

Degree	Type	Year
2503740 Computational Mathematics and Data Analytics	FB	1

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Teachers

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Teaching groups languages

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Prerequisites

- There are no prerequisites. It is a subject of 1st semester of 1st year.

Objectives and Contextualisation

The objective of this subject is to give the student a general view of the operation of a current computer, seeing its theoretical foundations and the functional units that integrate it, as well as analyzing the improvements introduced at the architectural level to achieve good performance.

Learning Outcomes

1. CM06 (Competence) Develop effective algorithmic solutions to computational problems in accordance with the established requirements.
2. CM06 (Competence) Develop effective algorithmic solutions to computational problems in accordance with the established requirements.
3. CM07 (Competence) Analyse the computational complexity of the algorithmic solutions to develop and implement the one that guarantees the best performance.
4. CM07 (Competence) Analyse the computational complexity of the algorithmic solutions to develop and implement the one that guarantees the best performance.

5. CM08 (Competence) Ensure the correct functioning of an algorithmic solution in accordance with the requirements of the problem to be solved.
6. KM06 (Knowledge) Recognise the basic concepts of computer logic, structure and programming.
7. KM07 (Knowledge) Describe the basic functioning of computer systems.
8. KM08 (Knowledge) Recognise the methods, systems and technologies specific to computation.
9. SM07 (Skill) Use operating systems and software commonly used in various fields.
10. SM07 (Skill) Use operating systems and software commonly used in various fields.
11. SM08 (Skill) Use algorithmic and data representation structures suitable for problem-solving.

Content

- 1.- Numbering systems.
- 2.- Boole's Algebra.
- 3.- Basic structure of a computer: Functional units.
- 4.- Memory hierarchy: Cache memory.
- 5.- Segmented processing.
- 6.- Multi / Many-core processors.
- 6.- Accelerators.
- 7.-Overview of a Computer System.

Activities and Methodology

Title	Hours	ECTS	Learning Outcomes
Type: Directed			
Exercises	6	0.24	CM06, CM07, CM08, SM08, CM06
Lab exercises	13	0.52	CM06, CM07, CM08, KM06, SM07, SM08, CM06
Theoretical lessons	20	0.8	CM06, CM07, CM08, KM06, KM07, KM08, SM07, SM08, CM06
Type: Autonomous			
Study, exercises and preparation of lab exercises	101	4.04	CM06, CM07, CM08, KM06, KM07, KM08, SM07, SM08, CM06

- 1.- Lectures: The knowledge of the subject will be presented in the form of lectures. In them the basic concepts exposed in the subject syllabus will be shown to the student and clear indications of how to complete and deepen these contents. The master classes, in spite of being mainly an explanation by the teacher, will try to make them participative for the student by giving them the opportunity to ask questions that they do not understand and they are constantly asked questions and problems to check the good understanding of the exposed subject .
- 2.- Seminars: The mission of the seminars is double. On the one hand, the scientific and technical knowledge exposed in the lectures will be worked on to complete their understanding and deepen them. For this, diverse

activities will be developed, from the typical resolution of problems to the discussion of practical cases. Learning methodologies and cooperative problem solving will be implemented. On the other hand, the seminars will be the natural forum in which to discuss in common the development of practical work, contributing the knowledge that the student lacks to carry it out, or indicating where he can acquire them. The mission of the seminars is to bridge the gap between the master classes and the practical work, which will promote the capacity for analysis and synthesis, critical reasoning, and which will train the student to solve problems.

3.- Practicum: At the beginning of the course the student will receive a dossier with the practical work that must be developed during the course. This practical work is based on the design and programming of assembler programs that allow to understand the operation of a computer and learn the mechanisms of the Input / Output subsystem. The practices will be developed individually. The practicum includes 6 practice sessions, lasting 2 hours, where the implementation and debugging of the programs will take place. Before each session the student will have to carry out a work of preparation of the session and will have to show the professor to be able to begin his work in the laboratory. The student will deliver a portfolio of the practicum in order to finish this one that, for reasons of teaching ability, will only be corrected in the case of students whose grade is doubtful. This approach of the work is oriented to promote an active learning and to develop the capacity competencies of organization and planning, oral and written communication, teamwork and critical reasoning. The quality of the project carried out, its presentation and its operation will be especially valued.

During theory classes and problem seminars, photos and recordings can not be made without the consent of the teacher.

The platform for virtual communication used throughout the assignautra will be the Virtual Campus - Moodle of the UAB.

