Master of Science (M.Sc.)

“Mannheim Master in Data Science”

University of Mannheim

– Module catalog –

for students starting in or after spring 2020

Academic Year
HWS 2022/ FSS 2023

Content

Foreword

This document describes the courses that will be offered in HWS 2022/ FSS 2023 for students studying M. Sc. Mannheim Master in Data Science (Examination Regulations for the Master's program from 4th December 2019). You can find the Examination Regulations on the website of the Student Services (Studienbüros):

https://www.uni-mannheim.de/en/academics/during-your-studies/examinations/examination-regulations/

It is possible that additional courses will be made available during the course of the academic year. These will be published in an appendix available on the following web page:

https://www.wim.uni-mannheim.de/en/academics/organizing-your-studies/mannheim-master-in-data-science/#c112237

A. Overview

		ECTS
Fundamentals	"Fundamentals" courses with at most 14 ECTS	0 – 14
Data Management	Minimum of three "Data Management" courses	18 – 36
Data Analytics Methods	Minimum of four "Data Analytics Methods" courses with at least 30 ECTS	30 – 54
Responsible Data Science	Minimum of one "Responsible Data Science" course	3 – 10
Projects and Seminars	Team Project or Individual Project, Scientific Research and Seminars	14 – 18
Master Thesis	Six-months-long written academic assignment	30
Total		120

General constraints:

1. Courses with 0-14 ECTS can be taken (0 to 14 ECTS)
2. 3 to 6 Data Management courses must be taken (18 to 36 ECTS)
3. Data Analytics Methods courses worth a combined 30 to 54 ECTS must be taken
4. 1 to 2 Responsible Data Science courses must be taken (3 to 10 ECTS)
5. You must either take a Team Project course or an Individual Project course
6. You must take Scientific Research
7. You must take a Seminar
8. You must write a Master Thesis

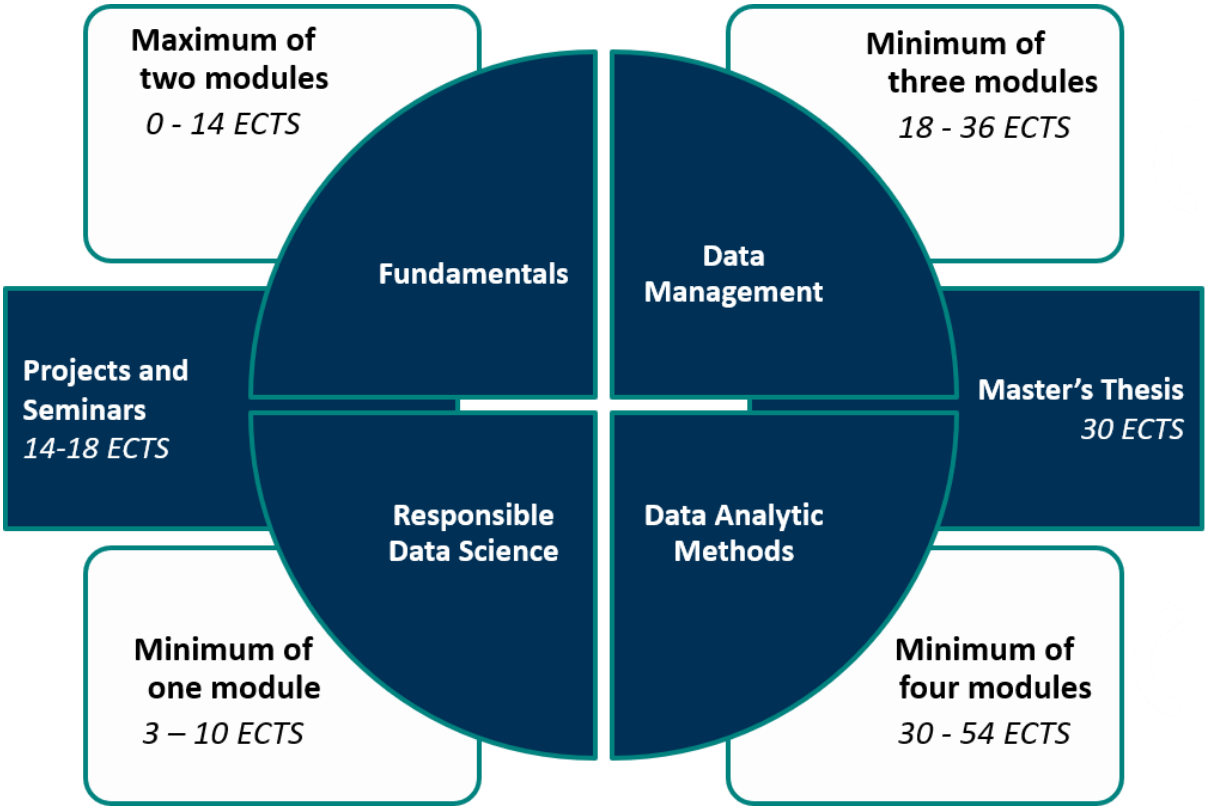
Abbreviations:

