Curriculum for the Master's Degree Programme

Computational Social Systems

Curriculum 2021

This curriculum was approved by the Senate of the University of Graz in the meeting held on 21.04.2021 and by the Senate of the Graz University of Technology in the meeting held on 19.04.2021.

The degree programme is a degree programme that has been jointly established (§ 54 para. 9 of the Universities Act; in German: *Universitätsgesetz* or UG) by the University of Graz (Uni Graz) and the Graz University of Technology (TU Graz) as part of the "Route 63" cooperation. The legal basis for this degree programme is the Universities Act (UG) as well as the provisions in the Uni Graz and TU Graz statutes (respective currently accepted versions) that apply to study law.

(Please note. The English version of this document is a courtesy translation. Only the German version is legally binding.)

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I. General information

§ 1 Subject of the degree programme and qualification profile

The interdisciplinary Master's Degree Programme in Computational Social Systems (hereinafter referred to as CSS) comprises four semesters. A total of 120 ECTS credits are assigned. The Master's Degree Programme in CSS is conducted as a foreign language programme in English in accordance with § 63a para. 8 UG.

Graduates of this programme are awarded the academic degree “Master of Science”, abbreviated as “MSc”.

(1) Subject of the degree programme

The English-language Master's Degree Programme in CSS provides students with an interdisciplinary education that combines aspects of the fields of computer science, economics, sociology, psychology and law. Questions are posed that refer to socio-technical systems. During the development of a digital society, these questions are omnipresent and permeate all areas of political, economic and academic life.

The functionality of computational social systems usually arises due to interactions among algorithms and the social behaviour of the users: Algorithms are applied to determine results on the basis of data on the users’ interactions with one another or with the system itself. Social, economic, legal and technical issues, therefore, are usually extremely difficult to consider as single units and require an interdisciplinary perspective of these socio-technical systems to be taken.

(2) Qualification profile and competences

The joint Master's Degree Programme in CSS has been developed to provide students with an interdisciplinary education in precisely the scientific disciplines mentioned above. This requires the students to receive academic training that enables them to understand data structures, algorithms, statistics, machine learning, data mining and data science, as well as to develop a thorough understanding of user behaviour, social and economic systems, the challenges they pose and the legal and ethical consequences of their interactions with each other.

Graduates of the Master's Degree Programme in CSS will gain the following knowledge, skills and competences:

Knowledge and understanding

The graduates

- master and learn selected relevant computer science methods, and especially those used in the fields of data science and machine learning.
- master and learn – depending on the specialisation – fundamental knowledge and methods from the fields of business administration, psychology, law, or sociology and receive an introduction to all these fields.

Application of knowledge and understanding

Graduates are able to,

- analyse and design complex socio-technical systems interdisciplinarily and systematically.

- design and carry out meaningful and methodologically sound studies using modern informatics methods, as well as interpret the results obtained from these studies by applying social, economic and cognitive science theories.
- apply their knowledge and problem-solving skills in new and unfamiliar situations.
- define and interpret the specific phenomena, boundaries, terminologies and doctrines belonging to at least two disciplines.

Submit assessments

Graduates are able to,

- analyse and assess the ethical, economic, technical, social, psychological, or legal aspects of socio-technical systems.
- formulate scientifically sound assessments and judge their resilience.

Communicative, organisational and social skills

The graduates are able to

- communicate with computer scientists as well as with business economists, psychologists, sociologists and legal scholars – depending on their area of specialisation – in a subject-specific and goal-oriented manner and to act as mediators between these professional groups.
- display proficiency in presentation techniques.
- write scientific texts.
- acquire further knowledge independently.
- apply relevant knowledge over the long-term due to their broad basic education.

(3) Need and relevance of the degree programme for science and the labour market

Graduates will make a significant, design-oriented contribution to future societal development by, for example, gathering new scientific knowledge of relevance for socio-technical systems, developing future technologies for these systems, or critically reflecting on their social impact.

Graduates fill a gap in the labour market for interdisciplinarily trained professionals who understand both the specific languages and methods used in the basic disciplines of this degree. These potential employees can analyse social processes and systems by applying informatics tools and critically assess informatics projects by taking a business, psychological, sociological, or legal approach. Thus, they have the skills needed to support the rapidly advancing digitalization of society and to reflect on these advances both critically and interdisciplinarily.

