Data Science for IE&IS students

Offered by: Department of Industrial Engineering & Innovation Sciences
Language: English
Primarily interesting for: All majors of the Industrial Engineering and Innovation Sciences faculty
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Requirements admission for the Master “Data Science and Entrepreneurship”
In order to be directly admissible to the Master Data Science and Entrepreneurship (jd) the curriculum of your Technical Bachelor program needs to minimally meet the following criteria:

✓ A minimum of 10 ECTS in Mathematics
✓ A minimum of 10 ECTS in Statistics
✓ Courses in:
  - Introduction to Computer Science / Data Science
  - Databases
  - Algorithms / Foundations of computing
  - Programming (ideally Python, preferably also R)
  - Machine Learning / Data Mining

Content and composition Coherent package
This coherent package provides students with the basic knowledge on data science including programming, databases and machine learning techniques. This coherent package largely covers the requirements on data science courses necessary for the direct admission of students majoring Industrial Engineering or Innovation Sciences to the master “Data Science and Entrepreneurship” in JADS, Den Bosch. JADS is the Joint Graduate School of Tilburg University and Eindhoven University of Technology (see www.jads.nl for more information).

<table>
<thead>
<tr>
<th>Course code</th>
<th>Course name*</th>
<th>Level classification</th>
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</thead>
<tbody>
<tr>
<td>JBI020/2IHA10**</td>
<td>Foundations of Computing / Algorithms &amp; Data Structures</td>
<td>2. Intermediate</td>
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<tr>
<td>JBI030</td>
<td>Data Mining</td>
<td>2. Intermediate</td>
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<tr>
<td>2ID50*** / JBI050</td>
<td>Data modelling &amp; Databases/ Data management for data analytics</td>
<td>2. Intermediate</td>
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* 1BK60 “Fundamentals of Algorithmic Programming” (2019/2020 onwards), is a mandatory elective for direct admission to the Master Data Science and Entrepreneurship.

* If you haven’t followed 1BK60 “Fundamentals of Algorithmic Programming”, the course JBI010 “Programming” is required for direct admission to the Master Data Science and Entrepreneurship.

* JBI010/1BK60 is not allowed for the BPT students. This course has a strong overlap with the obligatory course 0HV120 1e jaars vak BPT studenten. 0HV120 Serves as the replacement for JBI010/1BK60 in this case.

** Per academic year 2020/2021, JBI020 “Foundations of Computing” or 2IHA10 “Algorithms & Data Structures” is required for direct admission to the Master Data Science and Entrepreneurship for all the BSc degrees provided by IE&IS faculty of TU/e.

*** 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”, as noted in the table above.

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 Data Science and Entrepreneurship.

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 (JBI020 Foundations of computing and JBI030 Data Mining).

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

**JBI020 Foundations of computing**

- Upon completion of this course students:
  - understand basic proving techniques and can apply the right technique(s) to prove formal statements
  - understand computability and models of computations
  - understand what algorithms are and what they are used for, as well as some principles of data representation
  - are able to apply techniques from computer science to understand and solve problems

**2IHA10 Algorithms & Data Structures**

In this course, students will develop basic skills and knowledge to create and reason about efficient algorithms to solve computational problems. To be able to reason about algorithms efficiently students first consider the structure and textual form of formal proofs. Students then explore different basic algorithms and data structures for frequently appearing problems, using the proving techniques learned to show their correctness. Students consider basic algorithm design techniques, correctness analysis, and efficiency analysis of algorithms.

**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.

**2ID50 Datamodelling & 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, aggregation; Datalog basic queries, recursion.
**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.

**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.