Teaching Guide				
Identifying Data				2022/23
Subject (*)	Process Mining		Code	614544025
Study programme	Máster Universitario en Intelixencia Artificial			
Descriptors				
Cycle	Period	Year	Type	Credits
Official Master's Degree	2nd four-month period	First	Optional	3
Language	English			
Teaching method	Face-to-face			
Prerequisites				
Department	Ciencias da Computación e Tecnoloxías da Información			
Coordinador	Varela Rodeiro, Tirso	E-mail	tirso.varela.rodeiro@udc.es	
Lecturers	Varela Rodeiro, Tirso	E-mail	tirso.varela.rodeiro@udc.es	
Web	https://moodle.udc.es/			
General description	The objective of the subject is to provide the theoretical concepts and practical skills for the development of intelligent techniques in the field of information provided by the execution of business processes, in order to improve and optimize their performance. The subject will be approached from a descriptive approach, in which the techniques that allow to know what has happened and not what is believed to happen; and predictive, in which the main challenges of predictive monitoring and techniques will be presented.			

Study programme competences	
Code	Study programme competences
A8	CE07 - Ability to understand the consequences of the development of an explainable and interpretable intelligent system
A9	CE08 - Ability to design and develop secure intelligent systems, in terms of integrity, confidentiality and robustness
A10	CE09 - Ability to obtain a deep knowledge about fundamental principles and models of quantum computing and to apply them for the interpretation, selection, evaluation, modelling and creation of new concepts, theories, uses and technological developments related to Artificial Intelligence
A12	CE11 - Understanding and command of the main techniques and tools for data analysis, both from the statistical and the machine learning viewpoints, including those devised for large volumes of data, and ability to select those ones most suitable for problem solving
A14	CE13 - Knowledge of computer tools in the field of data analysis and statistical modelling and ability to select those ones most suitable for problem solving
A15	CE14 - Understanding and command of the main machine learning techniques, including those devised for big volumes of data. Understanding and command of basic concepts and techniques for information search and filtering in big collections of data.
A16	CE15 - Knowledge of computer tools in the field of machine learning and ability to select those ones most suitable for problem solving
A17	CE16 - Knowledge of the process and tools for processing and preparing data, from their acquisition, extraction, and cleansing to their transformation, loading, organisation and access
A20	CE19 - Knowledge of the different environments where AI based technologies can be applied and awareness of their capability to provide a differentiating added value
A21	CE20 - Ability to combine and adapt different techniques, extrapolating knowledge among different application domains
A22	CE21 - Knowledge of the techniques that facilitate the efficient organisation and management of AI projects in real environments, including resources management and tasks scheduling and taking into account the concepts of knowledge dissemination and open science
A23	CE22 - Knowledge of the techniques that facilitate the security of data, applications and communications and the derived consequences on different application domains in AI
A28	CE27 - Understanding the significance of the entrepreneurial culture and knowledge of the resources within the enterpreneur person's means
A29	CE28 - Appropriate knowledge of the concept of enterprise, its organisation and management, and of the different business sectors, with the goal of providing solutions from the AI perspective
A30	CE29 - Being able to apply knowledge, abilities and attitudes to the business and professional world, by planning, managing and evaluating projects in the scope of AI
A31	CE30 - Being able to set out, model and solve problems that require the application of AI methods, techniques and technologies

B1	CG01 - Maintaining and extending theoretical foundations to allow the introduction and exploitation of new and advanced technologies in the field of AI
B2	CG02 - Successfully addressing each and every stage of an AI project
B4	CG04 - Suitably elaborating written essays or motivated arguments, including some point of originality, writing plans, work projects, scientific papers and formulating reasonable hypotheses in the field
B5	CG05 - Working in teams, especially of multidisciplinary nature, and being skilled in the management of time, people and decision making
B6	CB01 - Acquiring and understanding knowledge that provides a basis or opportunity to be original in the development and/or application of ideas, frequently in a research context
B7	CB02 - The students will be able to apply the acquired knowledge and to use their capacity of solving problems in new or poorly explored environments inside wider (or multidisciplinary) contexts related to their field of study
B9	CB04 - The students will be able to communicate their conclusions, their premises and their ultimate justifications, both to specialised and non-specialised audiences, using a clear style language, free from ambiguities
B10	CB05 - The students will acquire learning abilities to allow them to continue studying in way that will mostly be self-directed or autonomous
C5	CT05 - Understanding the importance of the entrepreneurial culture and knowledge of the resources within the entrepreneur person's means
C8	CT08 - Appreciating the importance of research, innovation and technological development in the socioeconomic and cultural progress of society
C9	CT09 - Being able to manage time and resources: outlining plans, prioritising activities, identifying criticisms, fixing deadlines and sticking to them