Graduates can be employed in basic and applied research on computational social systems. Furthermore, graduates are qualified to pursue further doctoral studies.

II. General provisions

§ 2 Admission requirements

(1) The Master's Degree Programme in CSS has been developed for graduates of one of the following majors: Computer Science, Business Administration, Sociology, Psychology, or Law.

(2) A specialisation is deemed to exist if at least 60 ECTS credits can be assigned to the respective subject area. If the proportion is lower, additional courses and examinations (up to a maximum of 30 ECTS credits) may be taken if a degree programme with at least 180 ECTS credits is offered at a recognised domestic or foreign post-secondary educational institution and only individual supplemental courses or examinations are missing that would allow a specialisation with 60 ECTS credits to be achieved.

(3) Graduates of degree programmes offered at a recognised domestic or foreign post-secondary educational institution and assigned at least 180 ECTS credits are eligible for admission, if the primary programme focus was in one of the following subjects:

a. computer science
b. business administration
c. sociology
d. psychology, or
e. law

(4) Graduates of degree programmes for which the respective focus as described in (2) amounts to less than 30 ECTS credits are not eligible.

(5) As a prerequisite for admission to the degree programme, the student must provide proof of knowledge of the English language, as this is required to make successful progress in the degree programme. The form of the proof will be described in a regulation issued by the Rectorate.

§ 3 Assignment of ECTS credits

ECTS credits will be assigned to all performance items that are achieved by the students. These ECTS credits are used to determine the relative share of the workload associated with the individual performance items, whereby the yearly workload is equal to 1500 full hours of work, and 60 ECTS credits are assigned to this workload (corresponding to a volume of 25 full hours of work per ECTS credit). The workload comprises both the hours of individual study and the semester hours. One semester hour corresponds to 45 minutes per week of instruction during the semester.

§ 4 Structure of the degree programme

The Master's Degree Programme in CSS with a workload of 120 ECTS credits comprises four semesters. The course “1. Introduction to Computational Social Systems” provides students who have completed different degree programmes with an introduction to the subject area of CSS and provides them with competences they need for the interdisciplinary specialisations. The in-depth study takes place in an area of specialisation. Free-choice subjects, the master's thesis colloquium seminar, the master's thesis work and the final examination round out the programme. The programme is structured as follows:

	ECTS
1 Introduction to Computational Social Systems	Min. 42
2. Specialisations (choose one) *2.A: Specialisation in Business Analytics* *2.B: Specialisation in Societies, Technologies and Social Research* *2.C: Specialisation in Human Factors* *2.D: Specialisation in Law and Computer Science*	Min. 42
Free-choice subjects	Min. 6
Master's thesis colloquium	2
Master's thesis	27
Master's examination	1
Total	**120**

§ 5 Types of courses offered

The types of courses offered at Uni Graz and TU Graz are described in the statutes of the respective universities.

§ 6 Group sizes

The following maximum numbers of participants (group sizes) are specified for courses which are marked with the identifier “CSS” in the column entitled “Area” in the tables in § 8 para. 5:

Lecture (VO)	No limit
Lecture with exercise (VU)	*30*
Exercise (UE)	*30*
Proseminar (PS)	*25*
Seminars (SE)	*25*
Courses (KS)	*30*
Construction exercises (KU)	*30*

Regarding courses that are adopted from the curriculum of other degree programmes (i.e. identifier other than “CSS”), the number of participants is based on the curriculum of the respective degree programme.

§ 7 Guidelines for the allocation of places in courses

(1) If more students register for a course than places are available, parallel courses will be provided (if necessary, also during the lecture-free period).

(2) The following applies to courses adopted from the curriculum of other degree programmes: If enough parallel courses (groups) cannot be offered, students will be admitted to the course according to the order of prioritisation described in the relevant curriculum. The most current version of the curriculum will be applied. The relevant curriculum is shown in the tables in § 8 para. 5 in the column entitled “Area”.

