	Escuela Técnica Superior de Ingeniería	
	GENERAL SPECIFICATIONS	

COURSE 22/23

Subject Data

Name:
Modelos Bioinspirados y Heurísticas de Búsqueda

English name:
Bionspired Models and Search Techniques

Code:	**Type:**
606010239	required

Hours:			
	Total	**In class**	**Out class**
Time distribution	150	60	90

ECTS: 6			

Standard group	**Small groups**			
	Classroom	**Lab**	**Practices**	**Computer classroom**
4			2	

Departments:	**Knowledge areas:**
Information Technologies	Artificial intelligence and computer science

Year:	**Semester**
4°	2°

TEACHING STAFF		
Name:	**E-mail:**	**Telephone**
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Others Data (Tutoring, schedule...)		
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SPECIFIC INFORMATION OF THE COURSE

1. Contents description:

1.1 In English:

- Introduction and classification of metaheuristics, usefulness and
justification of approximate solutions.
- Metaheuristics based on paths and environments: Basic Local search algorithms,
simulated annealing, tabu search based on multiple paths and methods: multi-boot,
GRASP, ILS and VNS.
- Methods based on populations: genetic algorithms.
- Study on the balance between intensification and diversification in the search algorithms.
- Metaheuristics distributed and parallel search.
- Hybrid metaheuristics search: memetic algorithms, scatter search, etc.
- Introduction to computer models

1.2 In Spanish:

- Introducción y clasificación de las Metaheurísticas, utilidad y
justificación de las soluciones aproximadas.
- Metaheurísticas basadas en trayectorias y entornos: Búsqueda local básica,
algoritmos de enfriamiento simulado, búsqueda tabú y métodos basados en trayectorias múltiples: multiarranque, GRASP, ILS y VNS.
- Métodos basados en poblaciones: Algoritmos genéticos.
- Estudio sobre el equilibrio entre intensificación y diversificación en los algoritmos de búsqueda.
- Metaheurísticas de búsqueda distribuida y paralela.
- Metaheurísticas de búsqueda híbridas: Algoritmos meméticos, búsqueda dispersa, etc.
- Introducción a los modelos de computación

2. Background:

2.1 Situation within the Degree:

Subject to extend knowledge in the area of search paths based on heuristics, or bio-inspired
environments, useful for solving optimization problems and search that can't be done by other
algorithms.

2.2 Recommendations

artificial Intelligence subject completed (2nd Grade)

3. Objectives (as result of teaching):

Since students already know by mandatory and / or core subjects of the degree overview of the IA and optimization algorithms and based search metaheuristics in particular, this elective course aims to provide additional and detailed training some of the most use and have greater height at this time, so that not only have a basic theoretical knowledge of them but applied and adaptable to real problems.

4. Skills to be acquired

4.1 Specific Skills:

• CE3-C: Ability to evaluate the computational complexity of a problem, meet algorithmic strategies that can lead to resolution and recommend, develop and implement one that guarantees the best performance according to the requirements.
• CE4-C: Ability to know the basics, paradigms and own techniques of intelligent systems and analyze, design and build systems, services and applications that use these techniques in any scope

4.2 General, Basic or Transversal Skills:

• CB4: Be able to convey information, ideas, problems and solutions to both specialized and non specialised audiences.
• CG0: Capacity for analysis and synthesis: Find, analyze, critique (critical thinking), relate to structure and synthesize information from different sources and integrate ideas and knowledge.
• G02: Oral and written communication in academic and professional field with special emphasis on writing technical documentation
• G03: capacity to solve problems
• G04: Ability to make decisions based on objective criteria (experimental data, scientific or simulation available) and ability to argue logically justify those decisions, knowing how to accept other views
• G05: Capacity for teamwork.
• G06: Capacity for autonomous learning and initiative and entrepreneurship
• TC2. Develop a critical attitude, being able to analyse and synthesize.
• TC3. Develop an attitude of inquiry that permanently enables to review and deepen in the knowledge.
• TC4. Acquire Computer and Information Skills (CI2) and apply them working.

5. Training Activities and Teaching Methods

5.1 Training Activities:

• Theory sessions on the contents of the program.
• Problem solving sessions.
• Practical sessions in specialized laboratories or Computer Room.
• Academically Guided activities by teachers: seminars, conferences, development work, debates,
group tutorials, and self-evaluation activities.

5.2 Teaching Methods::

• Participative Master Class.
• Development Practices in specialized laboratories or Computer Rooms in small groups.
• Problem Solving and practical exercises.
• Approach, Realization, tutoring and presentation of work.
• Evaluations and reviews.

