SUBJECT TEACHING GUIDE

G652 - Algorithms and Complexity

Double Degree in Physics and Mathematics
Degree in Computer Systems Engineering
Degree in Mathematics
Academic year 2020-2021

1. IDENTIFYING DATA					
Degree	Double Degree in Physics and Mathematics Degree in Computer Systems Engineering			Type and Year	Optional. Year 5 Compulsory. Year 2
Faculty	Faculty of Sciences				
Discipline	Subject Area: Computer Programming Mention in Computer Science Compulsory Module				
Course unit title and code	G652 - Algorithms and Complexity				
Number of ECTS credits allocated	6	Term		Semester based (2)	
Web	http://personales.unican.es/gomezd				
Language of instruction	Spanish	English Friendly	No	Mode of delivery	Face-to-face

Department	DPTO. MATEMATICAS, ESTADISTICA Y COMPUTACION
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Other lecturers	CAMILO PALAZUELOS CALDERON SANTOS BRINGAS TEJERO

3.1 LEARNING OUTCOMES
- Knowledge of basic techniques for analysis of algorithms.
- Understand the inherent complexity of problems in NP.
- Hands-on experience in standard approaches when designing an algorithm and its consequences in the efficiency of the implementation.
- Awareness of the repercussion of data structures in implementations of algorithms.

4. OBJECTIVES

Be able to use the standard notation for measuring the efficiency of algorithms.
Apply rules to calculate efficiency of iterative algorithms.
Learn the implications of the master theorem for recursive algorithms.
Learn the applicability of divide-and-conquer strategies.
Understand the limitations of divide-and-conquer strategies and the use of dynamic programming.
Learn the basis of graph theory.
Learn the basis of complexity theory as well as some problems arising there.
Learn improvements for some problems where only brute-search approaches are available.

6. COURSE ORGANIZATION

CONTENTS	
1	Efficiency analysis in algorithms, complexity measures and the master theorem.
2	Graph theory, trees and DAGs, Kruskal and Prim algorithm, minimum paths.
3	Backtracking, greedy algorithms and Kruskal algorithm as a greedy algorithm.
4	Divide-and-conquer strategies and an analysis comparing dynamic programming, divide-and-conquer and greedy algorithms.
5	Complexity theory, decision problems and optimization problems. The P, NP, and NP-Complete classes. NP-Complete problems in graph theory.

7. ASSESSMENT METHODS AND CRITERIA

Description	Type	Final Eval.	Reassessn	%
Final exam	Written exam	Yes	Yes	60,00
Group assignments	Laboratory evaluation	No	Yes	20,00
Class assignments	Activity evaluation with Virtual Media	No	Yes	20,00
TOTAL				100,00

Observations

Students can improve their grades in their group assignments and class assignments in an exam (this exam accounts for 40% of the final grade) in the following cases:

- for partial-time students.
- for students who want to improve their grades or have failed to pass in any of the previous assignments.

The exam must be complete in less than two hours, it may contain theoretical questions as well as practical problems. The students are required to have completed all the assignments before the exam.

In the case that socio-sanitary conditions advise the end of in-person teaching, the final exam will be replaced by a practical exam and a written exam. The availability of resources will determine how the exams are performed, attempting to implement a asynchronous and telematic method.

Observations for part-time students

Partial-time students can choice between two methods of evaluation:
to be evaluated as any other student or do a special exam. The special exam accounts for 90% of the grade and the exam relative to laboratory assignments accounts for 10% of the grade.

8. BIBLIOGRAPHY AND TEACHING MATERIALS

BASIC

Dasgupta, Sanjoy, Christos H. Papadimitriou, and Umesh Vazirani. Algorithms. McGraw-Hill, Inc., 2006.

Cormen, Thomas H. Introduction to algorithms. MIT press, 2009.