



Teaching Guide

Identifying Data					2019/20
Subject (*)	Discrete Mathematics		Code	614G02002	
Study programme	Grao en Ciencia e Enxeñaría de Datos				
Descriptors					
Cycle	Period	Year	Type	Credits	
Graduate	1st four-month period	First	Basic training	6	
Language	Spanish				
Teaching method	Face-to-face				
Prerequisites					
Department	Ciencias da Computación e Tecnoloxías da InformaciónComputación				
Coordinador	Vidal Martin, Concepcion	E-mail	concepcion.vidalm@udc.es		
Lecturers	Aguado Martin, Maria Felicidad Perez Vega, Gilberto Vidal Martin, Concepcion	E-mail	felicidad.aguado@udc.es gilberto.pvega@udc.es concepcion.vidalm@udc.es		
Web	campusvirtual.udc.es/moodle				
General description	<p>The subject of Discrete Mathematics is taught in the first semester of the first year of the Degree in Science and Data Engineering and belongs to the Basic Training module.</p> <p>In this subject you must acquire the habits of abstraction and rigor necessary in the professional field of an engineer and data scientist. The concepts studied are basic for the development of other subjects; for example, in linear algebra, design and analysis of algorithms, introduction to databases, fundamentals of computers, mathematical optimization, machine learning ...</p>				

Study programme competences / results

Code	Study programme competences / results
A1	CE1 - Capacidade para utilizar con destreza conceptos e métodos propios da matemática discreta, a álgebra lineal, o cálculo diferencial e integral, e a estatística e probabilidade, na resolución dos problemas propios da ciencia e enxeñaría de datos.
A2	CE2 - Capacidade para resolver problemas matemáticos, planificando a súa resolución en función das ferramentas dispoñibles e das restricións de tempo e recursos.
B1	CB1 - Que os estudantes demostrasen posuír e comprender coñecementos nunha área de estudo que parte da base da educación secundaria xeral, e adóitase atopar a un nivel que, aínda que se apoia en libros de texto avanzados, inclúe tamén algúns aspectos que implican coñecementos procedentes da vangarda do seu campo de estudo
B5	CB5 - Que os estudantes desenvolvesen aquelas habilidades de aprendizaxe necesarias para emprender estudos posteriores cun alto grao de autonomía
B6	CG1 - Ser capaz de buscar e seleccionar a información útil necesaria para resolver problemas complexos, manexando con soltura as fontes bibliográficas do campo.
C1	CT1 - Utilizar as ferramentas básicas das tecnoloxías da información e as comunicacións (TIC) necesarias para o exercicio da súa profesión e para a aprendizaxe ao longo da súa vida.

Learning outcomes

Learning outcomes	Study programme competences / results		
Know and handle the symbolic language, formalize logical arguments and prove the validity of them	A1		
	A2		
Know the basic concepts of the theory of sets and applications	A1	B1	C1
	A2	B6	



Know the counting techniques and their applications	A1 A2	B1 B5 B6	C1
Know the fundamental concepts of graph theory and its application to problem solving.	A1 A2	B1 B5 B6	C1

Contents	
Topic	Sub-topic
1.- Logic Reasoning	Propositional logic: propositions and logical operators Implications and Logical Equivalences Proof methods: Semantic tables, induction principle Normal forms Predicate Logic
2.- Sets, functions and relations	Basic theory of sets: elements, subsets Some sets of numbers: the integers and the complexes Functions, types of functions, composition Binary relations, properties Equivalence relations, equivalence classes and quotient set Order relations, distinguished elements, Hasse diagrams
3.- Combinatorics and Recurrence	Basic counting principles Variations, permutations and combinations Binomial and multinomial coefficients Inclusion-exclusion principle Successions and series Recurrent relations Resolution of some recurrence equations. Applications
4.-Graphs	Directed graphs: basic concepts Non directed graphs: basic concepts Connectivity Trees. Rooted Trees Search trees Weighted graphs: the problem of the minimal spanning tree

Planning				
Methodologies / tests	Competencies / Results	Teaching hours (in-person & virtual)	Student?s personal work hours	Total hours
Guest lecture / keynote speech	A2 A1 B3 B6 B8 C1	30	45	75
Seminar	A2 A1 B1 B3 B6 B8 C1	8	12	20
Objective test	A1 A2 B1 B3 B6 B8 C1	3	0	3
Laboratory practice	A1 A2 B5 C1	20	30	50
Personalized attention		2	0	2

(*)The information in the planning table is for guidance only and does not take into account the heterogeneity of the students.

