

University of Tübingen exam regulations for the study program in Quantitative Data Science Methods – Psychometrics, Econometrics and Machine Learning culminating in an examination for a Master of Science (M.Sc.) degree – Special Provisions –

In accordance with §§ 19 paragraph (1) sentence 2 no. 9, 32 paragraph (3) of the law governing institutions of higher education (LHG) of 1 January 2005 (GBl. p. 1), in the version published 1 April 2014 (GBl. p. 99) most recently amended by article 7 of the law dated 21 December 2021 (GBl. 2022 p. 1, 2), the University of Tübingen Senate on 15.12.2022 passed these Special Provisions of the exam regulations for the study program in Quantitative Data Science Methods – Psychometrics, Econometrics and Machine Learning at the University of Tübingen culminating in an examination for a Master of Science (M. Sc.) degree.

Approved by the President on 20.12.2022.

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A. Validity of General Provisions and admission requirements

§ 1 Validity of General Provisions

The MRPO - the General Provisions of the University of Tübingen exam regulations for Master's degree programs culminating in an examination for a Master of Science (M.Sc.) / Master of Arts (M. A.) degree - as amended are part of these exam regulations, insofar as no other special regulations have been made.

§ 2 Requirements for admission to program

(1) ¹A prerequisite for enrollment in this Master's program is a Bachelor's degree in Data Science or a related subject (in particular Informatics, Mathematics, Physics, Psychology or Economics) with

a regular duration of study of at least six semesters and with courses worth 180 credit points, or a degree in a related subject covering basically the same material, or an equivalent degree, completed respectively with a grade of 2.5 or better. ²Furthermore, the applicant must demonstrate successfully completed coursework in the following subjects in particular in his/her Bachelor's studies:

- Mathematics: single- and multi-dimensional analysis, linear algebra and either numerics or stochastic processes
- Informatics: Programming, algorithms and data structures

³The respective examination board will decide on the equivalency of a degree and on whether the prerequisite in sentence 2 above has been met. ⁴The board of examiners may transfer the making of this decision revocably to the head of the board. ⁵If there is a restricted number of admissions, statutes may specify that the decision is instead made by a selection committee formed for the relevant selection process.

(2) To take part in the Master's program, applicants must also document knowledge of English at least at the level of B2 of the Common European Framework of Reference for Languages (CEFR).

B. Goals, content and structure of the program

§ 3 Goals and contents of program, regular duration of study, scope of program

(1) ¹Studies in Master of Science program (M. Sc.) in Quantitative Data Science Methods – Psychometrics, Econometrics and Machine Learning (hereinafter: the program) enable students to acquire the specific qualifications, competencies, knowledge, abilities and skills required for a Master's degree in the subject of Quantitative Data Science Methods – Psychometrics, Econometrics and Machine Learning under § 7 (1) of the Master's degree framework exam regulations, the MRPO. ²The objective of the program is to deepen or expand the knowledge acquired in the Bachelor's degree, thus providing the basis for the development and/or application of the student's own ideas (application or research-oriented); graduates possess a broad, detailed and critical understanding at the cutting edge of knowledge in one or more specialized fields

- and are able to apply their knowledge and understanding as well as their problem-solving skills in new and unfamiliar situations related to their field of study in a wider or multidisciplinary context (instrumental competencies),
- to integrate knowledge and deal with complexity,
- and to make academically sound decisions on the basis of incomplete or limited information, taking into account social, academic and ethical findings resulting from the application of their knowledge and from their decisions,
- to acquire new knowledge and skills independently and to carry out largely self-directed and/or autonomous independent research- or application-oriented projects (systemic competencies)
- to communicate their conclusions and the information and motives underlying them to experts in the subject and laypersons alike, in a clear and unambiguous manner in accordance with the latest research and practice; to exchange information, ideas, problems and solutions with both experts and laypersons on an academic level and to assume prominent responsibility in a team (communicative competencies).

³Further details of the course objectives are set out in the module handbook.

(2) ¹The regular duration of study for this degree program is 4 semesters. ²The program comprises 120 ECTS credit points (CP).

(3) Over and above the number of credit points prescribed for the degree program according to these regulations, students may obtain no more than a 60 additional credit points from the degree

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program modules specified in § 5, para. (1); in all other respects, § 2, para. (5) of the Master's degree framework exam regulations (MRPO) applies.

§ 4 Academic degree

The academic degree "Master of Science" (abbr. "M.Sc.") is conferred on the basis of a successful completion of the program.

