

University of Tübingen exam regulations for the study program in Machine Learning culminating in an examination for a Master of Science (M. Sc.) – 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 1 of the law dated 24 June 2020 (GBl. p. 426), the University of Tübingen Senate on 11.03.2021 passed the Special Provisions of these exam regulations for the study program in Machine Learning at the University of Tübingen culminating in an examination for a Master of Science (M. Sc.) degree.

Approved by the President and Vice-Chancellor on 25.03.2021.

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A. Validity of General Provisions and admission requirements

§ 1 Validity of General Provisions

The University of Tübingen exam regulations for Master's degree programs culminating in the academic degree of Master of Science (M.Sc.) / Master of Arts (M.A.) – Master's degree framework exam regulations (MRPO) – as amended represent the General Provisions of these exam regulations and are an integral part of them, insofar as no more specific provisions have been made.

§ 2 Requirements for admission to program

(1) A prerequisite for studies in this Master's program is a grade of 2.3 or better in a Bachelor's degree in the subject of Informatics, Mathematics or Physics, in a related program covering basically the same material, or an equivalent degree. In particular, these skills in the following areas are required, equivalent in content and scope to those in the B.Sc. in Informatics program in Tübingen:

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

(2) A further requirement for admission to the Master's program is very good English language skills; this must be documented by one of the following:

- German Abitur certificate with proof of 6 (G8) or 7 years (G9) of English lessons
- TOEFL iBT test with at least 94 points
- IELTS test with points of at least 7.0
- Cambridge Certificate in Advanced English (CAE)
- Higher education entrance qualification from the United Kingdom, Ireland, USA, Canada, Australia, New Zealand

(3) The board of examiners will decide on the equivalency of a degree and on whether Bachelor's degree subjects may be counted, as well as whether an applicant's language qualifications meet the requirements. The board of examiners may transfer the making of this decision revocably to the head of the board. If there is a set number for admission, the statutes may specify that the selection committee formed for the relevant selection process decides instead.

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 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 Machine Learning under § 7 (1) of the Master's degree framework exam regulations. ²The objective of the degree program is to deepen or expand the knowledge acquired in the Bachelor's degree program, 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 scientifically sound decisions on the basis of incomplete or limited information, taking into account social, scientific 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 expert representatives and laypersons in a clear and unambiguous manner, to exchange information, ideas, problems and solutions with both experts and laypersons on a scientific 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 credit points (CP).

(3) ¹Over and above the number of credit points prescribed for the degree program according to these regulations, students may obtain no more than a 30 additional credit points from the degree program modules specified in § 5, para. (1); in all other respects, § 2, paras. (4) and (5) of the Master's degree framework exam regulations apply.

§ 4 Academic degree

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

§ 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 study areas:

- a. *Foundations of Machine Learning*
- b. *Diverse Topics in Machine Learning*
- c. *General Computer Science*
- d. *Expanded Perspectives*
- e. Master's thesis

(2) Only graded modules may be credited. Students must select modules so as to make up the required total of ECTS credits. Within these areas, the modules given in the table below may be selected (subject to when each module is offered; see module handbook). Further elective modules may be set out in the module handbook. If such elective options exist, students must make use of them so that the exact required number of credit points is reached in each study area or sub-area, unless the examination board approves a different schedule. ECTS credit points obtained beyond the total required number are not included in the final grade.

Module name:	P/WP	Recommended semester (subject to availability and any changes set out in the module handbook)	Work for assessment	ECTS credit points
Study area: Foundations of Machine Learning with a workload of 24 CP. The following modules may be selected:				
Statistical Learning	WP	1-2	sPL or mPL	9
Probabilistic Inference and Learning	WP	1-2	sPL or mPL	9
Deep Learning	WP	1-2	sPL or mPL	6
Study area: Diverse Topics in Machine Learning with a workload of 36 CP. The following modules may be selected:				
Mathematics for Machine Learning	WP	1	sPL or mPL	9
Data Literacy	WP	1	sPL or mPL	6
Practical Machine Learning	WP	1-3	sPL or mPL	6
Machine Learning seminar	WP	1-3	sPL or mPL	3

