Fakultät für Ingenieurwesen
Facoltà di Ingegneria
Faculty of Engineering

# COURSE DESCRIPTION – ACADEMIC YEAR 2024/25

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| **Course title** | **Process Mining** |
| **Course code** | 73073 |
| **Scientific sector** | ING-INF/05 |
| **Degree** | Master in Computing for Data Science (LM-18) |
| **Semester** | 2 |
| **Year** | 1 |
| **Credits** | 6 |
| **Modular** | No |

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| **Total lecturing hours** | 40 |
| **Total lab hours** | 20 |
| **Attendance** | Not compulsory |
| **Prerequisites** | |
| **Course page** | https://ole.unibz.it/ |

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| **Specific educational objectives** | The course belongs to the type "caratterizzanti – discipline informatiche" in the curriculum "Data Management".<br><br>Process mining stands at the intersection of business process management, data science, and artificial intelligence, and combines model-driven and data-driven techniques to provide fact-based insights on the execution of operational and work processes.<br><br>The main goal of the course is to provide a comprehensive tour into the field of process mining. The course will cover the foundations and applications and process mining. We will start from different languages and notations to model processes, and discuss the main characteristics of event data collected and stored when processes are executed. We will then move to the three main pillars of process mining:<br><br>• process discovery - the automated learning of process models starting from event data;<br>• conformance checking – the comparison of the expected behaviour contained in a reference process model, with the actual behaviours contained in an event log;<br>• process enrichment and performance analysis – the infusion of event data into a reference process models to detect frequent vs outlier paths, bottlenecks, and queues.<br><br>We will pay particular attention to different algorithmic techniques to solve these problems, including prominently those based on artificial intelligence.<br><br>The course will conclude with an overview of more advanced problems, such as multi-perspective process mining, runtime analysis and prediction, as well as large-scale processes operating over multiple objects at once. |

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| **Lecturer** | Marco Montali (https://www.inf.unibz.it/~montali) |

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| **Contact** | Office B1.5.03, Faculty of Engineering, NOI Techpark, Via Bruno Buozzi, 1<br>montali@inf.unibz.it, 0471-016116 |
| **Scientific sector of lecturer** | ING-INF/05 |
| **Teaching language** | English |
| **Office hours** | Check the homepage of the lecturer. |
| **Lecturing assistant (if any)** | - |
| **Contact LA** | - |
| **Office hours LA** | - |
| **List of topics** | • Introduction to business process management and process mining<br>• Process modelling and event data<br>• Process discovery<br>• Conformance checking<br>• Process enrichment<br>• Advanced techniques and challenges |
| **Teaching format** | Frontal lectures, exercises, labs. |

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| **Learning outcomes** | Knowledge and understanding:<br>• D1.2 - Understanding of the skills, tools and techniques required for an effective use of data science<br>• D1.5 - Knowledge of principles and models for the representation, management and processing of complex and heterogeneous data<br>• D1.10 - Knowledge of languages, methodologies and architectures for modelling data, processes and organisations<br>Applying knowledge and understanding:<br>• D2.1 - Practical application and evaluation of tools and techniques in the field of data science<br>• D2.10 - Application of languages, tools, and methods for the design of information systems and their corresponding software applications for data, process, and organization management<br>Making judgments<br>• D3.2 - Ability to autonomously select the documentation (in the form of books, web, magazines, etc.) needed to keep up to date in a given sector<br>Communication skills<br>• D4.1 - Ability to use English at an advanced level with particular reference to disciplinary terminology<br>• D4.2 - Ability to present one's work in a clear and comprehensible way in front of an audience, including non-specialists<br>• D4.3 - Ability to structure and draft scientific and technical documentation<br>• D4.5 - Ability to interact and collaborate in the implementation of a project or research with peers and experts<br>Learning skills<br>• D5.1 - Ability to autonomously extend the knowledge acquired during the study course. |

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| | • D5.3 - Ability to deal with problems in a systematic and creative way and to appropriate problem solving techniques. |

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| **Assessment** | • Written exam with verification questions and questions to test knowledge application skills.<br>• Project work to test knowledge application skills and communication skills; the work is conducted in small groups that present their work in written |
| **Assessment language** | English |
| **Assessment Typology** | Monocratic |
| **Evaluation criteria and criteria for awarding marks** | • 50% written exam;<br>• 50% project work.<br><br>The written exam is evaluated by considering correctness, clarity and rationale of the provided answers. |

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| **Required readings** | • Wil M. P. van der Aalst: Process Mining - Data Science in Action, Second Edition. Springer 2016, ISBN 978-3-662-49850-7, pp. 3-452<br><br>Subject Librarian: David Gebhardi, David.Gebhardi@unibz.it |
| **Supplementary readings** | |
| **Software used** | • Tools for process modelling and analysis;<br>• Process mining tools. |