HWS (Herbst-/Wintersemester): Course is offered in the respective Fall semester

FSS (Frühjahrs-/Sommersemester): Course is offered in the respective Spring semester

FSS/HWS: course is offered both in Spring semester and Fall semester

Course Structure



B. Fundamentals

1. Overview

Module no.	Name of Module	Offered	Language	ECTS	Page
CS 450	Programming Course	HWS	E	6	7
CS 460	Database Technology	FSS	E	6	9
CS 470	Python for Data Scientists	FSS	E	6	11
	Multivariate Analyses	HWS	E	6	PS*
	Tutorial Multivariate Analyses	HWS	E	2	PS*
	Empirische Methoden der Politik-wissenschaft	HWS	G/E	6	PW*

* For a detailed description, please see the module catalogs of the respective following degree programs:

- PW: B.A. Politikwissenschaft, https://www.sowi.uni-mannheim.de/en/academics/students/political-science/ba-in-political-science/ (only available in German)
- PS: M.A. Political Science, https://www.sowi.uni-mannheim.de/en/academics/students/political-science/ma-in-political-science/

2. Detailed descriptions

CS 450	**Programming Course**
Form of module	Lecture and accompanying practical sessions
Type of module	Computer Science Fundamental
Level	Master
ECTS	6
Workload	Hours per semester present: 84h (6 SWS)
	Self-study: 84h per semester • 28h: pre and post lecture studying and revision • 56h: preparation and presentation of small software projects
Prerequisites	-
Aim of module	The course deals with the basic concepts of (object-oriented) programming using Java. In addition, some advanced topics are covered such as writing GUI applications and dealing with external data (XML, databases): • primitive data types, variables, operators, expressions • control flow statements • complex data types (arrays), references • classes • OO concepts (information hiding, inheritance, polymorphism, abstract classes, interfaces) • Java API • Exceptions • IO using streams • Java Collections • GUI programming • processing of XML documents • database access (SQL, JDOM)
Learning outcomes and qualification goals	Expertise: After taking the course, students will be familiar with the basic concepts of (object-oriented) programming in Java.
	Methodological competence:

	Students will acquire the skills to develop high-quality console and GUI Java applications of moderate size.
	Personal competence: • ability to work independently • ability to work in a team
Media	Beamer, PC (Linux), printed lecture slides
Literature	• Learning Java (P. Niemeyer, P.Leuck), O'Reilly UK Ltd. • Core Java Volume I—Fundamentals (C.S. Horstmann), Prentice Hall
Methods	lectures, tutorials, independent study
Form of assessment	written examination (Programmiertestat)
Admission requirements for assessment	successful completion and presentation of at least 75% of the weekly assessments
Duration of assessment	180 minutes
Language	English
Offering	Fall semester
Lecturer	Dr. Ursula Rost
Person in charge	Dr. Ursula Rost
Duration of module	1 semester
Further modules	-
Range of application	MMDS
Semester	1st/2nd semester

