Universitat Autònoma de Barcelona

2019/2020

Algorithmics and Combinatorics in Graphs. Heuristic Methods

Code: 104388
ECTS Credits: 6

Degree	Type	Year	Semester
2503740 Computational Mathematics and Data Analytics	FB	1	2

Contact

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Use of Languages

Principal working language: catalan (cat)
Some groups entirely in English: No
Some groups entirely in Catalan: Yes
Some groups entirely in Spanish: No

Teachers

Albert Ruíz Cirera

Prerequisites

It is necessary that the student has taken Mathematics in the two baccalaureate courses and has examined this r

[Translated from the Catalan version by Google translator]

Objectives and Contextualisation

Know the combinatorial graphs and their terminology
Know the different search algorithms and movement in graphs
Know the types of dynamic data for representation of graphs and their im
Know the basic algorithms of optimal searches in graphs and their compl

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Competences

- Apply a critical spirit and rigour for the validation or rejection of your own arguments and those of others.

- Demonstrate a high capacity for abstraction and translation of phenomena and behaviors to mathematical formulations.
- Formulate hypotheses and think up strategies to confirm or refute them.
- Make effective use of bibliographical resources and electronic resources to obtain information.
- Relate new mathematical objects with other known objects and deduce their properties.
- Students must be capable of collecting and interpreting relevant data (usually within their area of study) in order to make statements that reflect social, scientific or ethical relevant issues.
- Students must be capable of communicating information, ideas, problems and solutions to both specialised and non-specialised audiences.
- Students must have and understand knowledge of an area of study built on the basis of general secondary education, and while it relies on some advanced textbooks it also includes some aspects coming from the forefront of its field of study.
- Using criteria of quality, critically evaluate the work carried out.
- Work cooperatively in a multidisciplinary context assuming and respecting the role of the different members of the team.

Learning Outcomes

1. "Explain ideas and mathematical concepts pertinent to the course; additionally, communicate personal reasonings to third parties."
2. Apply a critical spirit and rigour for the validation or rejection of your own arguments and those of others.
3. Contrast, if possible, the use of calculation with the use of abstraction in solving a problem.
4. Describe the concepts and mathematical objects pertaining to the subject.
5. Develop autonomous strategies for solving problems such as identifying the ambit of problems within the course, discriminate routine from non-routine problems, design an a priori strategy to solve a problem, evaluate this strategy.
6. Evaluate the advantages and disadvantages of using calculation and abstraction.
7. Identify the essential ideas in the demonstration of ceratin basic theorems and know how to adapt these to obtain other results.
8. In an orderly and accurately manner, draft brief mathematical texts (exercises, resolution of theoretical questions, etc.).
9. Make effective use of bibliographical resources and electronic resources to obtain information.
10. Read and understand a mathematical text at the current level of the course.
11. Students must be capable of collecting and interpreting relevant data (usually within their area of study) in order to make statements that reflect social, scientific or ethical relevant issues.
12. Students must be capable of communicating information, ideas, problems and solutions to both specialised and non-specialised audiences.
13. Students must have and understand knowledge of an area of study built on the basis of general secondary education, and while it relies on some advanced textbooks it also includes some aspects coming from the forefront of its field of study.
14. Using criteria of quality, critically evaluate the work carried out.
15. Work cooperatively in a multidisciplinary context, taking on and respecting the role of the distinct members in the team.

Content

Combinatorial algorithms for graphics

Combined graphs and graph searches

Theory of graphs: introduction

Search in graphs: Depth-first and Breadth-first

Greedy Algorithms

Recursion

Abstract data types and object-oriented programming: Dynamic lists and

Graphic representation algorithms. Avantatgews disadvantages of each

Abstract and dynamic data types for graphs and their implementation in C
Basic algorithms for optimal search graphs and their complexity
- Calculation of distances from latitude and longitude
- Algorithm of Dijkstra for optimal routes in graphs
- Algorithm A *: heuristic search for optimal paths in graphs

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Methodology

The weekly sessions of the subject will be divided, usually, in two parts:
a) A theoretical part in which the teacher will introduce the concepts, met
b) A practical part in which students will be proposed a series of problem
Complementary exercises will also be proposed as an autonomous activ

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Activities

Title	Hours	ECTS	Learning Outcomes
Type: Directed			
Attend the theoretical and practical classes	56	2.24	2, 1, 10, 8, 9
Type: Supervised			
Completion of the practices	55	2.2	2, 14, 6, 3, 1, 10, 12, 11, 8, 15, 9
Type: Autonomous			
Resolution of complementary exercises	30	1.2	2, 14, 6, 3, 1, 10, 12, 11, 8, 15, 9

Assessment

The evaluation will consist of the following activities:
A recoverable final exam, which accounts for 40% of the note
An individual practical work with a delivery period where it will be nece
Delivery, during practical sessions, of practical exercises that will be ca

The minimum grade in each of the three evaluation activities to be able to pass the subject is 3.5 points out of 10

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Assessment Activities

Title	Weighting	Hours	ECTS	Learning Outcomes
Delivery of practical exercices	25%	0	0	2, 14, 4, 5, 1, 10, 13, 12, 11, 8, 15, 9
End of term exam	40%	4	0.16	4, 1, 7, 10, 11, 8
Individual practical work	35%	5	0.2	2, 14, 6, 3, 4, 5, 1, 10, 12, 11, 8

Bibliography

- Fundamentos de programación (algoritmos, estructuras de datos y objetos), Luis Joyanes, McGraw-Hill, Madrid etc. (2003).
- Algoritmos y estructuras de datos - una perspectiva en C, Luis Joyanes y Ignacio Zahonero, McGraw-Hill, Madrid etc. (2004).
- Grafs combinatòris i cerques en gràfs:Wikipedia
- Tipus abstractes de dades i programació orientada a objectes: Llistes dinàmiques i arbres; Tipus abstractes i dinàmics de dades per a grafs i la seva implementació en C.
  Notes del curs
  Algoritmos + Estructura de datos = Programas, Niklaus Wirth, Ediciones del Castillo, Madrid (1986).
  C algoritmos, programación y estructuras de datos, Luis Joyanes Aguilar et al., McGraw-Hill, Madrid etc. (2005).
- Algorismes de representació de grafs. Avantatgews inconvenients de cada una de les opcions: Wikipedia i notes del curs
- ACàlcul de distàncies a partir de la latitud i la longitud: Wikipoedia i notes del curs
- Algorisme de Dijkstra per a rutes òptimes en grafs: Presentació d'Eric Demaine
- Algorisme A*: cerca heurística per a rutes òptimes en grafs
  Heuristics: Intelligent Search Strategies for Computer Problem Solving, Judea Pearl Addison-Wesley Pub (Sd) | ISBN: 0201055945 | 1984-04 | djvu (ocr) | 399 pages | 3.66 Mb Pagines: 33 to 46, 48, 49, 64, 65, 73--85.L'exemple a les pàgines 52--54 pot ser relevant.