5.3 Development and Justification:

- Theoretical sessions: Presentation of techniques and study them. Session length: 1h Total sessions:
26.
- Laboratory practical sessions: Application of theoretical concepts into practical developments.
Session Duration: 2h. Total sessions 15
- Seminars, exhibitions and debates: Sporadic to improve specific issues.
- Resolution and delivery problems / practices: Realized in part in practical laboratory sessions and
theory. In the remainder as student work outside of class. The practices consist of three deliverables
three key aspects of the subject in which they are explained the details of software architecture in
practical classes. Problems are case studies and proposals discussed in class on issues that do not
have a practice which allows implementation.
- Theory tests at class, assessments of proposed problems will be made as well as issues develop. It
is necessary to overcome the theoretical tests for media with other concepts.

6. Detailed Contentsb

BLOCK I. Based Methods trajectories and Environments
• Topic 1.1. Metaheuristics: Introduction and classification
• Topic 1.2. Local search algorithms Basic
• Topic 1.3. Simulated Cooling algorithms
• Topic 1.4. I Tabu Search algorithms
• Topic 1.5. Based Methods multipath I: Basic methods Multiboot and GRASP
• Topic 1.6. Trajectories II based on multiple methods: ILS and VNS Topic 1.7 Introduction to Social
Adaptation based models Item 1.8. Optimization Based on Particle Theme Clouds 1.9
Metaheuristics in Decentralized Systems
BLOCK II: Models Bioinspired
• Topic 2.1 Natural based computing models
• Topic 2.2 Evolutionary Computation
• Topic 2.3. Genetic algorithms I. Basic Concepts
• Topic 2.4. Genetic Algorithms II. Diversity and Convergence
• Topic 2.5. Genetic algorithms III. Multimodal problems
• Topic 2.6. multiobjective
• Topic 2.7. Evolutionary strategies
• Topic 2.8. Memetic algorithms
• Topic 2.9. ants
• Topic 2.10 Artificial Neural Networks
• Topic 2.11 Other computer models bioinspirados

7. Bibliography

7.1 Basic Bibliography:

. D. Corne, M. Dorigo, F. Glover (Eds.). NEW IDEAS IN OPTIMIZATION. McGraw-Hill, 1999.
. A. Diaz and others. OPTIMIZATION AND NEURAL NETWORKS HEURISTICS. Paraninfo, 1996.
. AE Eiben, JE Smith. INTRODUCTION TO EVOLUTIONARY COMPUTING. Springer, 2003.
. F. Glover, GA Kochenberger (Eds.). HANDBOOK OF METAHEURISTICS. Kluwer Academic Press,
2003.
. T. Back, Evolutionary Algorithms in Theory and Practice. Oxford, 1996.
. T. Back, D. Fogel, Z. Michalewicz, Handbook of Evolutionary Computation. Institute of Physics
Publishing and Oxford University Press, 1997.
. W. Banzhaf, P. Nordin, RE Keller, FD Francone, Genetic Programming. An Introduction. Kaufmann
Publishers, 1998.
. P. Bentley, Digital Biology. How Nature is Transforming Our Technology. Headline, 2001.
. Rojas, R. Neural Networks. A systematic Introduction. Springer Verlag, 1995.
. Haykin, S. Neural Networks. A comprenhensive Foundation. Prentice Hall, 1999.
. Bishop, C. Neural Networks for Pattern Recognition. Clarendon Press-Oxford, 1995.

7.2 Additional Bibliography:

ANEXO I

. Reed, R. Marks, RJ Neural Smithing, Supervised Learning in Feedforward Artificial Neural Networks. The MIT Press, 1999.

. E. Bonabeau, M. Dorigo, T. Theraulaz. From Natural to Artificial Intelligence Swarm. Oxford University Press, 1999

. M. Chambers (Ed.), Practical Handbook of Genetic Algorithms, Vols. I, II, and III. CRC Press, 1995, 1998.

. D. Corne, M. Dorigo, F. Glover (Eds.), New Ideas in Optimization. McGraw-Hill, 1999.

. M. Dorigo, T. Stützle, Ant Colony optimization. The MIT Press, 2004.

. AE Eiben and JE Smith, Introduction to Evolutionary Computing. Springer, 2003.

. DB Fogel, Evolutionary Computation. IEEE Press, 1995.

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. DE Goldberg, Genetic Algorithms in Search, Optimization, and Learning. Addison Wesley, 1989.

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. Z. Michalewicz, Genetic Algorithms + Data Structures = Evolution Programs. Springer-Verlag, 1996.

. HP. Schwefel, Evolution and Optimum Seeking. John Wiley, 1995.

. M. Shipper. Machine Nature. The Coming Age of Bio-Inspired Computing. McGraw-Hill, 2002.