CS 460	**Database Technology**
Form of module	Lecture with Exercise
Type of module	MMDS Fundamental
Level	Master
ECTS	6
Workload	Hours per semester present: 56 h (4 SWS)
	Self-study per semester: 98 h • 70 h: pre and post lecture studying and revision • 28 h: examination preparation
Prerequisites	-
Aim of module	The course provides an introduction to relational database systems. The course will cover the following topics: • Principles of data storage • Database query languages (SQL) • Relational modeling • Keys and normal forms • Hash and index structures • Transactions and concurrency
Learning outcomes and qualification goals	Expertise: Basic understanding of relational data modeling and database design, as well as the functionality of relational database management systems, query handling, and transaction management. (BK4, BK5, BK6, BK7)
	Methodological competence: Abstraction, modeling, complexity consideration. (BF1, BF2)
	Personal competence: Understanding the role of data management in enterprises. (BK01, BK02)
Media	Electronic slides and exercise sheets
Literature	Avi Silberschatz, Henry F. Korth, S. Sudarshan: Database System Concepts

Methods	The course consists of a lecture together and exercises. The exercises encompass both theoretical exercises as well as practical assignments, which are conducted with a free modern database management system and allow the students to deepen their theoretical understanding of the course contents, as well as to gather hands-on experience with database management systems.
Form of assessment	Written or oral examination
Admission requirements for assessment	-
Duration of assessment	90 minutes (written exam)/30 minutes (oral exam)
Language	English
Offering	Spring semester
Lecturer	Prof. Dr. Heiko Paulheim
Person in charge	Prof. Dr. Heiko Paulheim
Duration of module	1 semester
Further modules	Database Systems II, Transaktionssysteme, Anfrageoptimierung, Large Scale Data Management
Range of application	MMDS
Semester	1st/2nd semester

CS 470	**Python for Data Scientists**
Form of module	Lecture and accompanying tutorial/practical sessions
Type of module	MMDS Fundamental
Level	Master
ECTS	6
Workload	Hours per semester present: 56h (4 SWS)
	Self-study: 84h per semester • 28h: pre and post lecture studying and revision • 56h: preparation and presentation of tutorial exercises
Prerequisites	None
Aim of module	The course will provide data scientists with the knowledge they need to be able to apply Python3 in data science projects. It assumes that students are familiar with another object-programming language such as Java, C# or C++, but does not assume any prior Python knowledge. Topics covered include – • The Python interpreter & programming paradigms • Basic expressions & control flow statements • Functions & scoping • Data structures • Modules • Classes & object-oriented concepts • Errors and exceptions • Testing and debugging • Exploring & visualizing data with Python • Machine learning applied - clustering and classification • Project management & (third-party) software repositories
Learning outcomes and qualification goals	Expertise: After taking the course, students will be familiar with Python3 and will be able to use it in data science projects
	Methodological competence: Students will acquire the skills to develop high-quality Python software for data science and other applications
	Personal competence: • ability to work independently • ability to work in a team

Media	Projector, PC (Linux), printed lecture slides
Literature	• Introduction to Computation and Programming Using Python, Third Edition (John. V. Guttag), MIT Press • Think Python: How to Think Like a Computer Scientist, 2nd Edition, Allen B. Downey, O`Reilly • The (Official) Python Tutorial
Methods	lectures, tutorials/practical sessions, independent study
Form of assessment	written examination (possibly including a programming test)
Admission requirements for assessment	none
Duration of assessment	120 minutes
Language	English
Offering	Spring Semester
Lecturer	Marcus Kessel
Person in charge	Marcus Kessel
Duration of module	1 semester
Further modules	-
Range of application	MMDS
Semester	1st/2nd semester

C. Data Management

1. Overview

Module no.	Name of Module	Offered	Language	ECTS	Page
AC 651	Additional Course – Data Management	HWS/FSS	E	AC 651*	14
CS 500	Advanced Software Engineering	HWS	E	6	BI*
CS 530	Database Systems II	FSS	E	6	BI*
CS 550	Algorithmics	FSS/HWS	E	6	BI*
CS 560	Large Scale Data Management	HWS	E	6	BI*
CS 600	Model-driven Development	HWS	E	6	BI*
CS 662**	Types and Programming Languages	HWS	E	6	BI*
IS 540**	Management of Enterprise Systems	HWS	E	6	MMM*
IS 556**	Public Blockchains	FSS	E	3	MMM*
IE 630	Query Optimization	FSS	E	6	BI*
IE 650	Knowledge Graphs	HWS	E	6	BI*
IE 663	Information Retrieval and Web Search	HWS	E	3	BI*
IE 670	Web Data Integration	HWS	E	3	BI*
IE 691	Information Retrieval Project	HWS	E	3	BI*
IE 683	Web Data Integration Project	HWS	E	3	BI*