§ 5 Program Structure

(1) ¹Students complete a program to earn credit points as set out in § 3 para. (2); the program consists of the following modules:

Se- mes- ter no.	Module no.	P/ WP	Module title	Work for as- sessment	CP
Foundations (18 - 27 CP)					
1	QDS-FO1	P	Mathematical Introduction	written	3
2	QDS-FO2	P	Advanced Statistics	written	3
1-2	QDS-FO3	WP	Programming I	K. or H. or foP	3
1-2	QDS-FO4	WP	Programming II	K. or H. or foP	3
1	QDS-FO5	WP	Experimental and Quasi-Experimental Design	K. or H	3
1-3	QDS-FO6	WP	Ethics Seminar	written or oral	3
2	QDS-FO7	WP	Bayesian Modeling	K or mP or foP or H	6
3	QDS-FO8	P	Research Project	H	9
3	QDS-FO9	WP	Master Seminar on Economics	H	9
2	QDS-FO10	WP	Connecting the Threads	written or oral	6
1-3	QDS-FO11	WP	Selected Topics in QDS I	written or oral	3
1-3	QDS-FO12	WP	Selected Topics in QDS II	written or oral	6
1-3	QDS-FO13	WP	Selected Topics in QDS III	written or oral	9
Psychometrics and Mathematical Psychology (18 - 30 CP)					
1	QDS-PS1	(P)	Foundations in Psychometrics	K or mP or foP or H	6
1	QDS-PS2	WP	Psychometrics	K or mP or foP or H	6
2	QDS-PS3	WP	Item Response Theory	K or mP or foP or H	6
3	QDS-PS4	WP	Mathematical Models in Psychology	K or mP or foP or H	6
3	QDS-PS5	WP	Longitudinal Data Analysis	K or mP or foP or H	6

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2	QDS-PS6	WP	Multilevel Modeling	K or mP or foP or H	6
1.3	QDS-PS7	WP	Structural Equation Modeling	K or mP or foP or H	6
1	QDS-PS8	WP	Latent Variable Modeling	K or mP or foP or H	6
1-3	QDS-PS9	WP	Core Topics Psychometrics I	written or oral	6
1-3	QDS-PS10	WP	Core Topics Psychometrics II	written or oral	9
Econometrics (18 - 30 CP)					
1	QDS-EC1a	(P)	Foundations in Econometrics I	written or oral	6
1-3	QDS-EC1b	(P)	Foundations in Econometrics II	written or oral	9
2	QDS-EC2	WP	Applied Econometrics	K	6
3	QDS-EC3	WP	Advanced Time Series Analysis	PF	9
2	QDS-EC4	WP	Advanced Microeconometrics	K	9
2	QDS-EC5	WP	Machine Learning in Econometrics	K	6
1.3	QDS-EC6	WP	Statistics of Financial Markets	K	9
2	QDS-EC7	WP	Empirical Asset Pricing	K	9
2	QDS-EC8	WP	Financial Market Microstructure	PF	6
1.3	QDS-EC9	WP	Financial Economics	PF	9
1-3	QDS-EC10	WP	Core Topics Econometrics I	written or oral	6
1-3	QDS-EC11	WP	Core Topics Econometrics II	written or oral	9
Machine Learning (18 - 30 CP)					
1	QDS-ML1	(P)	Foundations in Machine Learning	written or oral	6
1	QDS-ML2	WP	Machine Learning (1)	K	6
1	QDS-ML3	WP	Data Literacy	K	6
3	QDS-ML4	WP	Deep Learning	K	6
2	QDS-ML5	WP	Statistical Machine Learning	K	9
2	QDS-ML6	WP	Probabilistic Machine Learning	K	9
1-3	QDS-ML7	WP	Core Topics Machine Learning I	written or oral	6
1-3	QDS-ML8	WP	Core Topics Machine Learning II	written or oral	9
Thesis (30 CP)					
4	QDS-MT	P	Master's thesis (final module)	Master's thesis	30

Abbreviations: FS = recommended semester (subject to availability and change, see module handbook); module no. = current module no. or abbreviation (subject to change, see module handbook); P = compulsory; WP = required elective; (P) = compulsory in some cases, see sentence 4; CP = credit points; K = written exam; H = assignment; mP = oral examination; PF = portfolio examination; foP = formative assessment.

²Apart from the final module, a total of 90 CP must be earned; of these, at least 18 CP must be earned in each elective studies area Foundations, Psychometrics and Mathematical Psychology,

Econometrics and Machine Learning; all compulsory modules must be completed. ³The student may opt to obtain the remaining 18 CP in any of the designated elective studies areas; however, a total of 27 CP at most may be obtained in the Foundations elective studies area; in the other elective studies areas, a maximum of 30 CP respectively may be obtained. ⁴If, in the course of the decision under § 2 sentence 2, deficits are found in a student's required basic knowledge in the respective elective areas, completion of one or more of the modules QDS-PS1, QDS-EC1a/ QDS-EC1b or QDS-ML1 may be required and thus become part of the respective elective area under sentences 2 and 3; otherwise, these modules may not be selected.

§ 6 Module coursework

¹Details of the module coursework required in each of the modules is set out in the module table in these regulations (§ 5) and in the module handbook. ²Assessment must be clearly specified as to its type and scope, if this is not set out in the module table.

