DEGREE CURRICULUM

DATA STRUCTURES

Coordination: SAYAGO BARRANTES, SERGIO

Academic year 2022-23

DATA STRUCTURES 2022-23

Subject's general information

<table>
<tr><td>Subject name</td><td>DATA STRUCTURES</td></tr>
<tr><td>Code</td><td>102375</td></tr>
<tr><td>Semester</td><td>1st Q(SEMESTER) CONTINUED EVALUATION</td></tr>
<tr><td>Typology</td><td>
<table>
<tr><th>Degree</th><th>Course</th><th>Character</th><th>Modality</th></tr>
<tr><td>Bachelor's degree in Digital Interaction and Computing Techniques</td><td>2</td><td>COMPULSORY</td><td>Attendance-based</td></tr>
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<tr><td>Course number of credits (ECTS)</td><td>6</td></tr>
<tr><td>Type of activity, credits, and groups</td><td>
<table>
<tr><th>Activity type</th><td>PRALAB</td><td>TEORIA</td></tr>
<tr><th>Number of credits</th><td>3</td><td>3</td></tr>
<tr><th>Number of groups</th><td>1</td><td>1</td></tr>
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<tr><td>Coordination</td><td>SAYAGO BARRANTES, SERGIO</td></tr>
<tr><td>Department</td><td>COMPUTER SCIENCE AND INDUSTRIAL ENGINEERING</td></tr>
<tr><td>Teaching load distribution between lectures and independent student work</td><td>According to the academic framework of bachelor’s degrees of the EPS:
- 1 ECTS = 25 hours; 6 ECTS = 150 hours
- 40% (60h) of in-class work and 60% (90h) of autonomous work

This distribution in this course is as follows:
- Lectures: theory (28h) + laboratories (28h) = 56 + 4 hours of exams = 60h
- Independent student's work = first theory exam (20h) + second theory exam (20h) + first lab exam (20h) + second lab exam (30h) = 90h</td></tr>
<tr><td>Important information on data processing</td><td>Consult this link for more information.</td></tr>
<tr><td>Language</td><td>Spanish (materials). Spanish / Catalan (in the classroom)</td></tr>
<tr><td>Distribution of credits</td><td>See type of activity, credits, and groups</td></tr>
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DATA STRUCTURES 2022-23

Teaching staff	E-mail addresses	Credits taught by teacher	Office and hour of attention
LOPEZ FERNANDEZ, JESUS MARIA	jesus.lopez@udl.cat	3	
SAYAGO BARRANTES, SERGIO	sergio.sayago@udl.cat	3	Make an appointment via e-mail. Office 12 Campus Igualada (Pla de la Massa) / Online via videconference

Subject's extra information

Data Structures is a compulsory course of 6 ECTS. Data Structures is held in the first semester of the second year of the bachelor's degree in Digital Interaction and Computing Techniques (GTIDIC).

GTIDIC aims to train qualified professionals in the computing field with a very practical side, giving special emphasis to the design and implementation of interactive applications. The graduates will acquire solid programming knowledge, focusing on mobile and web applications, Internet technologies, administration tools and security systems, and interface design and development.

Data Structures focuses on data structures for programming. Data Structures is designed to provide students with a hands-on and thorough introduction to data structures. To this end, the students will carry out 6 laboratories.

Data Structures follows up on Object Oriented Programming, as it focuses on key concepts of OOP related to data structures in Java. Data Structures also aims to complement Mathematics for Computing and Computing Techniques by discussing algorithm analysis and complexity.

Free software will be used in the course. Namely, we will use IntellJ IDEA Community Edition (or similar).

Learning objectives

1. To be conversant with the main types of data structures: sequential access, trees, and tables
2. To delve into object oriented programming; design and develop interfaces, abstract classes and generics in data structures by using the Java Collections Framework
3. To analyse operations and algorithms by using Big Oh notation, and develop more efficient algorithms
4. To delve into recursion; design and develop recursive methods to traverse tree and turn these methods into iterative ones
5. To design and develop classes which make use of several data structures and aspects related to object oriented programming in order to solve problems

Competences

According to the table of competences of the GTIDIC (https://ja.cat/zvyK4):

Basic competences

CB03 That students have the ability to gather and interpret relevant data (usually within their area of study) to makejudgments that include a reflection on relevant social, scientific or ethical issue.

Transversal competences

CT3 Acquire training in the use of new technologies and information and communication technologies.

DATA STRUCTURES 2022-23

General competences

CG10. Capacity to apply proper algorithmic techniques to solve computational problems.

Specific competences

CE2. Capacity to understand and master the basic concepts of discrete mathematics, logics, algorithmic and computational complexity, and its application to solve computational problems

CE8. Knowledge and application of the basic algorithmic procedures of computer technologies to design solutions to computational problems, analyzing the suitability and complexity of the proposed algorithms.