* For a detailed description, please see the module catalog of the respective following degree programs:

- BI: M.Sc. Business Informatics, https://www.wim.uni-mannheim.de/studium/studienorganisation/m-sc-business-informatics/
- MMM: M.Sc. Mannheim Master in Management, https://www.bwl.uni-mannheim.de/studium/master/mmm/

**Additional offer to the Examination Regulations.

AC 651	**Additional Course – Data Management**
Form of module	Depends on course
Level	Master
ECTS	Max. 18
Workload	Depends on course
Prerequisites	Depends on course
Aim of module	The course falls into the data management area of the MMDS and covers topics related to data management, but is not directly equivalent to any course in the MMDS module catalogue. The course level equals a regular course in MMDS study program. The module can be taken either at the University of Mannheim or at any other university in Germany or abroad.
Learning outcomes and qualification goals	Depends on course
Media / Literature / Methods / Form and duration of assessment	Depends on course
Language	English preferred, but any other language possible if Mannheim faculty member is able to identify content and level
Offering	Spring semester / Fall semester
Lecturer	Lecturer at the host university
Person in charge	Lecturer at the host university
Duration of module	1 Semester
Further modules	-
Range of application	MMDS
Semester	2nd/3rd/4th semester

D. Data Analytics Methods

1. Overview

Module no.	Name of Module	Offered	Language	ECTS	Page
AC 652	Additional Course – Data Analytics Methods	HWS/FSS	E	AC 652*	17
DA 110	Computational Analysis of Communication	HWS	E	6	18
IE 500	Data Mining I	HWS/FSS	E	6	BI*
IE 560	Decision Support	HWS	E	6	BI*
IE 661	Text Analytics	HWS	E	6	BI*
IE 671	Web Mining	FSS	E	3	BI*
IE 672	Data Mining II	FSS	E	6	BI*
IE 675b	Machine Learning	HWS	E	9	BI*
~~IE 676~~	~~Network Analysis~~ replaced by IS 622 (FSS)	~~HWS~~	~~E~~	~~6~~	~~BI*~~
IE 678	Deep Learning	FSS	E	6	BI*
IE 684	Web Mining Project	FSS	E	3	BI*
IE 692	Advanced Process Mining	FSS	E	6	BI*
IE 694	Artificial Intelligence Applications in Industry	FSS	E	6	BI*
IE 696	Advanced Methods in Text Analytics	FSS	E	6	BI*
IS 622	Network Science**	FSS	E	6	MMM*
MAA 519	Stochastic Calculus	HWS	E	5	MBE*
MAB 504	Mathematics and Information	irregular	G	8	MBE*
MAB 508	Algebraische Statistik	irregular	G/E	8	MBE*
MAC 404	Optimierung	HWS	G	8	WM*
MAC 502	Computational Finance	FSS	G/E	6	MBE*
MAC 507	Nichtlineare Optimierung	FSS	G/E	6	MBE*
MAC 527	Markov Processes	FSS	E	4	MBE*
MKT 511	Marketing Analytics	FSS	E	6	MMM*
MKT 545	Customers, Markets and Firm Strategy	FSS	E	6	MMM*

	Lecture Cross Sectional Data Analysis	HWS	E	6	Soc*
	Tutorial Cross Sectional Data Analysis	HWS	E	3	Soc*
	Lecture Advanced Quantitative Methods	FSS	E	6	PS*
	Tutorial Advanced Quantitative Methods	FSS	E	2	PS*
	Lecture Longitudinal Data Analysis	FSS	E	6	Soc*
	Tutorial Longitudinal Data Analysis	FSS	E	3	Soc*
	Lecture Research Design	HWS	E	6	Soc*
	Tutorial Research Design	HWS	E	3	Soc*

