

SUBJECT TEACHING GUIDE

G682 - Algorithm Design

Degree in Computer Systems Engineering

Academic year 2024-2025

1. IDENTIFYING DATA					
Degree	Degree in Computer Systems Engineering			Type and Year	Optional. Year 4
Faculty	Faculty of Sciences				
Discipline	Subject Area: Computing Mention in Computing				
Course unit title and code	G682 - Algorithm Design				
Number of ECTS credits allocated	6	Term	Semester based (1)		
Web	https://moodle.unican.es/course/view.php?id=12151				
Language of instruction	Spanish	English Friendly	No	Mode of delivery	Face-to-face

Department	DPTO. MATEMATICAS, ESTADISTICA Y COMPUTACION				
Name of lecturer	DOMINGO GOMEZ PEREZ				
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Other lecturers					

3.1 LEARNING OUTCOMES

- Know how to apply advanced algorithmic techniques for problem solving and corresponding implementation of data structures. The student should be able to accurately analyze many common techniques, including randomization tools and the application of different versions of the master theorem.

4. OBJECTIVES

For the students to have a deep knowledge of algorithmic techniques and the interplay of the corresponding data structures in the different programming paradigms.

6. SUBJECT PROGRAM	
CONTENTS	
1	<p>Computation and functions:</p> <p>The general theme of this block is to introduce some ideas about the nature of algorithms and the elements of programming. In this block, time complexity will be studied for several algorithms in the worst, best and average case. Space complexity will also be introduced.</p>
2	<p>The master theorem:</p> <p>This block discusses some important ideas about notions required to perform recursion and ultimately develop some fundamental concepts underlying the master theorem. The technique of memoization will be discussed and the trade-off in time and memory will be calculated.</p>
3	<p>Advanced data structures and complexity on average:</p> <p>This block introduces concepts related to the implementation and complexity of various data structures. Among other structures, the block is devoted to balanced trees, ordered hash maps and ordered sets that will be studied along with their efficiency.</p> <p>For improving complexity on average, generating functions and formal power series will be studied.</p>
4	<p>Applications of advanced data structures:</p> <p>In this block we will discuss different applications of the data structures introduced in the previous chapter to various problems in computer science. The list includes problems such as information compression and file systems. The relationship between graphs and searches with greedy algorithms and dynamic programming will also be reviewed.</p>
5	<p>Optimization through the use of probabilistic algorithms:</p> <p>The topic of this block is which computational processes can be accelerated through the use of probabilistic algorithms. Their analysis and techniques to improve probability of success are studied for several problems.</p>

7. ASSESSMENT METHODS AND CRITERIA				
Description	Type	Final Eval.	Reassessn	%
Final Exam	Written exam	Yes	Yes	50,00
Laboratory assignments	Laboratory evaluation	No	Yes	30,00
Group assignments	Activity evaluation with Virtual Media	No	No	20,00
TOTAL				100,00
Observations				
<p>If a student who does not take the final exam in the regular exam period and has not taken evaluation activities whose weight exceeds 50% of the grade, the student will receive a grade 'no-show'. Otherwise, the corresponding grade will appear in the academic certificate. In the extraordinary period, a student who does not take the final exam will appear as a no-show in either of the two cases mentioned above. The student will have the right to take an exam in the extraordinary period with a value of 100% of the total grade for the recoverable activities of the course. This exam will be carried out in the same way as in the ordinary period (In person if sanitary conditions allow it, on remote otherwise).</p> <p>Any student who uses illicit means in the celebration of an exam, or who improperly attributes the authorship of academic work required for the evaluation, will have the grade of 'fail' or '0', depending on whether they are literal or numerical grades, respectively. When this circumstance occurs, the professor may submit a report to the Dean, which, within a maximum period of two months, and after hearing the student, will proceed to decide on the possible inclusion of this fact in the student's record.</p>				
Observations for part-time students				
Students who have requested and approved their inclusion in the part-time regime may only take the final exam with a weight of 100% of the grade of the subject. This will be valid both in ordinary and extraordinary period.				

8. BIBLIOGRAPHY AND TEACHING MATERIALS

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Cormen, T. H. (2009). Introduction to algorithms (3rd ed.). MIT Press.

Abelson, H., Sussman, G. J., & Sussman, J. (2002). Structure and interpretation of computer programs (2nd, [7th print.]. ed.). The MIT Press.