

SUBJECT TEACHING GUIDE

M1521 - Heuristic and Metaheuristic Techniques

Master's Degree in Mathematics and Computing

Academic year 2022-2023

1. IDENTIFYING DATA					
Degree	Master's Degree in Mathematics and Computing			Type and Year	Optional. Year 1
Faculty	Faculty of Sciences				
Discipline					
Course unit title and code	M1521 - Heuristic and Metaheuristic Techniques				
Number of ECTS credits allocated	3	Term	Semester based (2)		
Web					
Language of instruction	Spanish	English Friendly	No	Mode of delivery	Face-to-face

Department	DPTO. MATEMATICAS, ESTADISTICA Y COMPUTACION				
Name of lecturer	JOSE LUIS MONTAÑA ARNAIZ				
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Other lecturers	ANGEL COBO ORTEGA ANDRES IGLESIAS PRIETO				

3.1 LEARNING OUTCOMES

- Learn, understand and know how to apply different heuristic and metaheuristic techniques to solving complex problems , mainly in the scope of Artificial Intelligence.

4. OBJECTIVES

Understand and know how to apply trajectory and neighbourhood methods: basic local search, simulated annealing, variable neighbourhood search.

Understand and know how to apply population-based methods: genetic algorithms, evolutionary strategies, memetic algorithms, genetic programming, swarm methods.

Understand and know how to apply adaptive search methods: tabu search, scatter search, path relinking.

Introduce metaheuristic search techniques for multi-objective optimisation.

Identify those problems for which metaheuristic techniques are appropriate, due to the problem complexity, and be acquaintances with real-life problems where these techniques have been successfully applied.

6. COURSE ORGANIZATION

CONTENTS

1	Introduction: basic concepts (intensification versus exploitation, convergence, evaluation), classification, hybridisation.
2	Trajectory and neighbourhood methods: basic local search, simulated annealing, variable neighbourhood search.
3	Population-based methods: genetic algorithms, evolution strategies, memetic algorithms, genetic programming, swarm methods.
4	Adaptive search methods: tabu search, scatter search, path relinking.
5	Introduction to metaheuristics for multi-objective optimisation.

7. ASSESSMENT METHODS AND CRITERIA

Description	Type	Final Eval.	Reassessn	%
Written assignment.	Work	No	Yes	100,00
TOTAL				100,00
Observations				
The assignment may (optionally) be written in English. The topic and nature of the written assignment will be decided depending on the student's interests and may be proposed by the student, subject to the lecturers' approval.				
Observations for part-time students				
The assessment method for part-time students is the same as for the rest of the students.				

8. BIBLIOGRAPHY AND TEACHING MATERIALS

BASIC

Z. Michalewicz, D. B. Fogel "How to solve it: Modern heuristics", Springer, 2nd Ed. (2004)

E-G. Talbi, "Metaheuristics. From design to implementation", John Wiley & Sons (2009)

M. Gendreau, J-Y. Potvin (eds), "Handbook of Metaheuristics", Springer, 2nd Ed. (2010)