* For a detailed description, please see the module catalogs of the respective following degree programs:

- BI: M.Sc. Business Informatics, https://www.wim.uni-mannheim.de/studium/studienorganisation/m-sc-business-informatics/
- WM: B.Sc. Wirtschaftsmathematik, https://www.wim.uni-mannheim.de/studium/studienorganisation/b-sc-wirtschaftsmathematik/ (only available in German)
- MBE: M.Sc. Mathematics in Business and Economics, https://www.wim.uni-mannheim.de/studium/studienorganisation/m-sc-wirtschaftsmathematik/ (only available in German)
- PS: M.A. Political Science, https://www.sowi.uni-mannheim.de/studium/studierende/politikwissenschaft/ma-political-science/ (only available in German)
- Soc: M.A. Sociology, https://www.sowi.uni-mannheim.de/studium/studierende/soziologie/ma-sociology/
- MMM: Mannheim Master in Management, https://www.bwl.uni-mannheim.de/studium/master/mmm/#c176637

**Prerequisite: Not completed exam in IE 676

AC 652	**Additional Course – Data Analytics Methods**
Form of module	Depends on course
Level	Master
ECTS	Max. 18
Workload	Depends on course
Prerequisites	Depends on course
Aim of module	The course falls into the data analytics methods area of the MMDS and covers topics related to data analytics methods, but is not directly equivalent to any course in the MMDS module catalogue. The course level equals a regular course in MMDS study program. The module can be taken either at the University of Mannheim or at any other university in Germany or abroad.
Learning outcomes and qualification goals	Depends on course
Media / Literature / Methods / Form and duration of assessment	Depends on course
Language	English preferred, but any other language possible if Mannheim faculty member is able to identify content and level
Offering	Spring semester / Fall semester
Lecturer	Lecturer at the host university
Person in charge	Lecturer at the host university
Duration of module	1 Semester
Further modules	-
Range of application	MMDS
Semester	$2^{nd}/3^{rd}/4^{th}$ semester

DA 110	Computational Analysis of Communication
Form of module	Exercise
Type of module	Data Analytics Methods
Level	Master
ECTS	6
Workload	Hours per semester present: 28 (2 SWS)
	Self-study: 145h (70h lectures/exercises, 75h research report)
Prerequisites	Basic skills in descriptive and inferential statistics, basic knowledge of data structures and data wrangling procedures, machine learning, web-scraping/web-mining
Aim of module	As "big data" and "algorithms" affect our daily communication, new research questions arise at the intersection between societies and technologies. Many of these questions are of great social relevance and are therefore prominently discussed both by researchers and in the media. One outstanding, recent example from the field of media psychology is a rising interest in the association of (social) media use and mental-health. Another example, from the realm of political communication, is the ongoing debate about the role of new communication technologies during political campaigns (e.g., to spread disinformation). Both questions revolve around the process of communication. Sound research in this area thus requires both a solid foundation from communication theory as well as expertise in handling new and "big" data. To close this gap, the growing discipline of Computational Communication Science (CCS) takes on a combinatory perspective between social and computer science. The present course will provide an overview about the current state of CCS and intends to motivate students to approach pressing social questions from a different perspective.
Learning outcomes and qualification goals	Expertise: After the course the students are aware of the typical research topics and questions in automated media content analyses and the different methodological approaches for tackling them; they know the different methods' potentials, limitations, and typical fields of application; they are able to develop their own specific research questions and can make an informed decision about which method to apply for answering it
	Methodological competence: Students are able to independently develop a research question and design in the area of automated media content

	analysis and can conduct a respective analysis using one of the different methodological approaches introduced in the exercise; they are able to document the results of their analyses in a research report and reflect upon their findings' limitations with regards to reliability and validity
	Personal competence: The course supports students to develop problem-solving competences with regards to research-design oriented questions. By solving exercises independently, the transfer of the learned material to related questions is promoted and self-confidence with regards to research-oriented tasks is gathered.
Media	Exercise sheets and lecture slides are available online
Literature	van Atteveldt, W., Trilling, D., & Arcila, C. (2021). Computational Analysis of Communication: A practical introduction to the analysis of texts, networks, and images with code examples in Python and R. http://cssbook.net/
Methods	Lecture elements, student presentations, weekly exercises, literature studies
Form of assessment	Written research report
Admission requirements for assessment	-
Duration of assessment	-
Language	English
Offering	HWS
Lecturer	MKW
Person in charge	MKW
Duration of module	1 semester
Further modules	-
Range of application	M.Sc. Data Science
Semester	1st/ 2nd/3rdsemester