Methodologies	
Methodologies	Description



Guest lecture / keynote speech	<p>Through the virtual platform of the university, students will be provided detailed information on the contents of each topic so that each student can configure, according to their criteria and needs, the appropriate material for monitoring and understanding the matter; You can make use of the recommended bibliography and / or material available in the network.</p> <p>The theoretical and practical classes will be developed simultaneously in the classroom, performing exercises after the theoretical explanations. The explanation of formal techniques will begin by means of examples, emphasizing concrete calculations and the algorithmic nature of some of them. It is intended that students are able to draw conclusions from the results obtained, trying to motivate students to participate and be able to infer conclusions.</p>
Seminar	During the tutorial sessions, students may raise questions about the concepts, exercises and procedures seen in the theory and problems sessions.
Objective test	There will be a written exam that will consist of a collection of theoretical questions and / or problems (of the same type as those proposed in the seminars (TGR) and in the collections of exercises).
Laboratory practice	<p>At the beginning of each chapter, students will be given a collection of exercises related to the theoretical contents explained in the guest lecture sessions. In these sessions it is intended:</p> <p>I) to encourage the student by solving exercises, with the help of the teacher, to reinforce the understanding of the concepts studied,</p> <p>II) to encourage the reasoned resolution of the exercises, avoiding the use of "recipes".</p> <p>Depending on the subject and the resources available, work can be done with computer programs that reinforce the concepts worked on in the theoretical and exercise classes.</p>

Personalized attention

Methodologies	Description
Laboratory practice	<p>In the sessions in small groups, the doubts raised by the students are solved, especially when they are common to several of them or correspond to cases of special interest for their practical application. If the question is more specific or not fully resolved for any student, it would be treated in the hours of individualized tutoring.</p> <p>The students will know the evaluation of the tests carried out throughout the course, in order to correct the errors and / or improve the answers to the exercises, with a view to a more solid formation.</p> <p>Students have also the possibility to review the grade obtained in the final written test, verifying that it meets the established evaluation criteria.</p>

Assessment

Methodologies	Competencies / Results	Description	Qualification
Laboratory practice	A1 A2 B5 C1	<p>Ao longo do curso realizarase unha avaliación dos distintos temas onde se exporán definicións dos conceptos introducidos, cuestións e exercicios similares aos do correspondente boletín. Valorarase a resposta correcta ás cuestións e exercicios expostos e, a presentación e a claridade da exposición realizada.</p> <p>Poderase ter en conta a actitude participativa do alumnado na resolución das cuestións formuladas durante as prácticas.</p>	20



Objective test	A1 A2 B1 B3 B6 B8 C1	<p>Ao final do curso farase unha proba escrita. Esta proba inclúe:</p> <ul style="list-style-type: none"> - Preguntas curtas que permiten valorar se o alumno comprendeu os conceptos teóricos básicos. - Problemas cun grao de dificultade similar aos feitos en clase e os presentados nas coleccións de exercicios propostos. <p>Valoraranse o dominio dos conceptos teóricos da materia, a súa comprensión e a súa aplicación na resolución de exercicios. Así mesmo, avaliarase a claridade, a orde e a presentación dos resultados expostos.</p> <p>Para superar a materia é necesario obter máis de 3,2 puntos dos 8 posibles na proba escrita.</p> <p>A presentación á proba final do curso supón que o alumno completou o proceso de avaliación continua.</p>	80
Others			

Assessment comments

The evaluation of the laboratory practices of students with part-time enrollment can be made by attending, as far as possible, to their particular circumstances.

Sources of information

Basic	<ul style="list-style-type: none"> - Aguado, F. et al (2018). Problemas resueltos de Combinatoria. Laboratorio con SageMath. Paraninfo - Caballero, R., Hortalá, M.T., Martí, N., Nieva, S., Pareja, A. y Rodríguez, M. (2007). Matemática Discreta para Informáticos. Ejercicios resueltos. Pearson - García Merayo, F.; Hernández Peñalver, G. y Nevot Luna, A. (2003). Problemas Resueltos de Matemática Discreta. Thomson - Rosen, K. H. (2019). Discrete Mathematics and Its Applications. McGraw-Hill - Vieites A. et al (2014). Teoría de grafos. Ejercicios resueltos y propuestos. Laboratorio con SAGE. Paraninfo
Complementary	<ul style="list-style-type: none"> - Biggs, N. L. (1994). Matemática Discreta. Vicens Vives - Scheinerman, E. R. (2001). Matemáticas Discretas. Thomson Learning - Grimaldi, R. P. (2006). Discrete and Combinatorial Mathematics. Pearson Education

Recommendations

Subjects that it is recommended to have taken before

Subjects that are recommended to be taken simultaneously

Subjects that continue the syllabus

Other comments

<p>It is recommended to have taken the subjects of Mathematics from high school</p>

(*The teaching guide is the document in which the URV publishes the information about all its courses. It is a public document and cannot be modified. Only in exceptional cases can it be revised by the competent agent or duly revised so that it is in line with current legislation.