Data Science for IE&IS students (& preparation master DSBE)	
Offered by	Department of Industrial Engineering & Innovation Sciences
Language	English
Primarily interesting for	This coherent package largely covers the requirements on data science courses necessary for the direct admission of students majoring Industrial Engineering and Innovation Sciences to the Master Data Science in Business and Entrepreneurship (DSBE) at JADS, Den Bosch In order to be admissible to the Master DSBE the curriculum of your technical Bachelor Program needs to minimally meet the following criteria: A minimum of 15 ECTS in Mathematics and Statistics, at least 5 ECTS should be statistics and at least 5 should be mathematics Courses in: • Introduction to Computer science/ data Science • databases • Algorithms/ Foundations of computing • Programming (ideally Python/ preferably also R) • Machine Learning/ data Mining For IE&IS students (esp. PT and IE)this elective package should (typically) be sufficient to be directly admissible, given the other courses in their program.
Prerequisites	• Programming (see below)
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Content and composition

Topic (choose one per row)	course code	course name		level	timeslot
prior knowledge*: programming	1BK60	Fundamentals of algorithmic programming		1	2E
	JBI010	Programming		1	1A
Foundations and algorithms**	JBI026	Discrete Mathematics		1	2E
Databases	2ID50***	Data modeling & databases		2	2E
	JBI050	Data management for data analytics		2	3D
Data Mining and machine learning	JBI030	Data mining		2	2C (23-24) 1E (24-25)

*   *Programming is required prior knowledge for this elective package (not part of the 3 courses). 1BK60 (IE) or 0HV120 (PT) are sufficient background. If you did not follow these, take one the courses suggested.*

** *From 2022/23 the course JBI026 replaces the courses JBI025 "Foundations of computing" and 2IHA10 "Algorithms and Data Structures". One of these 3 courses is required for admission to the Master Data Science.*

*** *Prior knowledge requirement for the 2ID50 course is 2IT60 "Logic and set theory", which contents are partially covered in the obligatory courses in the major TBK and P&T. The course 2ID50 has an entrance test which will validate whether this prior knowledge is sufficient, allowing students to qualify for this course. Students can follow JBI050 "Data management for data analytics" as an alternative to 2ID50 "Data modelling & Databases"*

Admission to DSBE master

In most of the cases following this coherent package plus the course 'JBI010 Programming' as part of your Bachelor, will be sufficient for IE&IS students to get direct admission to the master DSBE. BP&T students generations (2016/2017 onwards) have likely fulfilled most of the requirements as part of their major (requirements as mentioned above) and would only need to finish 2 extra courses to be able to join (JBI026 Discrete Mathematics and JBI030 Data Mining).

Please be aware when applying for admission to the Master "Data Science in Business and Entrepreneurship", that you will be checked upon the admission criteria as mentioned above. This counts for all IE&IS students.

Course descriptions

1BK60 Fundamentals of Algorithmic Programming

This course teaches students the fundamental algorithmic programming skills needed to make a computer solve certain problems, using Python. The solutions to these problems may include simple algorithmic ones to those that are non-trivial and address -for instance- optimization problems that are common in operations management. The course also introduces the basic steps to configure programs with tool chains consisting of existing program libraries.

JBI010 Programming

This course introduces imperative and object-oriented programming using Java and Python. Topics: basic imperative programming (assignment, choice, repetition, input/ output, functions), typing, recursion, objects (both data objects, or records, and domain objects), a few collection classes, inheritance, interfaces, specification of methods, coding style practice, API use, basic handling of large data sets.

JBI026 Discrete Mathematics

This course provides the foundations of computing and algorithms and covers he following topics:
- introduction to Logic and Set Theory and proof techniques
- Functions and relations, regular expressions and counting
- Graphs, Trees and Finite-state Automata

2ID50 Data modelling & Databases

Our lives are awash in data (e.g., social, business, and web) which only continues to grow in both quantity and variety. Database management systems are the key technologies which facilitate our practical use of these massive data sets. In this course, we study fundamental concepts, such as data model design and formulation of queries against databases, which underpin the effective practical use of industrial strength data management systems.

JBI050 Data management for data analytics

The focus of the course is on practical problem-solving in an application domain. Students will gain practical experience developing the ability to design effective databases based on a solid understanding of the underlying principles. By design, hands-on practical assignment(s) using contemporary frameworks and technologies are a central component of the course. The following topics will be covered:
* Data modeling: conceptual modeling in the ER model and UML; logical data modeling in the relational database model; optimization of logical models, basics of normalization.
* Querying databases: SQL basic queries, ag gregation; Datalog basic queries, recursion.

JBI030 Data Mining

The course fits with the educational philosophy of the program by emphasizing the interdisciplinary perspective of data science and introducing students to research in the field of data science. During this course, the students will learn the foundations of data mining and gain hands-on experience in applying data mining in practice.