(3) The following applies to all other courses: If enough parallel courses (groups) cannot be offered, students will be admitted to the course according to the following order of prioritization:

   a. The course is listed as compulsory for the student in the curriculum.

b. The total number of the courses that have been successfully completed in the relevant degree programme (i.e. total ECTS credits).
c. The date (priority given to the earliest date) on which the student fulfilled the participation requirement.
d. Students who have already been deferred once or who have had to repeat the course will be given priority for the next course.
e. The examination grade received in the course(s) in which participation is required or the grade average of the examinations (weighted by the ECTS credits assigned).
f. Students for whom such courses are not necessary to complete the curriculum will only be considered if free places are available; it is possible to request inclusion on a separate waiting list. The provisions described above apply mutatis mutandis.

(4) Students who complete part of their studies as part of a mobility programme at the universities involved in the programme (TU Graz and Uni Graz) are given priority for up to 10% of the available places.

III. Degree programme content and curriculum

§ 8 Modules, courses and semester assignment

(1) The individual courses included in this master's degree programme and the modules they are assigned to are listed below. The knowledge, methods, or skills that will be taught in the modules are described in more detail in Appendix I. The assignment of the courses to the curriculum is a recommendation, ensuring that the sequence of the courses enables the student to optimally build on previous knowledge and that the academic year workload does not exceed 60 ECTS credits. The assignment of courses to the participating universities is found in the table in para. 5. Compulsory courses are held in English. In cases where the free-choice subjects include additional courses in German, this is noted accordingly.

(2) The interdisciplinary specialisations 2.A to 2.D in the Master's Degree Programme in CSS build on the competences acquired in the previous degree programme. In order to acquire complementary competences that are still missing in each case, students must complete modules 1.1 and 1.7 in “1. Introduction to Computational Social Systems”. In addition, depending on the previous studies and specialisation, the modules listed in the following tables must be completed:

a. Prerequisite studies in information technology according to § 2 para. 3 lit. a

Selected specialisation:	Module to be completed:
Business Analytics	1.2: Introduction to Business Analytics for students with computer science background
Societies, Technologies and Social Research	1.3: Introduction to Societies, Technologies and Social Research for students with computer science background
Human Factors	1.4: Introduction to Human Factors for students with computer science background
Law and Computer Science	1.5: Introduction to Law and Computer Science for students with computer science background

(3)

b. Prerequisite studies in business administration according to § 2 para. 3 lit. b

Specialisation:	Module to be completed:
Business Analytics	1.6: Introduction to Computer Science for students with backgrounds in business administration, law, sociology, psychology and comparable fields

c. Prerequisite studies in sociology according to § 2 para. 3 lit. c

Specialisation:	Module to be completed:
Societies, Technologies and Social Research	1.6: Introduction to Computer Science for students with backgrounds in business administration, law, sociology, psychology and comparable fields

d. Prerequisite studies in psychology according to § 2 para. 3 lit. d

Specialisation:	Module to be completed:
Human Factors	1.6: Introduction to Computer Science for students with backgrounds in business administration, law, sociology, psychology and comparable fields

e. Prerequisite studies in law according to § 2 para. 3 lit. e

Specialisation:	Module to be completed:
Law and Computer Science	1.6: Introduction to Computer Science for students with backgrounds in business administration, law, sociology, psychology and comparable fields

(4) In the specialisation, three modules each 2.A.1, 2.A.2 and 2.A.3 (Business Analytics) or 2.B.1, 2.B.2 and 2.B.3 (Societies, Technologies and Social Research) or 2.C.1, 2.C.2 and 2.C.3 (Human Factors) or 2.D.1, 2.D.2 and 2.D.3 (Law and Computer Science) must be completed. These comprise compulsory (*Pflicht*) and/or free-choice (*Wahl*) subject areas. The minimum number of ECTS credits must be achieved in each of the modules mentioned. The total sum of credits for the three modules must amount to at least 42 ECTS credits.

(5) The degree programme comprises the modules and performance items shown in the table. The table also indicates the university that offers the course and the subject assignment of the course. “CSS” corresponds to Computational Social Systems, “BA” to Business Administration, “Soc.” to Sociology, “Psy.” to Psychology, “Law” to Law and “Inf.” to Computer Science.

(6) The following table contains courses in the modules 1.3, 1.4, 2.B.2, 2.C.2 and 2.D.1, which change annually. These are assigned each year by the Curricular Committee responsible for the subject (University of Graz) and the Curricular Committee Working Group (TU Graz). During this process, care is taken to allocate ECTS credits equitably (with regard to workload and semester allocation) and ensure that enough English-language courses are offered.

