UNIVERSIDADE DA CORUÑA

Teaching Guide				
Identifying Data				**2022/23**
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 Información			
Coordinador	Vidal Martin, Concepcion		E-mail	concepcion.vidalm@udc.es
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General description	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. 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 ...			

Study programme competences / results	
Code	Study programme competences / results
A1	CE1 - Capacidade para utilizar con destreza conceptos e métodos propios da matemática discreta, a álxebra 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 A2	B1 B6	C1

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	A1 A2 B6 C1	30	45	75
Seminar	A1 A2 B1 B6 C1	8	12	20
Objective test	A1 A2 B1 B6 C1	3	0	3
Laboratory practice	A1 A2 B5 B6 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	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. 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.
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	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: I) to encourage the student by solving exercises, with the help of the teacher, to reinforce the understanding of the concepts studied, II)to encourage the reasoned resolution of the exercises, avoiding the use of "recipes". 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.

Personalized attention	
Methodologies	**Description**
Laboratory practice	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. 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. Students have also the possibility to review the grade obtained in the final written test, verifying that it meets the established evaluation criteria.

Assessment			
Methodologies	**Competencies / Results**	**Description**	**Qualification**
Laboratory practice	A1 A2 B5 B6 C1	Throughout the semester several tests will be carried out on some topics of the subject, these tests will contain questions and exercises similar to those of the corresponding bulletins. The correct answer to the questions and exercises raised will be valued, as well as the presentation and clarity of the presentation made.	30

Objective test	A1 A2 B1 B6 C1	Throughout the semester, a test will be done using the Moodle (M) platform. The test will consist of theoretical questions and problems similar to those made in the classroom. It will address the contents and results of the syllabus seen up to that point in the course. The result of this quiz (M) will contribute 20% to the total grade. On the dates established by the Faculty Board in its annual schedule, the student will take a written test (E). To pass the subject it will be necessary that the note of this exam (E) be at least 4 points. This test (E) will include: - Short questions that allow assessing whether the student understood the basic theoretical concepts. - Problems with a degree of difficulty similar to those carried out in class and those presented in the collections of proposed exercises. Mastery of the theoretical concepts of the subject, its understanding and its application in solving exercises will be valued. Likewise, the clarity, order and presentation of the exposed results will be evaluated. The calculation of the final mark of the subject (F) is detailed in the Assessment comments.	70
Others			

Assessment comments

Calculation of the final mark of the subject

The qualification of the laboratory tests (P) cannot be recovered.

On the contrary, the grade obtained on the day of the final exam (E) will be re-scaled so that the student has the opportunity to recover 20% of the grade corresponding to the Moodle test (M).

In this way, the final grade (F) of the student will be calculated with the formula:

$$F = P + M + 0'1*(7-M)*E$$

whenever the value of E is greater than or equal to 4.

If the value of E is less than 4, the final mark will be equal to E (ie: F=E).

The presentation to the final test of the course supposes that the student has completed the continuous evaluation process.

For the students who take the second opportunity, the calculation of the final grade (F) will be carried out in the same way as in the first opportunity, substituting the previous value of E for the one obtained in the new written test that will take place on the date official determined by the Faculty Board.

In either of the two opportunities, to pass the subject, the value of F must be greater than or equal to 5.

Evaluation of students enrolled part-time:

Depending on the particularities of each specific case and the possibilities of the teaching staff in charge of the group to which a student enrolled part-time is assigned, the continuous assessment tests will be adjusted so that said student can obtain the same grade as a / a regular enrollment student.

Evaluation of enrolled students with needs for some curricular adaptation:

Depending on the particularities of each case and the possibilities of the teaching staff, the evaluation tests will be adjusted so that said student can take the same tests as their classmates.

On the opportunity brought forward to December:

The exam will be graded on ten points, being necessary to obtain at least a five to pass the subject.

Sources of information

Basic	- Aguado, Felicidad et al (2018). Problemas resueltos de Combinatoria. Laboratorio con SageMath. Paraninfo
	- Vieites Ana. et al (2014). Teoría de grafos. Ejercicios resueltos y propuestos. Laboratorio con SAGE. Paraninfo
	- Rosen, K. H. (2019). Discrete Mathematics and Its Applications. McGraw-Hill
	- Epp, S. (2012). Matemáticas Discretas con Aplicaciones. Cengage Learning
Complementary	- García Merayo, F. (2001). Matemática Discreta. Paraninfo
	- García Merayo, F., Hernández, G. y Nevot, A. (2018). Problemas resueltos de matemática discreta. Paraninfo
	- 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>