E. Responsable Data Science

1. Overview

Module no.	Name of Module	Offered	Language	ECTS	Page
CS 652	Data Security and Privacy	FSS	E	6	BI*
	Legal and Ethical Aspects of Privacy	HWS	E	3	21
CS 718	AI and Data Science in Fiction and Society	HWS	E	4	23

* For a detailed description, please see the module catalogs of the respective following degree programs:

- BI: M.Sc. Business Informatics, https://www.wim.uni-mannheim.de/studium/studienorganisation/m-sc-business-informatics/

2. Detailed Description

	Legal and Ethical Aspects of Privacy
Form of module	Lecture
Type of module	Responsible Data Science
Level	Master
ECTS	3
Workload	Hours per semester present: 28 h (2 SWS)
	Self-study per semester: 60 h • Pre-and post-lecture studying and preparation (30h) • Examination preparation (30h)
Prerequisites	None
Aim of module	In a first section the course will acquaint the students with the origins and basic principles of privacy law mainly in Europe. Furthermore, it will contrast the European privacy foundations with the U.S. approach. At the core of this course stands the new European General Data Protection Regulation (GDPR) and its applicability to specific cases and basic principles. Moreover, the course will cover current challenges to the existing privacy paradigms by big data and big data analytics. In a second section the course will cover ethical aspects of the use of personal and non-personal data. Data potentially allows to identify and target individuals and offer individualized products to them. However, sometimes this kind of individualization might be legal but the question arises whether it is also desirable from an ethical and societal point of view? The course will use selected examples (e.g. first-degree price discrimination) in order to illustrate the ambivalence of legality, legitimacy, and ethics. In this context, the use of artificial intelligence and its impact on privacy will be addressed.
Learning outcomes and qualification goals	Students will… • have a basic knowledge on the applicability of the General Data Protection Regulation (GDPR) and its basic principles; • be aware of privacy issues and potential legal limitations when processing data; • be aware of current challenges to the existing privacy • have an understanding why privacy issues are treated differently in Europe and the U.S.; • paradigms by big data and big data analytics; • be aware of currently discussed new approaches to privacy (e.g. privacy by design); • be aware of ethical issues of using personal as well as non-

	personal data • be aware of the chances and challenges the use of artificial intelligence will bring
Media	Video tutorials, lectures, online quizzes
Literature	Students will receive reading assignments for each unit together with the syllabus at the beginning of the semester.
Methods	The class will generally be conducted as a lecture. However, some of the sessions will be conducted on an inverted classroom principle. Students will be able to access the video lectures at the beginning of the semester. The content of these videos will be discussed along with additional reading in the individual class sessions.
Form of assessment	written examination
Admission requirements for assessment	Successful participation in 5 out of at least 7 online quizzes
Duration of assessment	90 minutes
Language	English
Offering	HWS
Lecturer	Prof. Dr. Thomas Fetzer
Person in charge	Prof. Dr. Thomas Fetzer
Duration of module	1 semester
Further modules	-
Range of application	MMDS
Semester	1st/2nd/3rd semester