ANEXO I

8. Systems and Assessment Criteria

8.1 System for Assessment:

• Practice Presentarion
• Work presentation and essays
• Individual Student Monitoring

8.2 Assessment Criteria and Marks:

8.2.1 Examinations Convocatory I

The principles of the subject evaluation criteria are preferably continuous evaluation, meaning the diversified assessment is carried out at different times of the academic year in progress. This diversified assessment only applies to June and September . It is made using the following evaluation systems face and weights:
• 70% delivery and oral defense practices consist in making practices and presential defense in a timely manner described in the description of the practice. To consider superseded this part must meet the following requirements
• An oral examination on the content of it. The student should know that each section corresponds theoretical part developed and be able to explain it with the support of the material the student may bring to the event.
• Mandatory parties established in each practice must be properly implemented as is indicated in the subject and have to match with what is explained in theory. If code and documentation did not have a sufficient level this part is considered unsurpassed. Partial deliveries may be indicated to be delivered
• 20% Work presentation and essays, 3 - 5 activities will be carried with equal weight, not necessarily planned, on some issues, in theory sessions or practices involving any of these tasks:
• Search and / or presentation of information in class about a particular concept
• Questions and brief reasoning on any of the topics covered in the subject
• Theoretical and practical approaches to developing a problem in class
• 10% Individual Student Monitoring, consisting of optional parts or optional work practices.
To pass the subject is required to have more than a 5 by applying the previous formula of and overcome the practical part.

The mention of Honor Distinction may be awarded to students who have achieved a score equal to or greater than 9.0. As a general rule, these references will go in descending order granting the final grade obtained. In any case the number of "Distinctions" will be granted above the maximum set for the subject in the current academic year. In case of a tie, obtained regularity prevail over all proposed evaluation systems. If the tie persists, the students involved would be proposed conducting a new assessment test.
For all materials submitted by students implicitly it assumes the statement of originality thereof, understood in the sense that it did not use sources without properly citing them. Detection of plagiarism in any of these materials, and under Article 15 of Regulation Evaluation for degrees and official master's degree from the University of Huelva, will lead the numerical grade of zero on the subject, regardless of other qualifications the students had obtained. In addition, the appropriate disciplinary proceedings before the Commission of Teaching Department will start.
the acquisition of skills as follows guaranteed: by the work carried out in practice, skills: C-CE3, CE4-C, G02, G03, G04 and; through active participation in the theoretical sessions, skills: CE3-C, CB4, CG0, G02, G04 G05, G06 and T01; and by the academically supervised activities, skills: CE3-C, C-CE4, G02, G03, G04, G05, G06 and T01.

8.2.2 Examinations Convocatory II

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In September (2nd ordinary convocatory):
• Approved practices and activities are only saved until September.
• Unsurpassed activities or practices will recover the day of the September session. These will be assessed by delivery and defense in the same way. The practice / activity course or other similar content will be published with at least two weeks in advance in moodle. If there are no specific activities / practices on that date the same ones raised during the course will be applicable.

8.2.3 Examinations Convocatory III

• Theory (30%): it will be an examination of theoretical / problems that may include development in pseudocode to solve similar to those developed in practical problem questions, has a classroom and individual character and last for an hour and a half. The matter under consideration will be treated all along the course. Only it is used documentation provided by the teaching staff on the day of the test. As far as possible, it is held in a computer room.
• Practice (70%): It will be an examination in which a practical statement is similar to those performed during the course. This statement may refer to more than one thematic block. It will have an individual character and a duration of 4 hours. 3 hours to resolution and time at the end to defend it in the same conditions as the practices during the course. Only documentation provided by the teaching staff on the day of the test will be available. As far as possible, it will be held in a computer room.
It will be necessary to obtain an average of 5 (using the formula a above) and at least 5 in the practical part to pass the course.

ANEXO I

8.2.4 Extraordinary Convocatory

• Theory (30%): it will be an examination of theoretical / problems that may include development in pseudocode to solve similar to those developed in practical problem questions, has a classroom and individual character and last for an hour and a half. The matter under consideration will be treated all along the course. Only it is used documentation provided by the teaching staff on the day of the test. As far as possible, it is held in a computer room.
• Practice (70%): It will be an examination in which a practical statement is similar to those performed during the course. This statement may refer to more than one thematic block. It will have an individual character and a duration of 4 hours. 3 hours to resolution and time at the end to defend it in the same conditions as the practices during the course. Only documentation provided by the teaching staff on the day of the test will be available. As far as possible, it will be held in a computer room.
It will be necessary to obtain an average of 5 (using the formula a above) and at least 5 in the practical part to pass the course.

8.3 Single Final Evaluation:

• Theory (30%): it will be an examination of theoretical / problems that may include development in pseudocode to solve similar to those developed in practical problem questions, has a classroom and individual character and last for an hour and a half. The matter under consideration will be treated all along the course. Only it is used documentation provided by the teaching staff on the day of the test. As far as possible, it is held in a computer room.
• Practice (70%): It will be an examination in which a practical statement is similar to those performed during the course. This statement may refer to more than one thematic block. It will have an individual character and a duration of 4 hours. 3 hours to resolution and time at the end to defend it in the same conditions as the practices during the course. Only documentation provided by the teaching staff on the day of the test will be available. As far as possible, it will be held in a computer room.
It will be necessary to obtain an average of 5 (using the formula a above) and at least 5 in the practical part to pass the course.