



Universitat de Lleida

DEGREE CURRICULUM  
**LANGUAGES, AUTOMATA AND  
GRAMMARS**

Coordination: MIRET BIOSCA, JOSE MARIA

Academic year 2022-23

Subject's general information

<b>Subject name</b>	LANGUAGES, AUTOMATA AND GRAMMARS			
<b>Code</b>	102062			
<b>Semester</b>	2nd Q(SEMESTER) CONTINUED EVALUATION			
<b>Typology</b>	<b>Degree</b>	<b>Course</b>	<b>Character</b>	<b>Modality</b>
	Bachelor's Degree in Computer Engineering	2	COMPULSORY	Attendance-based
	Double bachelor's degree: Degree in Computer Engineering and Degree in Business Administration and Management	2	COMPULSORY	Attendance-based
<b>Course number of credits (ECTS)</b>	4.5			
<b>Type of activity, credits, and groups</b>	<b>Activity type</b>	PRAULA		TEORIA
	<b>Number of credits</b>	1.5		3
	<b>Number of groups</b>	2		1
<b>Coordination</b>	MIRET BIOSCA, JOSE MARIA			
<b>Department</b>	MATHEMATICS			
<b>Teaching load distribution between lectures and independent student work</b>	4,5 ECTS correspond to a workload of 45 h of lectures and assesment and 67 h of autonomous study work for each student.			
<b>Important information on data processing</b>	Consult <a href="#">this link</a> for more information.			
<b>Language</b>	Preferably in Catalan. Lectures can be given in Spanish or English, if required.			
<b>Distribution of credits</b>	Theoretical lectures are combined with problem solving sessions.			
	On-line lectures will take 2 hours per week. There will be 2 face-to-face groups, with 2 hours every 2 weeks of classroom activities each.			

Teaching staff	E-mail addresses	Credits taught by teacher	Office and hour of attention
MIRET BIOSCA, JOSE MARIA	josepmaria.miret@udl.cat	6	

## Subject's extra information

Previous knowledge on the subjects *Algebra*, *Computational Logics* and *Discrete Mathematics* is recommended.

This subject is scheduled in the second semester of the 2nd year

The knowledge and competencies acquired in this subject will be useful to follow other subjects in the specialisation on *Computing*, and in particular for the subjects *Computational Models and Complexity* and *Language Processing Algorithms*.

## Competences

GII-FB3. Capacity to understand and master the basic concepts of discrete mathematics, logical, algorithmic and computational complexity, and its application to solve engineering problems.

EPS5. Capacity of abstraction and of critical, logical and mathematical thinking.

## Subject contents

### 1. Alphabets and languages

- Alphabets, words and languages.
- Concatenation of words.
- Universal language.
- Operations with languages.
- Kleene star of a language.

### 2. Finite Automata

- Deterministic finite automata.
- Accepted language by a deterministic finite automaton.
- Indeterministic finite automata.
- Determinization of finite automata.
- Minimization of finite automata.
- Operations with regular languages.
- Regular Expressions.

### 3. Context free grammars

- Generated language by a context free grammar.
- Operations with context free languages.
- Ambiguous grammars.
- Elimination of null productions, unit productions and useless symbols.
- Chomsky normal form.
- Regular grammars.

### 4. Pushdown automata

- Deterministic pushdown automata.
- Indeterministic pushdown automata.
- Accepted language by a pushdown automata.

## Methodology

Theoretical and practical contents are mixed for the sake of combining basic aspects with illustrative examples and problem solving. Problem solving combines joint resolution on the blackboard or individual resolution. Some sessions will be devoted to group problem solving.

## Development plan

Week	Lesson	Activities	student workload
1	Introduction. Lesson 1	Lectures	2 hours. Study and problem solving.
2	Lesson 1	Lectures and problem sessions	3 hours. Study and problem solving.
3	Lesson 2	Lectures and problem sessions	3 hours. Study and problem solving.
4	Lesson 2	Lectures and problem sessions	3 hours. Study and problem solving.
5	Lesson 2	Lectures and problem sessions	3 hours. Study and problem solving.
6	Lesson 2	Lectures and problem sessions	3 hours. Study and problem solving.
7	Lesson 2	Lectures and problem sessions	3 hours. Study and problem solving.
8	Lesson 3	Lectures and problem sessions	6 hours. Study for exams.
9		Partial 1 assessment	8 hours. Study for exams.
10	Lesson 3	Lectures and problem sessions	3 hours. Study and problem solving.
11	Lesson 3	Lectures and problem sessions	3 hours. Study and problem solving.
12	Lesson 3	Lectures and problem sessions	3 hours. Study and problem solving.
13	Lesson 3	Lectures and problem sessions	3 hours. Study and problem solving.
14	Lesson 4	Lectures and problem sessions	3 hours. Study and problem solving.
15	Lesson 4	Lectures and problem sessions	6 hours. Study for exams.
16		Tutorization	6 hours. Study for exams.
17		Partial 2 assessment	8 hours. Study for exams.
18		Tutorization	
19		Final assessment	

## Evaluation

Acr.	Assessment activities	Weight	Minimum mark	Resit

P1	Partial 1. Lessons 1, 2	4.5 points	1 point	Yes
P2	Partial 2. Lessons 3, 4	4.5 points	1 point	Yes
AC	Complementary activities : Implementation of an algorithm studied in class	1 point	No	No
PCL	Active participation or attending conferences or exhibitions on related topics	0.5 points	No	No

**Final Mark** = P1 + P2 + AC+ PCL

A student with final mark below 5 or who has not reached the minimum marks required, can resit either P1, P2 or both. Up to 0.5 additional points can be assigned, according to participation in the classroom and delivered problems.

## Bibliography

### Basic bibliography:

RAFEL CASAS, LLUÍS MÁRQUEZ, Llenguatges, gramàtiques i autòmats, Curs bàsic. Aula Teòrica 58, Edicions UPC, 1997.

JOSEP M. MIRET, MAGDA VALLS, Recull de problemes de Llenguatges, Autòmats i Gramàtiques. Universitat de Lleida, 2002.

### Complementary bibliography:

QUITI BORGES, JOAN SERRA, JOSEP M. ARQUES, Teoria d'autòmats. Materials 28, Servei de Publicacions UAB.

JOHN E. HOPCROFT, JEFFREY D. ULLMAN, Introduction to Automata Theory, Languages and Computation. Addison- Wesley, 1979.

DEAN KELLEY, Teoría de Autómatas y Lenguajes Formales. Prentice-Hall, 1995.

JAIRO ROCHA, FRANCESC ROSSELLÓ, Autòmats i Llenguatges: verificació, implementació i concurrència. Materials didàctics 107, Universitat de les Illes Balears, 2003.