CS 718	**AI and Data Science in Fiction and Society**
Form of Module	Seminar
Type of Module	Seminar
Level	Master
ECTS	4
Workload	120 h per semester
Prerequisites	Bachelor degree
Aim of module	In this seminar, students analyze and discuss fictional works in the area of AI and data science with respect to technological and societal aspects. The present the results orally and in a written report.
Learning Outcomes and Qualification Goals	Expertise: Students will learn about societal effects of AI and data science and become aware of potential threats and dangers, but also of chances of those new technologies.
	Methodological competence: Students will develop methods and skills to find relevant literature for his/her topic, and to write a well-structured scientific paper and to present his/her results. He/she will be also aware of the need to avoid plagiarism. The key qualification Scientific Research is highly recommended as a prerequisite for the seminar.
	Personal qualification: Students will acquire skills on how to find relevant literature for a research topic, discuss a fictional work using secondary literature as background material, write a well-structured, concise paper about it and present the results of their work. He/she is well prepared to write and present a Master's Thesis.
Media	Fictional and non-fictional texts
Literature	A detailed literature list is compiled for each offering.
Teaching and Learning Methods	Do scientific work independently under the guidance of a professor or a research staff member
Form of Assessment	Grading of the seminar paper, Peer Review, Presentation

Admission requirements for assessment	
Duration of Assessment	N/A
Language	English
Offering	Fall semester
Lecturers	Prof. Dr. Heiko Paulheim and research staff members
Person in charge	Prof. Dr. Heiko Paulheim
Duration of module	1 semester
Further modules	-
Range of Application	MMDS, M. Sc. Wirtschaftsinformatik, Lehramt für Gymnasien
Semester	3. Semester

F. Projects and Seminars

1. Overview

Module no.	Name of Module	Offered	Language	ECTS	Page
AC 653	Additional Course – Projects and Seminars	HWS/FSS	E	AC 653*	26
TP 500	Team Project	FSS/HWS	G/E	12	BI*
IP 500	Individual Project	irregular	G/E	8	27
SQ 500	Scientific Research	HWS/FSS	E	2	BI*
CS 701	Seminar Selected Topics in Algorithmics and Cryptography	FSS	E	4	BI*
CS 704	Master Seminar Artificial Intelligence	HWS/FSS	E	4	BI*
CS 705	Datenbankseminar	HWS/FSS	G	4	BI*
CS 707	Seminar Data and Web Science	HWS/FSS	E	4	BI*
CS 708	Seminar Software Engineering	HWS/FSS	E	4	BI*
CS 709	Seminar Text Analytics	HWS/FSS	G/E	4	BI*
CS 710	Seminar Prof. Paulheim	HWS/FSS	G/E	4	BI*
CS 715	Seminar Large Scale Data Integration	FSS	E	4	BI*
CS 716	Seminar Prof. Armknecht	HWS	E	4	BI*
CS 719	Seminar on Process Analysis	HWS/FSS	E	4	BI*
CS 720	Uncertainty Estimation	FSS	E	4	BI*
CS 721	Seminar Data-Science I	FSS	E	4	BI*
IE 704	Seminar AI Systems Engineering	HWS/FSS	E	4	BI*

* For a detailed description, please see the module catalogs of the respective following degree programs:

- BI: M.Sc. Business Informatics, https://www.wim.uni-mannheim.de/studium/studienorganisation/m-sc-business-informatics/

2. Detailed descriptions

AC 653	**Additional Course – Projects and Seminars**
Form of module	Depends
Level	Master
ECTS	Max. 18
Workload	Depends
Prerequisites	Depends
Aim of module	The course equals a seminar in the MMDS study program. The module can be taken either at the University of Mannheim or at any other university in Germany or abroad.
Learning outcomes and qualification goals	Depends on course
Media / Literature / Methods / Form and duration of assessment	Depends
Language	English preferred, but any other language possible if Mannheim faculty member is able to identify content and level
Offering	Spring semester / Fall semester
Lecturer	Lecturer at the host university
Person in charge	Lecturer at the host university
Duration of module	1 Semester
Further modules	-
Range of application	MMDS
Semester	2nd/3rd/4th semester

IP 500	**Individual Project**
Form of module	Project
Type of module	Individual Project
Level	Master
ECTS	8
Workload	Self study: 240 h per semester
Prerequisites	Depends on topic
Aim of Modules	The student solves a practical problem individually. The student has to analyse and refine the problem and come up with a project plan for developing a concrete solution. Concrete topics for projects are defined by the supervisors and offered to the students who can apply for different topics. Problem area and techniques involved depend on the expertise of the offering chair.
Learning outcomes and qualifications goals	Depending on the actual topic of the project, participants will acquire • in-depth knowledge in a certain application of data science • knowledge about methods and technologies typically applied in the application area • knowledge about practical problems and challenges when applying a certain technique in a given application area Participants will learn to • refine a given problem statement by analysing requirements and the state of the art using techniques like literature research and expert interviews. • define a workplan including tasks, milestones, deliverables and resources and continually assess and modify the plan according to the actual progress of the work.
Media	Depends on project
Literature	Depends on topic
Methods	Self study, presentations
Form of Assessment	Final report and presentation