Masterstudium Computational Social Systems			LV		Semester mit ECTS-Anrechnungspunkten				Angeboten von		Area
Module	Lehrveranstaltung	SSt.	Typ	ECTS	I	II	III	IV	KFU	TUG	
1. Introduction to Computational Social Systems											
Module 1.1: General Introduction to Computational Social Systems											
Pflicht	Introduction to Computational Social Systems *[Teamteaching Uni Graz/TU Graz]*	2	VU	5	5				x	x	CSS
Pflicht	Foundations of Computational Social Systems	2	VU	5	5					x	CSS
Pflicht	Research Design	2	VO	5	5				x		CSS
Total Module 1.1		**6**		**15**	**15**						
Module 1.2: Introduction to Business Analytics for students with Computer Science background											
Pflicht	Introduction to Business Administration for Computer Scientists	2	KS	4	4				x		CSS
Wahl	Masterkurs Accounting*	2	VO	4	4				x		BA
Wahl	Masterkurs Finance	2	VO	4	4				x		BA
Wahl	Masterkurs Marketing	2	VO	4	4				x		BA
Wahl	Masterkurs Produktion und Logistik	2	VO	4	4				x		BA
Wahl	Masterkurs Management*	2	VO	4	4				x		BA
Total Module 1.2		**6**		**12**	**12**						

* Courses offered in the German language

		SSt.	Typ	ECTS	I	II	III	IV	KFU	TUG	Area
Module 1.3: Introduction to Societies, Technologies and Social Research for students with Computer Science background											
Pflicht	Einführung in die Soziologie	2	VO	3	3				x		Soc.
Pflicht	Introduction to Empirical Social Research	2	VO	3	3				x		Soc.
Wahl	Ausgewählte LV aus "Social Analysis" **		VU/KS	0-8	0-8	0-8			x		Soc.
Wahl	Ausgewählte LV aus "Empirical Social Research" **		VU/KS	0-10	0-10	0-10			x		Soc.
Wahl	Ausgewählte LV aus "Core Areas of Sociology" **		VU/KS	0-8	0-8	0-8			x		Soc.
Total Module 1.3				**min. 12**	**min. 12**						
Module 1.4: Introduction to Human Factors for students with Computer Science background											
Pflicht	Introduction to Psychology I	2	VU	3	3				x		Psy.
Pflicht	Introduction to Psychology II	2	VU	3	3				x		Psy.
Pflicht	Ausgewählte LV aus "Topics in Psychology of Human Factors I"		SE/VO/VU	3-4	3-4				x		Psy.
Wahl	Ausgewählte LV aus "Topics in Psychology of Human Factors II"		SE/VO/VU	6-8	6-8				x		Psy.
Total Module 1.4				**min. 12**	**min. 12**						
Module 1.5: Introduction to Law and Computer Science for students with Computer Science background											
Pflicht	Introduction to Law	1	VU	1,5	1,5				x		Law
Pflicht	Computer Ethics	2	VU	3	3				x		CSS
Pflicht	Technical Standards and Law	2	VO	5	5				x		Law
Pflicht	Legal Databases	1	KS	2,5	2,5				x		Law
Total Module 1.5		**6**		**12**	**12**						
Module 1.6: Introduction to Computer Science for students with background in Business Administration, Law, Sociology, Psychology and comparable											
Pflicht	Informatik 1	3	VU	4	4					x	Inf.
Pflicht	Datenbanken	2	VU	3	3					x	Inf.
Pflicht	Computational Methods for Statistics	2	VU	2,5	2,5					x	Inf.
Wahl	Introduction to Data Science and Artificial Intelligence	2	VU	3		3				x	Inf.
Wahl	Design your own App	2	VU	3	3					x	Inf.
Total Module 1.6		**9**		**12,5**	**12,5**						
Module 1.7: Joint module Computational Social Systems											
Pflicht	Computational Modeling of Social Systems	3	VU	4,5		4,5				x	Inf.
Pflicht	Knowledge Discovery and Data Mining 1	2	VO	3		3				x	Inf.
Pflicht	Knowledge Discovery and Data Mining 1	1	KU	1,5		1,5				x	Inf.
Pflicht	Introduction to IT Law	2	VO	3		3			x		Law
Pflicht	Social Aspects of Digital Technologies: Gender, Diversity and Research Ethics	2	VU	3			3		x		Soc.
Total Module 1.7		**10**		**15**		**12**					
Total 1. Introduction to Computational Social Systems				**42**	**42**						

