UNIVERSIDAD DE CASTILLA - LA MANCHA
GUÍA DOCENTE

1. General information

Course: DATA STRUCTURES

Type: CORE COURSE

Degree: 405 - DEGREE IN COMPUTER SCIENCE ENGINEERING (TA)

Center: 15 - FACULTY OF SOCIAL SCIENCES AND INFORMATION TECHNOLOGIES

Year: 2

Main language: Spanish

Use of additional languages: Technical documentation in English

Web site: https://campusvirtual.uclm.es

Code: 42312

ECTS credits: 6

Academic year: 2021-22

Group(s): 60

Duration: First semester

Second language: Spanish

English Friendly: Y

Bilingual: N

Lecturer: **ALFONSO NIÑO RAMOS** - Group(s): **60**

Building/Office	Department	Phone number	Email	Office hours
2.11	TECNOLOGÍAS Y SISTEMAS DE INFORMACIÓN	6474	alfonso.nino@uclm.es	Available at: https://www.uclm.es/toledo/fcsociales/grado-informatica/profesorado-y-tutorias

2. Pre-Requisites

Basic knowledge of maths: Logic, Functions theory, Algebraic structure, a minimum of abstraction capability and mathematical expression. It is enough to have passed the subjects of "Algebra" and "Cálculo".

Basic knowledge of Java programming language, fundamentals of information systems and development environments. It is enough to have passed the subjects Programming Funtamentals (I & II) and Sistemas de Información.

It is recommended the student is studying: Lógica (1st semester) and Programming methodology (2nd semester).

3. Justification in the curriculum, relation to other subjects and to the profession

Data structures belongs to the subject of Programming, and is part of the Común a la Rama de Informática module from Grado en Ingeniería Informática

This subject could be seen as a continuation of Programming Fundamentals II, studying new data structures from new viewpoints, in addition to its use, formal definition and implementation; with the advantage of adding the implemented data structures as external libraries.

Furthermore, Programming methodology could be seen as a continuation of this subject, in which each algorithmic scheme might have an immediate application on new data structures (ordering of lineal structures, greedy explorations or tree dynamics, optimal routes in graphs, etc.). Also, in the subject Programación declarativa (intensificación de Computación), apart from being required certain acquired knowledge (lists, recursive techniques, etc.), it will deep in the definition of all previously learned data structures taking into account important features related to efficiency and optimization (inheritance, higher order, infinite structures, ...).

Finally, during all these studies and also in professional life, software apps should be implemented making use of complex data structures. Programming languages provide apropppriate structures (lists, queues, etc.). The detailed analysis of these data structures is important to understand their working. In other cases, languages do not provide them (e.g. trees and graphs), and we need to add them. On the other hand, the use of data structures from a design and analysis viewpoint provides us a proper abstraction level and will boost our programming skills (recursion, modularization, etc.), which are needed in software development.

4. Degree competences achieved in this course

Course competences

Code	Description
BA04	Basic knowledge about the uses and programming of computers, operating systems, data bases, and digital programmes with applications in engineering.
CO06	Knowledge and application of basic algorithms in digital technologies for the development of solutions, analysing their appropriateness and complexity.
CO07	Knowledge, design, and efficient use of types of data and structures which arise as most appropriate in problem solving.
CO08	Ability to analyse, design, build and maintain applications in a strong, safe, and efficient manner by selecting the most appropriate paradigms and programming languages.
INS01	Analysis, synthesis, and assessment skills.
INS04	Problem solving skills by the application of engineering techniques.
PER01	Team work abilities.
PER02	Ability to work in an international context.
PER04	Interpersonal relationship skills.
PER05	Acknowledgement of human diversity, equal rights, and cultural variety.
SIS01	Critical thinking.
SIS03	Autonomous learning.
UCLM02	Ability to use Information and Communication Technologies.

5. Objectives or Learning Outcomes

Course learning outcomes

Description

Ability to manage types of data, data structures, and abstract tupes of data in an appropriate manner regarding their problems, as well as their formal

specifications, implementations, and use of abstract types of lineal and non-lineal data

Additional outcomes

Not established

6. Units / Contents

Unit 1: General concepts

Unit 2: Stacks

Unit 3: Queues

Unit 4: Lists

Unit 5: Graphs

Unit 6: Trees

ADDITIONAL COMMENTS, REMARKS

In laboratory sessions, practical exercises with linear and non-linear data structures will be done.