Admission requirements for assessment	-
Duration of Assessment	15 minutes (presentation)
Language	English/German
Offering	Spring semester/Fall semester
Lecturer	Professors of the Institute of School of Business Informatics and Mathematics or of the School of Social Sciences
Person in Charge	A professor of the Institute of School of Business Informatics and Mathematics of the School of Social Sciences
Duration of module	1 semester
Further modules	-
Range of Applications	MMDS
Semester	1st/2nd/3rd semester

G. Master Thesis

	Master Thesis
Form of module	Master Thesis
Type of module	Thesis
Level	Master
ECTS	30
Workload	Self study: 840 h per semester
Prerequisites	-
Aim of Modules	Develop a deep understanding of an advanced topic of data science
Learing outcomes and qualifications goals	Expertise: The student has a deep understanding of an advanced topic. (MK1)
	Methodological competence: The student is familiar with methods for analysing and independently solving advanced, complex problems. (MK1, MK2, MK3)
	Personal competence: The student has the capability to understand, analyse and independently find solutions to advanced, complex problems. The student has the capability to assess and understand the state-of-the-art in business informatics and adapt the latest technologies and methods to solve real world problems. The student is able to present a complex topic in written and oral form in a clear and understandable way. (MF1, MF2, MF3, MF4, MKO2, MKO3)
Media	Various
Literature	Topic dependent
Methods	Independent research work
Form of Assessment	Written thesis
Admission requirements for assessment	To be permitted to write the master thesis, the student is to obtain at least 60 ECTS
Duration of Assessment	-

Langauges	English only
Offering	Every semester
Person in Charge	Examiners: University teachers, auxiliary professors, honorary professors and senior academic staff members of the School of Business informatics and mathematics or of the School of Social Sciences
Duration of module	1 semester
Further modules	-
Range of Applications	MMDS
Semester	4th semester

Abbreviations

Explanation of abbreviations

Knowledge

This degree program provides students with a solid theoretical foundation as well as practical skills for data management, data analytics methods and responsible data science. The courses are divided into two groups – fundamental courses and advanced courses. After studying optional fundamental courses in computer science and empirical social sciences, in their advanced courses students can focus on the concepts and methods of computers science and advanced empirical methods and the application of these methods. In addition to the regular lecture courses, students participate in a one or two semester team project or individual project.

During their studies -

(MK1) all students develop a deep understanding of the relevant concepts, methods and problem solving strategies used in different application domains.

(MK2) technology-oriented students learn the concepts, algorithms and strategies used to solve concrete, practical application-oriented problems in informatics.

(MK3) social sciences-oriented students develop a deep understanding of how to set up, analyse and interpret advanced empirical research questions.

As part of this education, students become familiar with a wide range of models, modelling languages, methods and tools. Regardless of their specialization, students also learn how to collect, structure, manipulate, prepare, interpret, communicate and use data, information and knowledge.

Capabilities

After completing their studies, students have the ability to –

(MF1) apply a wide range of abstraction and analysis techniques.

(MF2) understand, interpret, describe and present relevant scientific publications.

(MF3) exploit the latest scientific results.

(MF4) independently tackle problems in data management and analytics and describe their results in a structured, written form.

(MF5) continue their studies at the PhD level, if their results are of sufficient quality.

Competencies

After completing their studies, students have the competences needed to –

(MKO1) apply their knowledge and capabilities to solve specific problems in a team context.

(MKO2) use their interdisciplinary education to mediate between technical and non-technical individuals.

(MKO3) evaluate the latest changes in programming languages, systems, models and, wherever possible, exploit them to develop better solutions to data-science related problems.