§ 7 Languages of instruction and examination

¹English is the language of instruction and examination in this degree program. ²Classes may also be conducted in the following languages:

- German.

³At the discretion of the teachers, module coursework may be required and carried out in those languages in which the module classes are taught. ⁴Examinations are usually conducted in the language in which the relevant classes were held; other assessment is usually conducted in the language in which the relevant classes were held. ⁵In accordance with the current state of research and teaching, content from other languages may also be dealt with in classes. ⁶It is therefore assumed that students have sufficient knowledge of the relevant languages.

C. Assessment in the program

I. General Provisions for assessed coursework

§ 8 Multiple-choice procedures

(1) ¹Written assessment in the form of examinations may, in the following cases, be wholly or partly conducted in such a way that the candidate must indicate which of the answers - presented with the examination questions - he or she considers to be correct (multiple-choice procedure). ²The conditions for the conducting of examinations including multiple-choice questions are:

- the examination tasks are set by the person or persons acting as the examiner, and
- the examinations, after they have been completed, are corrected in their entirety by the person or persons acting as examiners, and
- the examinations are graded by the person or persons acting as examiners according to their respective individual grading scheme according to § 19 MRPO.

³Prior to correction of examinations, no final determination may be made regarding certain assessments, such as the setting of certain grades if a certain proportion of the examination questions are answered correctly or if a certain number of points is achieved.

(2) Regarding assessment conducted via online attendance in accordance with § 12 MRPO, para. (1) applies accordingly.

II. Special provisions for the final module

§ 9 Final module

(1) ¹In the final module, 30 credit points must be obtained. ²Of these, 30 CP are obtained in the Master's thesis. ³The Master's thesis and the oral examination in the final module are regulated in § 28 MRPO.

(2) The time limit for writing a Master's thesis - from the issuing of the topic to submission of the thesis - is 8 months.

(3) Notwithstanding § 28 (4) sentence 1 MRPO, the Master's thesis is to be written in English; the board of examiners will decide on applications to write the thesis in any other language.

§ 10 Subject-specific provisions for admission to final module

In addition to the prerequisites set out in the MRPO, the subject-related prerequisites for admission to the Master's thesis and the oral exam in the final module are:

- the successful completion of modules worth a total of at least 60 ECTS credits.

D. Deadlines for examinations in the program

§ 11 Deadline for completion of studies

¹All coursework and assessment required under the exam regulations for the module coursework must be completed by the end of the student's 8th semester in the subject. ²If this time limit is exceeded, the student's right to be examined is lost, unless the failure to meet the deadline is beyond the control of the student.

§ 12 Student counseling

In order to ensure academic success within the limits of the law, students should be called for an interview by the appropriate academic advisor if the following CP have not been achieved in the program:

- by the end of the 4th subject-specific semester: 90 CP.

E. Master's overall grade

§ 13 Calculation of Overall Grade

The overall grade for the program is calculated from the average of all graded modules, as weighted by credit points.

§ 14 Certificate and other documentation

Along with the details provided for under § 36 par. 1 MRPO, the following details are entered:

- upon written application by the student to the examinations office, the study focus area "Psychometrics and Mathematical Psychology," "Econometrics" or "Machine Learning" may be included in the certificate if at least 27 CP were obtained in the respective elective study area (cf. § 5) and the Master's thesis was completed in the respective study area; the latter is usually the case if at least one or one of the two thesis examiners belongs to the respective study area.

F. Closing remarks

§ 15 Effective date and transitional arrangements

¹These exam regulations come into effect on the date of their publication in the University of Tübingen's official bulletin, the Amtliche Bekanntmachungen. ²Their first semester of validity is the winter semester 2023/2024.

³Students who commenced their studies at the University of Tübingen prior to the semester specified in sentence 2 are - subject to the following provisions - entitled to complete their module coursework in this degree program at the University of Tübingen by 30.09.2026 under the previously valid rules; however, regarding the examination board, § 6 MRPO applies. ⁴Students who commenced their studies at the University of Tübingen prior to the semester specified in sentence 2, are entitled to switch and complete their module coursework in the degree program under these current exam regulations upon written application, which must be submitted to the responsible examination office by 31.03.2024. ⁵If no application under sentence 4 above is lodged, then - after the deadline specified in sentence 3 - the module coursework in the degree program must be completed under these current regulations. ⁶In cases under sentences 4 and 5 above, module coursework completed previously will be accredited according to the new exam regulations and the corresponding module handbook, subject to the following provisions. ⁷These exam regulations do not grant any new or additional right to be assessed in an area already assessed; any fails in assessed work under the previous exam regulations will be included. ⁸Furthermore the responsible board of examiners may agree suitable transitional arrangements in individual cases, particularly if previous classes are no longer offered as before or if certain classes have been completed, possibly offering partial accreditation and/or requiring certain conditions to be fulfilled, particularly if a "learning agreement" is to be considered.

Tübingen, 20.12.2022

Professor Dr. Karla Pollmann
President