between programs: send/receive parameters for the GET and POST methods of the HTTP protocol, links with HTML, cookies and http header, session variables. Interfacing databases with web applications
- Implementing interactions on the `client side'. Javascript : basics, event language, document object model,

Examination: written		
6 ECTS	4 hours/week	Semester 1

Formal logic

The aim the module is to master the syntax and semantics of propositional logic from the point of view of a computer scientist, and to introduce the predicate calculus. The main parts of the module are:

- Boolean algebra
- Formal and axiomatic-deductive systems
- Propositional calculus: syntax, semantics, Hilbert and natural deduction systems. Consistency and completeness theorems. Normal forms.
- Introduction to predicate calculus
- Applications for Computer Science: the resolution methods

Examination: written		
3 ECTS	2 hours/week	Semester 1

Foreign Languages and Communication Skills

This modules consists of two equivalent parts: Foreign Languages and Communication Skills.

The English part aims to introduce the general and technical English terms for the domain of Computer Science (development of communication skills, study of scientific and cultural texts)

The Communication Skills part aims to provide better communication skills between students, students and teachers, to improve the job/placement search skills. The main parts are:

- Writing cover letters
- Writing CVs
- Preparing a job interview
- Integration to the industrial environments
- Other communications skills (small and big groups, observation and communication case studies, PNL, transactional analysis, interviews...)

Examination: written

3 ECTS	2 hours/week	Semester 1

Synthesis project		
This project will be developed in common with other modules.		

Examination: presentation of a project

3 ECTS		Semester 1

Second Semester

Compilation		
The module aims to understand how a compiler works in order to better use different programming languages paradigms. The main parts are :		

- Compilation phases: lexical analysis, syntax, semantics, code generation, code optimisation
- Problems when using different programming languages
- Systematic translation
- Managing memory at runtime.

Examination: written

3 ECTS	2 hours/week	Semester 2

Language theory		
The module aims to master the definition and the analysis of regular and algebraic languages. The main parts are:		

	● Formal languages. Regular languages. Deterministic/non-deterministic finite automata. Regular expressions. Resolution of non-determinism in automata. Minimisation of deterministic automata. Grammars. ● Algebraic languages. Pushdown automata. LL descendent syntactic analysis. Ascendent syntactic analysis SLR, LR, LALR	
Examination: written		
3 ECTS	2 hours/week	Semester 2

Introduction to Computer Security and Networks

The module introduces to the students the basic notions of security in networks and computer systems, as well as the methods to protect and prevent against the main flaws in computer systems. Also, different network protocols are presented. The main parts of the module are:

- Human, system and network flaws
- Introduction to cryptography and its applications
- Reliability: public keys infrastructure
- Security protocols: SSH, HTTPS
- Authentication
- Initiation to cryptography (history, some common algorithms)

- IP protocol: role, addressing, CIDR, VLSM, sending/reception protocol: ARP, routing table

- UDP and TCP: comparison

- The applicative layer: telnet, DNS, DHCP, email (SMTP, MIME, POP, IMAP)

Examination: written		
6 ECTS	4 hours/week	Semester 2

Operations Research and Data Analysis

This module is split in two equal parts: Operations Research and Data Analysis

The Operations Research part aims to introduce the basic notions and tools of Operations Research domain, as below:

- Graphs: (optimal pathways, PERT and ROY graphs)
- Optimisation algorithms on graphs
- Linear programming and the use of XPRESS tool to find optimal solutions

The Data Analysis part deals with 'factorial' data, according to the following :

- Statistical descriptions
- Linear regression
- Analysis using main components

- Factorial analysis of correspondences

Examination: written		
6 ECTS	4 hours/week	Semester 2

Software Engineering

This module aims to synthesize and better understand the analysis, design, development and deployment of software applications. It is also an introduction to organising and supervising projects.

The main parts are:

- Typology and evolution of models and development methods
- Functional and non-functional properties of software
- Test, verification and validation
- Elements of organising and managing development projects

Examination: written

3 ECTS	2 hours/week	Semester 2

Human Factors and Mobile Programming

The module is split in two parts: Human Factors and Mobile Programming.

The Human Factors part introduces the basic concepts of cognitive psychology and ergonomics in game development, according to the following:

- Human Factors and HCI (definition, methods, perception and representation, attention and memory, knowledge and mental models, metaphors and conceptual models, social aspects, group communication, organisational aspects, …)
- Ergonomics (history, domains, approaches, methods, concepts, applications)

Mobile Programming aims to introduce different techniques for mobile development for e.g. PDAs, phones, etc. Practical situations, from game developments, are presented when students should face with difficulties and find solutions.

Examination: written

6 ECTS	4 hours/week	Semester 2

Foreign Languages

The module aims to introduce the general and technical English or German terms for the domain of Computer Science (development of communication skills, study of scientific and cultural texts)

Examination: written

3 ECTS	2 hours/week	Semester 2

Industrial Placement

The module aims at providing the practical work in a project group within an industrial environment.

Examination: presentation of a project

	8 weeks	Semester 2

Range of the marks

16 - 20:   very good
13 - 14:   good
10 - 12:   quite good
 0 - 9:   not passed