7. Activities, Units/Modules and Methodology

Training Activity	Methodology	Related Competences (only degrees before RD 822/2021)	ECTS	Hours	As	Com	Description
Class Attendance (theory) [ON-SITE]	Lectures	BA04 CO06 CO07 CO08	0.72	18	N	-	
Individual tutoring sessions [ON-SITE]		BA04 CO06 CO07 CO08 UCLM02	0.18	4.5	N	-	
Study and Exam Preparation [OFF-SITE]	Self-study	BA04 CO06 CO07 CO08 SIS01 SIS03	2.1	52.5	N	-	
Other off-site activity [OFF-SITE]	Practical or hands-on activities	BA04 CO06 CO07 CO08 INS01 INS04 PER01 PER02 PER04 PER05 SIS03	0.6	15	N	-	
Problem solving and/or case studies [ON-SITE]	Problem solving and exercises	BA04 CO06 CO07 CO08 PER01 PER02 PER04 PER05 SIS01 SIS03 UCLM02	0.6	15	Y	N	
Writing of reports or projects [OFF-SITE]	Self-study	BA04 CO06 CO07 CO08 INS01 INS04 PER01 PER02 PER04 PER05 SIS03	0.9	22.5	Y	N	
Laboratory practice or sessions [ON-SITE]	Practical or hands-on activities	BA04 CO06 CO07 CO08 INS04 PER01 PER02 PER04 PER05	0.6	15	Y	Y	
Final test [ON-SITE]	Assessment tests	BA04 CO06 CO07 CO08 INS01 INS04	0.3	7.5	Y	Y	
Total:			**6**	**150**			
Total credits of in-class work: 2.4						**Total class time hours: 60**	
Total credits of out of class work: 3.6						**Total hours of out of class work: 90**	

As: Assessable training activity

Com: Training activity of compulsory overcoming (It will be essential to overcome both continuous and non-continuous assessment).

8. Evaluation criteria and Grading System

Evaluation System	Continuous assessment	Non-continuous evaluation*	Description
Final test	50.00%	50.00%	Compulsory activity that can be retaken (rescheduling) to be carried out within the planned exam dates of the final exam call (convocatoria ordinaria)
Theoretical papers assessment	15.00%	15.00%	0.00% Non-compulsory activity that can be retaken. To be carried out before the end of the teaching period
Assessment of active participation	10.00%	10.00%	Non-compulsory activity that can be retaken. To be carried out during the theory/lab sessions by the continuous assesment students. Non-continuous evaluation students will be evaluated with an alternative system.
Laboratory sessions	25.00%	25.00%	Compulsory activity that can be retaken. To be carried out during lab sessions
Total:	**100.00%**	**100.00%**	

According to art. 4 of the UCLM Student Evaluation Regulations, it must be provided to students who cannot regularly attend face-to-face training activities the passing of the subject, having the right (art. 12.2) to be globally graded, in 2 annual calls per subject , an ordinary and an extraordinary one (evaluating 100% of the competences).

Evaluation criteria for the final exam:

Continuous assessment:

In compulsory activities, a minimum mark of 40% is required in order to pass that activity and have the possibility to therefore pass the entire subject. The

evaluation of the activities will be global and therefore must be quantified by means of a single mark. If the activity consists of several sections, each section may

be evaluated separately provided students are informed in writing of this evaluation criterion at the beginning of the academic year. In the case of the activities

that may be retaken (i.e., rescheduling), an alternative activity or test will be offered in the resit/retake exam call (convocatoria extraordinaria).

The final exam will be common for all the theory/laboratory groups of the subject and will be evaluated by the lecturers of the subject in a serial way, i.e., each

part of the final exam will be evaluated by the same lecturer for all the students.

A student is considered to pass the subject if she/he obtains a minimum of 50 points out of 100, taking into account the points obtained in all the evaluable activities, and also have passed all the compulsory activities.

For students who do not pass the subject in the final exam call (convocatoria ordinaria), the marks of activities already passed will be conserved for the resit/retake exam call (convocatoria extraordinaria). If an activity is not recoverable, its assessment will be preserved for the resit/retake exam call (convocatoria extraordinaria) even if it has not been passed. In the case of the passed recoverable activities, the student will have the opportunity to receive an alternative evaluation of those

activities in the resit/retake exam call and, in that case, the final grade of the activity will correspond to the last grade obtained.

The mark of the passed activities in any call, except for the final exam, will be conserved for the subsequent academic year at the request of the student, provided

that mark is equal or greater than 50% and that the activities and evaluation criteria of the subject remain unchanged prior to the beginning of that academic year.

The failure of a student to attend the final exam will automatically result in her/him receiving a "Failure to attend¿ (no presentado). If the student has not passed

any compulsory evaluation activity, the maximum final grade will be 40%

Non-continuous evaluation:

Students who are unable to attend training activities on a regular basis may apply at the beginning of the semester for the non-continuous assessment mode. Similarly, if a student who is undergoing continuous assessment incurs any circumstance that prevents her/him from regularly attending the classroom-based training activities, she/he may renounce the accumulated mark in continuous assessment and apply for the non-continuous assessment mode.

