COURSE INFORMATION

METAHEURISTICS

Code number: 606010239
Degree: Degree in Computer Engineering
Department: Information Technologies
Academic Year: 2017-2018. Second semester.
Course type: Compulsory. 4th year.
Teaching hours: 2 sessions - 4hours per week
Credit value: 6 ECTS
Link to Spanish counterpart: http://www.uhu.es/etsi/guia-de-asignatura/?codigo=606010239

TEACHING STAFF

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PROGRAMME

1. DESCRIPTION

Introduction and classification of metaheuristics, utility and justification of approximated solutions. Metaheuristics based on trajectories and environments: basic local search algorithms, cooling simulated taboo search and multipath based methods: multiboot, GRASP ,ILS and VNS.
- Methods based on populations: genetic algorithms.
- Study of the balance between intensification and diversification in the search algorithms.
- Metaheuristics distributed and parallel search.
- Hybrid search metaheuristics: memetic algorithms, scatter search, etc..
- Introduction to computer models based on natural models: models of adaptation social, evolutionary, and others.

2. PREREQUISITES

Strong knowledge of code programming in Java or other object programming language.
General Knowledge of Artificial Intelligence foundations

3. LEARNING OUTCOMES

The student will learn how to use and implement optimization techniques based in nature behaviour and other search algorithms more used on the real world to solve problems that are not solvable with standard optimization methods.

4. COMPETENCES

- SPECIFIC COMPETENCES
    - CE3-C
    - CE4-C
- BASIC COMPETENCES
    - CB4
    - CG0
    - G02
    - G03
    - G04
    - G05
    - G06
    - T01

5. TEACHING METHODOLOGY

The main method of providing information for knowledge is through lectures and the associated hand-outs and supporting material on the blackboard and Moodle. Lecturers will introduce analysis or design methods for which problems will be set to assist students in assimilating this knowledge during their private study.

The lectures are supported by associated problem solving sessions which reinforce the lecture content. There is a substantial amount of self-directed learning through project work. The degree of complexity of the project work grows as the student progresses through the programme.

6. CONTENTS

BLOCK I: Methods Based on Environments and Trajectories

- Topic 1.1. Metaheuristics: Introduction and Classification
- Topic 1.2. Basic Local Search Algorithms
- Topic 1.3. Simulated Cooling Algorithms
- Topic 1.4. Taboo Search Algorithms
- Topic 1.5. Multiple Trajectories I: Basic Multilevel Methods and GRASP
- Topic 1.6. Multiple Trajectories II: ILS and VNS
- Topic 1.7. Particle Cloud Optimization
- Topic 1.8. Memetic Algorithms
- Topic 1.9 Paralleling Metaheuristics

BLOCK II: Bio-inspired methods

- Topic 2.1. Computing Based on Bio-inspired Models
- Topic 2.2. Introduction to Evolutionary Computing
- 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. Multi-objective Algorithms
- Topic 2.7. Evolutionary Algorithms
- Topic 2.8. Decentralized Systems: Parallel and Distributed
- Topic 2.9. Optimization Based on Ants Colonies
- Topic 2.10. Neural networks

7. BIBLIOGRAPHY

. A.E. Eiben, J.E. Smith. INTRODUCTION TO EVOLUTIONARY COMPUTING. Springer, 2003.
. F. Glover, G.A. 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, R.E. Keller, F.D. 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 comprehensive Foundation. Prentice Hall, 1999.
. Bishop, C. Neural Networks for Pattern Recognition. Claredon Press-Oxford, 1995.

8. ASSESSMENT

- Project development (4 deliveries of code, documentation and Oral Presentation) 60%
- In class work 30%
    - Tests
    - Internet Summary works
    - Participation in debate
- Optional assignment 10%.
    - Written summary presented at class

Note that is mandatory to have at least a 5 over 10 in the Project Development delivery in order to pass the course . No Late work will be accepted