** Contains courses in the German and English languages

2. Specialisations											
2.A Specialisation in Business Analytics											
Module 2.A.1: Business Analytics		**SSt.**	**Typ**	**ECTS**	**I**	**II**	**III**	**IV**	**KFU**	**TUG**	**Area**
Pflicht	Data-Driven Business Model Seminar	2	PS	4		4			x	x	CSS
Pflicht	Data Science in Business 1	2	PS	4			4		x	x	CSS
Pflicht	Data Science in Business 2	2	PS	4			4		x	x	CSS
Total Module 2.A.1		**6**		**12**		**12**					
Module 2.A.2: Elective Module Business Analytics											
Wahl	Business Intelligence and Analytics	2	PS	4		4			x		BA
Wahl	Data Management for Business Analytics	2	PS	4			4		x		BA
Wahl	Data-Driven Decision Support	2	PS	4		4			x		BA
Wahl	Eine Spezielle Betriebswirtschaftslehre (SBWL) aus dem Curriculum Master Betriebswirtschaft: Es sind die 4 Proseminare einer SBWL im Umfang von 16 ECTS-Anrechnungspunkten) zu absolvieren**		PS	16		16			x		BA
Total Module 2.A.2				**min. 12**		**min. 12**					

** Contains courses in the German and English languages

Module 2.A.3: Computer Science for Business Analytics		**SSt.**	**Typ**	**ECTS**	**I**	**II**	**III**	**IV**	**KFU**	**TUG**	**Area**
Wahl	Visual Analytics	3	VU	5		5				x	Inf.
Wahl	Information Visualisation	3	VU	5		5				x	Inf.
Wahl	Knowledge Discovery and Data Mining 2	3	VU	5			5			x	Inf.
Wahl	Recommender Systems	2	VU	3		3				x	Inf.
Wahl	Network Science	3	VU	5			5			x	Inf.
Wahl	Social Media Technologies	2	VU	3		3				x	Inf.
Wahl	Introduction to International Entrepreneurship	3	VU	5			5			x	Inf.
Wahl	Information Search and Retrieval	3	VU	5			5			x	Inf.
Wahl	Configuration Systems	2	VU	3			3			x	Inf.
Wahl	Softwareentwicklungsprozess*	1	VO	1,5		1,5				x	Inf.
Wahl	Advanced Information Retrieval	3	VU	5			5			x	Inf.
Wahl	Data Analysis and Introduction to R	2	VO	3			3			x	Inf.
Wahl	Data Analysis and Introduction to R	1	UE	2			2			x	Inf.
Wahl	Data Structures and Algorithms 1	2	VO	3			3			x	Inf.
Wahl	Data Structures and Algorithms 1	1	UE	1,5			1,5			x	Inf.
Wahl	Machine Learning 1	2	VO	3		3				x	Inf.
Wahl	Machine Learning 1	1	UE	1,5		1,5				x	Inf.
Wahl	Designing Interactive Systems	2	VU	3		3				x	Inf.
Wahl	Secure Product Lifecycle	2	VO	3			3			x	Inf.
Wahl	Secure Product Lifecycle	1	KU	2			2			x	Inf.
Total Module 2.A.3				**min. 11**		**min. 11**					
Total 2.A Specialisation in Business Analytics				**42**		**42**					

* Courses offered in the German language

		SSt.	**Typ**	**ECTS**	**I**	**II**	**III**	**IV**	**KFU**	**TUG**	**Area**
2.B Specialisation in Societies, Technologies and Social Research											
Module 2.B.1: Societies, Technologies and Social Research											
Pflicht	Research Seminar	3	KS	6			6		x	x	Soc.
Pflicht	Culture, Social Change, Technology	2	KS	4		4			x		Soc.
Total Module 2.B.1		**5**		**10**		**4**	**6**				
Module 2.B.2: Digital Societies: Theories, Methods and Critical Reflections											
Wahl	Ausgewählte LV aus "Advanced empirical Social Research" **		KS/VU	0-21		0-21	0-21		x		Soc.
Wahl	Ausgewählte LV aus "Special Topics in Sociology" **		SE/KS/VU	0-21		0-21	0-21		x		Soc.
Wahl	Ausgewählte LV aus "Science and Technology Studies"		VO/UE/SE	0-21		0-21	0-21			x	Soc.
Total Module 2.B.2				**min. 12**		**min. 12**					