In the same way, the student may change to the non-continuous evaluation mode as long as she/he has not participated during the teaching period in evaluable activities that together account for at least 50% of the total mark of the subject. If a student has reached this 50% of the total obtainable mark, or the teaching period is over, she/he will be considered in continuous assessment without the possibility of changing to non-continuous evaluation mode.

Students who take the non-continuous assessment mode will be globally graded, in 2 annual calls per subject , an ordinary and an extraordinary one (evaluating 100% of the competences), through the assessment systems indicated in the column "Non-continuous assessment".

In the "non-continuous assessment" mode, it is not compulsory to keep the mark obtained by the student in the activities or tests (progress test or partial test) taken in the continuous assessment mode.

Specifications for the resit/retake exam:

Evaluation tests will be conducted for all recoverable activities

Specifications for the second resit / retake exam:

Same characteristics as the resit/retake exam call

9. Assignments, course calendar and important dates	
Not related to the syllabus/contents	
Hours	**hours**
Individual tutoring sessions [PRESENCIAL][]	4.5
Study and Exam Preparation [AUTÓNOMA][Self-study]	52.5
Other off-site activity [AUTÓNOMA][Practical or hands-on activities]	15
Writing of reports or projects [AUTÓNOMA][Self-study]	22.5
Laboratory practice or sessions [PRESENCIAL][Practical or hands-on activities]	15
Final test [PRESENCIAL][Assessment tests]	7.5
General comments about the planning: The subject is taught in 3 x 1,5 hour sessions per week. The planning can be modified in the event of unforeseen causes.	
Unit 1 (de 6): General concepts	
Activities	**Hours**
Class Attendance (theory) [PRESENCIAL][Lectures]	3
Problem solving and/or case studies [PRESENCIAL][Problem solving and exercises]	1.5
Unit 2 (de 6): Stacks	
Activities	**Hours**
Class Attendance (theory) [PRESENCIAL][Lectures]	2
Problem solving and/or case studies [PRESENCIAL][Problem solving and exercises]	3.5
Unit 3 (de 6): Queues	
Activities	**Hours**
Class Attendance (theory) [PRESENCIAL][Lectures]	2
Problem solving and/or case studies [PRESENCIAL][Problem solving and exercises]	1.5
Unit 4 (de 6): Lists	
Activities	**Hours**
Class Attendance (theory) [PRESENCIAL][Lectures]	2
Problem solving and/or case studies [PRESENCIAL][Problem solving and exercises]	2.5
Unit 5 (de 6): Graphs	
Activities	**Hours**
Class Attendance (theory) [PRESENCIAL][Lectures]	3.5
Study and Exam Preparation [AUTÓNOMA][Self-study]	2.5
Unit 6 (de 6): Trees	
Activities	**Hours**
Class Attendance (theory) [PRESENCIAL][Lectures]	5.5
Study and Exam Preparation [AUTÓNOMA][Self-study]	3.5

Global activity

Activities	hours
Class Attendance (theory) [PRESENCIAL][Lectures]	18
Individual tutoring sessions [PRESENCIAL][]	4.5
Problem solving and/or case studies [PRESENCIAL][Problem solving and exercises]	9
Other off-site activity [AUTÓNOMA][Practical or hands-on activities]	15
Writing of reports or projects [AUTÓNOMA][Self-study]	22.5
Laboratory practice or sessions [PRESENCIAL][Practical or hands-on activities]	15
Final test [PRESENCIAL][Assessment tests]	7.5
Study and Exam Preparation [AUTÓNOMA][Self-study]	58.5
Total horas:	150

10. Bibliography and Sources

Author(s)	Title/Link	Publishing house	City	ISBN	Year	Description
Weiss, M.A.	Data Structures and Problem Solving Using Java (Fourth Edition) http://users.cs.fiu.edu/~weiss/	Addison-Wesley		0-321-54140-5	2010	
Weiss, M.A.	Estructura de datos en Java (4ª edición)	Pearson		9788415552239	2014	
Goodrich, M.T., Tamassia R. , Goldwasser M.H.	Data structures and algorithms in Java http://bcs.wiley.com/he-bcs/Books?action=index&itemId=1118808576&bcsId=8950	Wiley		978-1-118-80836-8 2	2014	
Oracle	Lenguaje de Programación JAVA http://www.java.com/es	Oracle				
R. Sedgewick, K. Wayn	Algorithms, 4th Edition http://algs4.cs.princeton.edu/home/	Addison-Wesley		978-0321573513	2011	
Martí Oliet, N., Ortega Mallén Y., Verdejo López J.A.	Estructuras de datos y métodos algoritmicos: ejercicios resueltos	Prentice Hall		978-84-205-3849-5 2	2003	