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Statistical Learning Theory	WP	2-3	sPL or mPL	6
Numerical Algorithms of Machine Learning	WP	2-3	sPL or mPL	6
Computer Vision	WP	1-3	sPL or mPL	6
Self-Driving Cars	WP	1-3	sPL or mPL	6
Time Series	WP	1-3	sPL or mPL	6
Convex and Non-convex Optimization	WP	2-3	sPL or mPL	9
Study area: General Computer Science with a workload of 18 CP				
All graded Master's and Bachelor's modules in Informatics	P	1-3	sPL or mPL	18
Study area: Expanded Perspectives with a workload of 12 CP				
All graded Master's and Bachelor's modules at the University (see sentence (5) below).	P	1-3	kP	12
Study area: Masters Thesis with a workload of 30 ECTS				
Master's thesis (final module)*	P	4	Master's thesis, R	30

1) A maximum of three seminars may be selected in the program.

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, CP = credit points, K = written exam, H = assignment; mP = oral examination/assessment; kP=no assessment, sPL=written assessment; *Master's project (final module): Master's thesis and accompanying final colloquium on the contents of the Master's thesis.

(3) The number of credit points obtainable in each study area are limited as follows:

- (a) 24 ECTS points must be obtained in the **Foundations of Machine Learning** study area.
- (b) 36 credit points must be earned in the study area **Diverse Topics in Machine Learning**. Of those credit points, 6 at most may be obtained through seminars, and 6 credits at most may be earned via an internship.
- (c) 18 ECTS credit points must be obtained in the **General Computer Science** study area.
- (d) In the study area **Expanded Perspectives** 18 ECTS credit points must be completed.

(4) All graded Master's and Bachelor's modules in Informatics may be accredited to the **General Computer Science** study area. Some modules may be excepted; the examination board shall decide on a list of exceptions.

(5) For the **Expanded Perspectives** study area, all graded University modules except those of the University Sports Center may be accredited. Some modules may be excepted; the examination

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board shall decide on a list of exceptions. Grades obtained from classes in the *Expanded Perspectives* study area are not included in the calculation of the final grade.

§ 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. ³For the imported modules, students may be directed to the module handbook of the respective department with which the modules originate.

§ 7 Languages of instruction and examination

¹English is the language of instruction and examination in this degree program. ²Classes or module coursework may be conducted in German in the study areas General Computer Science and Expanded Perspectives; this is stipulated by the teachers and examiners.

C. Assessment in the program

I. General Provisions for assessed coursework

§ 8 Multiple-choice procedure

(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 the correction of the examinations, no 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, 27 CP are obtained in the Master's thesis and 3 CP in the oral examination in the final module [this takes the form of a final colloquium as part of the Master's thesis process (3 CP)]. ³The Master's thesis and the oral examination in the final module are regulated by § 28 MRPO.

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

(3) Notwithstanding § 28 (5) 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.

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(4) ²The oral exam in the final module under para. (1) is assessed by one examiner and takes place without the additional presence of an observer; for grading, § 19 MRPO applies.

§ 10 Subject-specific requirements for admission

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 30 ECTS credits.

§ 11 Repetition for a better grade

Assessment resulting in a pass may not be repeated.

D. Deadlines for examinations in the program

§ 12 Deadlines for completion of module coursework

Deadlines for the completion of coursework or module-specific assessment are not currently provided for.

§ 13 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 7th 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.

§ 14 Student counselling

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

- by the end of the 2nd subject-specific semester: 40 CP.

E. Master's overall grade, Calculation of overall grade

§ 15 Calculation of Overall Grade

¹The overall grade for the Master's examination process is calculated from the average of all graded modules, as weighted by credit points. ²Grades obtained from classes in the *Expanded Perspectives* study area are not included in the calculation of the Master's overall grade. ²Notwithstanding § 19 (3) sentence 3 MRPO, calculation takes into account whole numbers and the first two decimal places only; all further decimal places are deleted with no rounding.

F. Closing remarks

§ 16 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 2021/22. ³Students who commenced their studies in this program 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

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by 30.09.2024 under the previously valid rules; however, regarding the examination board, § 6 MRPO applies. ⁴Students who commenced their studies in this program 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 30.09.2022. 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. ⁶Module coursework completed previously will only 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, 25.03.2021

Professor Dr. Bernd Engler
President