TRANSVERSAL COMPETENCES

The transversal competences will be worked and evaluated in several moments throughout the course. specifically:

T01.00 - Evaluate critically and with quality criteria the work developed: In the laboratory sessions the students will carry out a practical work and analyze the proposed solutions to solve the problems.

T02.00 - Work cooperatively in a multidisciplinary context, assuming and respecting the role of the different members of the team: During the practices, the students will work as a team.

T04.00 - Use the bibliography and electronic resources effectively to obtain information: On a constant basis throughout the assignment, students should consult materials and manuals.

Annotation: Within the schedule set by the centre or degree programme, 15 minutes of one class will be reserved for students to evaluate their lecturers and their courses or modules through questionnaires.

Assessment

Continous Assessment Activities

Title	Weighting	Hours	ECTS	Learning Outcomes
Exam 1	30%	2	0.08	CM06, KM06, KM07, KM08, SM08
Exam 2	20%	2	0.08	CM07, CM08, SM08
Lab exercises	30%	1	0.04	CM06, CM08, KM06, SM07, SM08
Practicum validation	Multiplying factor of the lab mark beteewn 0.5 and 1.25	1	0.04	

Seminar exercises 1	5%	1	0.04	KM06, KM07, KM08
Seminar exercises 2	5%	1	0.04	CM06, CM08
Seminar exercises 3	5%	1	0.04	CM07
Seminar exercises 4	5%	1	0.04	CM07, SM08

Evaluation process and activities:

The aim of the assessment process is to verify that the students have achieved the knowledge and skills defined in the objectives of the subject, as well as the skills.

The evaluation will be carried out based on the degree of involvement in the seminars, the scientific-technical knowledge of the subject achieved by the students and the practical work developed by the students in groups of 3 people.

The following instruments are used to make this assessment:

- The evaluation of the work in the Seminar sessions, which will include the delivery of a work in each session.
- A series of exams carried out throughout the course, at an individual level, to adequately assess the level of knowledge achieved by the students.
- The assessment of the students' work in the laboratory, as well as the documentation provided for their practical work and the corresponding individual validation test.

Final grade = Seminars grade * (0.2) + Controls grade * (0.5) + Practice grade * (0.3)

- Seminars

Seminars Grade = > There will be 6 4 exercise seminars. Each seminar has a weighting of 0.25 in the final seminar rating.

The seminars will be held in teams of 2 people (always the same teams). In the exceptional case of not being able to attend a seminar due to force majeure, you can consider the possibility of connecting with the team through Teams and participating in the resolution of the seminar so that attendance can be counted.

Seminars cannot be made up or held on days other than those established in the calendar.

- Controls

Controls grade = Control 1 * (0.6) + Control 2 * (0.4)

Minimum average grade of controls: 5 points

Minimum mark for each control to be able to make an average: 3 points

Students who do not pass the part of the tests (either for having obtained less than 2 points in a test or for not reaching an average of 5 points in this part) will be able to take a reassessment exam of ALL the subject matter subject in the schedule established by the coordination.

- Practicum

Practicum grade = Laboratory * Validation

Minimum practice grade: 5 points

Minimum laboratory grade to be able to make an average: 5 points

Attendance at the laboratory sessions is mandatory and cannot be recovered. In the exceptional case of not being able to attend a laboratory session due to force majeure, you can consider the possibility of connecting with the team through Teams and participating in the practice session. Failure to attend two practical sessions means a not pass in the laboratory qualification.

The practical work carried out in the laboratory sessions is NOT RE-ASSESSED.

The practice will be structured in three levels: Basic, Intermediate and Advanced:

- The basic level gives the option of a score between 0 and 6 points, if delivered in the first 3 sessions. If it is delivered in the fourth or fifth session you can reach a 5.5 and if it is delivered in the last session a 5.
- The middle level allows one point to be added to the basic level qualification, if it is given in the two sessions following the delivery of the basic level, and half if it is given from the third session after having delivered the basic level.
- The advanced level gives the option to add one point to the score achieved after delivering the intermediate level if it is delivered in the two sessions following the delivery of the intermediate level and half a point from the third session.

You cannot present a level if you have not previously presented the previous level to the teacher, and he/she has given the approval. Only one level can be presented in a session. A team can request tutoring from their practice teacher to present a level between two laboratory sessions. Levels cannot be submitted after the last lab session.

The grade obtained in the laboratory is individual, and will depend on the attendance, participation and work developed during the practice sessions, and on the answers by each member of the team to the questions that the teacher may ask.