Learning outcomes			
Learning outcomes	Study programme competences		
Know the main process discovery techniques and be able to select the most appropriate for a given domain.	AC7 AC13 AC14 AC16 AC28	BC7 BC9	CC5 CC9
Know how to apply search and optimization techniques to verify the conformity of a process.	AC15 AC29 AC30	BC9	CC8
Know and develop solutions based on artificial intelligence for predictive monitoring.	AC9 AC11 AC16	BC4 BC7 BC10	CC9
Understand and solve optimization problems in business processes.	AC21	BC5 BC9	CC9
Know and understand the quality metrics of a process.	AC11 AC22	BC6	CC5
Know the main problems that process mining solves.	AC8 AC19 AC20 AC27	BC1 BC2 BC6 BC7 BC10	CC5 CC8

Contents	
Topic	Sub-topic

THEORY	1. Process concept. 2. Event registration. 3. Key business and process indicators. 4. Process discovery. 5. Compliance of processes. 6. Process analytics. 7. Predictive monitoring. 8. Optimization of processes.
PRACTICE	1. Log analysis. 2. Discovery and analysis of processes. 3. Process compliance. 4. Predictive monitoring and optimization.

Planning				
Methodologies / tests	Competencies	Ordinary class hours	Student?s personal work hours	Total hours
Laboratory practice	A9 A14 A15 A16 A20 A21 A31 A30 B2 B4 B5 B9 B10 C8 C9	11	25	36
Guest lecture / keynote speech	A8 A10 A12 A17 A22 A23 A28 A29 B1 B6 B7 C5	10	25	35
Personalized attention		4	0	4
(*)The information in the planning table is for guidance only and does not take into account the heterogeneity of the students.				

Methodologies	
Methodologies	Description
Laboratory practice	They are aimed at students acquiring skills in the implementation and use of process mining techniques. The student will be exposed to a project that must be resolved throughout the subject and whose resolution requires the understanding and application of the theoretical-practical contents included in the contents of the subject. Therefore, in the laboratory practices a project-based learning methodology will be followed. Attendance at these laboratory practices is MANDATORY.
Guest lecture / keynote speech	They are aimed at explaining the concepts and characteristics of process mining, with special emphasis on the type of problems it solves and the different kinds of techniques that could be applied to solve each of them. In addition, in these classes the projects that will be developed throughout the subject will be adressed, highlighting the problems of each of the aspects that the students should focus on.

Personalized attention	
Methodologies	Description
Laboratory practice	The doubts that may arise as part of the development of the teaching activities of the subject will be addressed.

Assessment			
Methodologies	Competencies	Description	**Qualification**
Guest lecture / keynote speech	A8 A10 A12 A17 A22 A23 A28 A29 B1 B6 B7 C5	Exam in which mastery of the theoretical aspects of process mining will be demonstrated. You will need to answer a set of questions about process concepts and the different types of process analytics.	40

Laboratory practice	A9 A14 A15 A16 A20 A21 A31 A30 B2 B4 B5 B9 B10 C8 C9	Completion of a project that will start from the explanation of the process and the data that are the input to the process mining techniques and that the students will develop throughout the subject. In practice classes, the students will have to solve the questions using the most appropriate techniques to obtain information about the process analytics.	60

Assessment comments
If the student sends the first installment of the project, it will be considered as presented in the subject. SECOND OPPORTUNITY The evaluation criteria of the theory and practice parts in the second opportunity will be exactly the same as for the ordinary opportunity. Therefore, in addition to passing the theory exam and the bulletins, in order to pass the subject it will be necessary to have attended the interactive practical sessions (with the attendance criteria indicated below). ATTENDANCE CONTROL Attendance at the interactive sessions is mandatory because they address key concepts of the subject, and the control of this attendance is done through signature sheets that will be covered at the end of each of the sessions. In addition, if less than 80% of the interactive practical sessions are attended, it will be considered that the subject has not been passed. PLAGIARISM DETECTION In the case of fraudulent completion of exercises or tests, the provisions of the "Rules of assessment, review and claim of qualifications for two undergraduate and university master's degrees of the University of Coruña" will apply. Link: Normas_avaliacion_revision_reclamacion_consolidado_l.pdf_2063069239.pdf (udc.es)

Sources of information	
Basic	1. VAN DER AALST, Wil. Process Mining - Data Science in Action. 2a Edición, Springer 2016. ISBN 978-3-662-49850-7.2. FLUXICON. https://fluxicon.com/book/read/3. FERREIRA, Diogo R. A primer on process mining: Practical skills with Python and Graphviz. 2a Edición, Springer 2020. ISBN: 978-3-030-41818-2
Complementary	

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
Attendance at laboratory practices is mandatory, and furthermore, this participation should be active. In addition to this, additional time will be needed to work on the following aspects:1. Autonomous study of the concepts of process mining. The time dedicated to this study not only includes the time needed to prepare for the theoretical exam, but also the time needed to understand the theoretical concepts so that they can be correctly applied to solve problems.2. Project development. This time is necessary for the development of the project to be completed, beyond the progress that takes place in the practice sessions. During this time, it will be possible to internalize the way to solve the exposed problem, to the extent that in the practical sessions more emphasis is placed on understanding the problem and the types of techniques that are necessary to address it, while the details necessary to complete the problem should be done in the additional time of practical work.