CE9. Knowledge, design and efficient use of the types and data structure more suitable for solving a problem

CE10. Capacity to analyse, design, build and maintain safe and efficient applications, choosing the most suitable paradigm and programming languages.

Subject contents

- Introduction to algorithms complexity for data structures
- Aspects related to object oriented programming related to the course and guided introduction to the Java Collections Framework
- Main data structures of sequential access: introduction, design, implementation and analysis
- Trees: introduction, design, implementation and analysis
- Hash tables

Methodology

Methdology	Theory	Laboratories	Indepdent student's work
Interactive lectures	X		
Exercises in laboratories (in groups, 2 students per group)		X	
Exercises at home			X
Study (preparation for exams)			X

Development plan

Week	Dates	Theory	Labs	Comments
1	12 Sept - 16 Sept	Presentation + T1	P1	
2	19 Sept - 23 Sept	T2	P1 (cont.) P2	Submission P1.
3	26 Sept - 30 Sept	T2 (cont)	HOLIDAYS	
4	03 Oct - 07 Oct	T3	P2 (cont.)	
5	10 Oct - 14 Oct	T3 (cont)	P3	Submission P2
6	17 Oct - 21 Oct	T3 (cont)	P3 (cont.)	
7	24 Oct - 28 Oct	Mockup_1	P4	Submission P3
8	31 Oct - 04 Nov	HOLIDAYS	P4 (cont.)	
9	07 Nov - 11 Nov	Exams		Theory (T1, T2, T3) Labs (P1, P2, P3)

10	14 Nov - 18 Nov	T4	P5	Submission P4
11	21 Nov - 25 Nov	T4 (cont.)	P5 (cont.)	
12	28 Nov - 2 Dec	T4 (cont.)	P5 (cont.)	Submission P5
13	05 Dec - 09 Dec	HOLIDAYS	P6	
14	12 Dec - 16 Dec	T5	P6 (cont.)	
15	19 Dec - 23 Dec	Mockup_2	P6 (cont.)	Submission P6
16	09 Jan - 13 Jan	Exams		Theory (T4, T5) Labs (P4, P5, P6)
17	16 Jan - 20 Jan	Exams		
18	23 Jan - 27 Jan	Office hours		
19	30 Jan - 03 Feb	Retakes		

Evaluation

The assessment instruments and their relationship with the learning objectives and specific competences are listed below:

Instrument	Learning objectives	Specific competences
Labs	All	All
Exams	All	All

The overall assessment framework is defined by the GTIDIC, the academic framework of the EPS (https://www.eps.udl.cat/ca/informacio-academica/normatives/marc-academic-eps/), and the regulation of assessment in degrees at UdL (http://www.udl.cat/ca/udl/norma/). The evaluation, within this context, in this course is as follows:

Continuous assessment

Final Grade (FG) = **Theory * 0.5 + Laboratories * 0.5, FG >= 5**

- **Theory** (50% of the FG) **>= 5**
  - (20% of the FG) First exam. 2 h max. WIthout notes. In paper.
    - First exam = MAX (MockUP_Exam_1, First_exam)
  - (20% de la FG) Second exam. 2 h max. WIthout notes. In paper.
    - Second exam = MAX (MockUP_Exam_2, Second_exam)
  - (10% de la FG) Participation in sessions
- **NP** (50% of the FG) **>= 5**
  - (20% of the FG) Labs
    - Labs submitted beyond the deadline = 0.
    - Labs (over 10) = [P1(10%), P2(10%), P3 (15%), P4 (15%), P5 (20%), P6 (30%)]
  - (15% of the FG) First exam of labs (P1. P2, P3).
    - It will be carried out together with the first theory exam. It will be a written exam without course materials
    - First exam of labs (over 10) = [P1(20%) + P2 (40%) + P3(40%)].
  - (15% of the FG) Second exam of labs (P4, P5, P6).
    - It will be carried out together with the second theory exam. It will be a written exam without course materials
    - Second exam of labs (over 10) = [P4 (33%), P5 (33%), P6 (33%)]

Retakes - mininum grade = 5, maximum grade = 7.5

- Retakes are not for getting a higher grade
- If **Theory < 5** : final exam. 2 hours.
- If **Laboratories < 5**: final (written) exam of laboratories. 2 hours.

Bibliography

Apropament a les estructures de dades des del programari lliure/ Josep Maria Ribó Balust

Curs pràctic d'àlgebra per a informàtics / Joan Gimbert Quintilla ... [et al.]

Data structures and algorithms in Java / Adam Drozdek

Data structures and problem solving using Java / Mark A. Weiss

Data structures and the Java collections framework / William Collins

Curs Pràctic d'álgebra per a informàtics. Col·lecció Eines. Edicions de la Universitat de Lleida. Joan Gimbert, Ramiro Moreno, Josep Maria Ribo, i Magda Valls