There is a written test of individual validation of the practices in the schedule established by the coordination for the partial seconds in January. A rating of 0 points on the validation test will give a factor of 0.5, a rating of 5 points will give a factor of 1, and a rating of 10 will give a factor of 1.25. In other words, there is a scale factor between 0 and 5 ($0.5+0.1*\text{mark}$) and a scale factor between 5 and 10 ($1+0.05*(\text{mark}-5)$).

Scheduling and operation of the evaluation activities:

The dates of the continuous evaluation tasks and delivery of work will be published on the virtual campus and may be subject to possible changes in programming for reasons of adaptation to possible incidents; the virtual campus (CV) will always be informed about these changes since it is understood that the CV is the usual mechanism for communication of information by the professor. Students who wish to communicate with the teacher electronically must do so using their institutional e-mail and directing it to the teacher's institutional e-mail in order to avoid reception problems.

Both regarding the controls and the overall evaluation, no person will be allowed to enter after 5 minutes from the start of the test. Mobile phones cannot be used in assessment tests.

Qualification review process:

For each assessment activity, a review place, date and time will be indicated in which students can review the activity with the teacher. In this context, claims can be made about the grade of the activity, which will be evaluated by the teaching staff responsible for the subject. People who do not attend this review will not be able to review this activity later.

Particular cases:

- The student is considered to have attended the subject when he has completed a seminar exercise and attended a control.
- To pass the subject it will be necessary to have obtained a minimum score of 5 in each of the parts (practicum and controls).
- There will be a global assessment of the theory part (controls) at the end of the semester so that they have passed the practicum, but not the controls. As long as the grade of this global reassessment of the controls is greater than 5 points, the final grade will be calculated by averaging the corresponding grade with the practicum grade and the seminars.
- In case of not passing the subject because of not reaching the minimum score in any of the sections, even though when taking the average the final grade was equal to or higher than 5, the grade that will be placed on the file will be 4, 5. If the average does not reach 5, the grade that will appear in the file will be the average grade obtained numerically.
- In order to qualify for the honors registration qualification, it is a necessary condition to have obtained a final grade for the subject of more than 9 points. On the other hand, only a maximum number of honorary registrations equal to 5% of the number of people registered can be assigned.

Evaluation of repeat students:

Repeat students are assessed in the same way as newly enrolled students, without any difference, nor keeping any notes from the previous year.

Consequences of irregularities committed by students:

Without prejudice to other disciplinary measures that are deemed appropriate, and in accordance with current academic regulations, irregularities committed by a student that may lead to a variation of the grade will be graded with a zero (0). For example, plagiarizing, copying, allowing copying, unauthorized AI use (i.e. Copilot, ChatGPT o equivalents) ..., an assessment activity will result in failing that assessment activity with a zero (0). Assessment activities qualified in this way and by this procedure will not be recoverable. If it is necessary to pass any of these assessment activities to pass the subject, this subject will be suspended directly, with no opportunity to recover it in the same course.

Single Assessment Evaluation:

The single assessment will consist of 4 parts that will take place in a single day:

- In the first part, a set of exercises will have to be solved in teams of two or people (if there is more than one person with single assessment) with the possibility of using the material. The duration of the test will be an hour and a half. This part will represent 20% of the final grade.
- In the second part, you will have to do a practice that will be proposed using your computer. This test will be individual and will last 3 hours. It is necessary to have a 5 in this test in order to pass the subject.
- In the third part, a validation test of the practice carried out will have to be carried out. It will be individual and will last 1 hour. Between the practice carried out and the validation test they will have a weight of 30% of the final qualification.
- In the last part, an individual examination of all the subject matter will have to be carried out, without using additional material. This test will last 2 and a half hours and will represent 50% of the final grade. It is necessary to have at least a 5 in this test to be able to get an average.

Bibliography

- "Organización y Arquitectura de Computadores. Principios de estructura y funcionamiento" William Stallings. Ed. Pearson. Prentice-Hall.
- "Estructura y diseño de computadores" David Patterson/John L. Hennessy. Ed. Reverté.
- "Computer Systems Design and Architecture" Vicent P. Heuring / Harry F. Jordan. Ed. Addison-Wesley
- "Problemas resueltos de estructura de Computadores" Félix García Carballeira, Jesús Carretero Pérez, José Daniel García Sánchez, David Expósito Singh. Editorial Paraninfo

Software

VirtualBox

Ubuntu virtual machine

Geany

Yasm

KDBG

Language list

Name	Group	Language	Semester	Turn
(PLAB) Practical laboratories	1	Catalan	first semester	morning-mixed
(PLAB) Practical laboratories	2	Catalan	first semester	morning-mixed
(TE) Theory	1	Catalan	first semester	morning-mixed