** Contains courses in the German and English languages

Module 2.B.3: Computer Science for Societies, Technologies and Social Research		SSt.	Typ	ECTS	I	II	III	IV	KFU	TUG	Area
Wahl	Machine Learning 1	2	VO	3		3				x	Inf.
Wahl	Machine Learning 1	1	UE	1,5		1,5				x	Inf.
Wahl	Data Structures and Algorithms 1	2	VO	3			3			x	Inf.
Wahl	Data Structures and Algorithms 1	1	UE	1,5			1,5			x	Inf.
Wahl	Knowledge Discovery and Data Mining 2	3	VU	5			5			x	Inf.
Wahl	Natural Language Processing	3	VU	5		5				x	Inf.
Wahl	Recommender Systems	2	VU	3		3				x	Inf.
Wahl	Data Analysis and Introduction to R	2	VO	3			3			x	Inf.
Wahl	Data Analysis and Introduction to R	1	UE	2			2			x	Inf.
Wahl	Seminar Data Science	3	SE	5			5			x	Inf.
Wahl	Information Search and Retrieval	3	VU	5			5			x	Inf.
Wahl	Network Science	3	VU	5			5			x	Inf.
Wahl	Visual Analytics	3	VU	5		5				x	Inf.
Wahl	Social Media Technologies	2	VU	3		3				x	Inf.
Wahl	Advanced Information Retrieval	3	VU	5			5			x	Inf.
Wahl	Secure Product Lifecycle	2	VO	3			3			x	Inf.
Wahl	Secure Product Lifecycle	1	KU	2			2			x	Inf.
Total Module 2.B.3				**min. 11**		**min. 11**					
Total 2.B Specialisation in Societies, Technologies and Social Research				**42**		**42**					

		SSt.	Typ	ECTS	I	II	III	IV	KFU	TUG	Area
2.C Specialisation in Human Factors											
Module 2.C.1: Human Factors Basics											
Pflicht	Topics in cognitive psychology	2	VU	3		3			x		Psy.
Pflicht	Designing Interactive Systems	2	VU	3		3				x	Inf.
Pflicht	Advanced Seminar (Decision making)	2	SE	4			4		x		Psy.
Total Module 2.C.1		**6**		**10**		**6**	**4**				
Module 2.C.2: Psychology of Human Factors											
Pflicht	Empirical seminar	4	SE	5		5			x		Psy.
Wahl	Ausgewählte LV aus "Modeling of complex Systems"		VO/VU/SE	0-8			0-8		x		Psy.
Wahl	Ausgewählte LV aus "Topics in Robotics"		VO/SE	0-7			0-7		x		Psy.
Wahl	Ausgewählte LV aus "Quantitative research Methods"		VO/VU/SE/PS	0-8		0-8	0-8		x		Psy.
Wahl	Ausgewählte LV aus "Special Topics in Psychology of Human Factors"		VO/VU/SE	0-12		0-12	0-12		x		Psy.
Total Module 2.C.2				**min. 11**		**min. 11**					
Module 2.C.3: Computer Science for Human Factors											
Pflicht	Human Factors lab	4	SE	5			5			x	CSS
Wahl	Human Computer Interaction	3	VU	4,5		4,5				x	Inf.
Wahl	Evaluation Methodology	2	VU	3			3			x	Inf.
Wahl	User Interfaces*	1,5	VU	2		2				x	Inf.
Wahl	Intelligent User Interfaces	3	VU	5			5			x	Inf.
Wahl	Visual Analytics	3	VU	5		5				x	Inf.
Wahl	Information Visualisation	3	VU	5		5				x	Inf.
Wahl	Game Design and Development I	3	VU	5			5			x	Inf.
Wahl	Wearable Computing	3	VU	5		5				x	Inf.
Wahl	Methods of functional brain research	2	VO	3		3				x	Inf.
Wahl	Cognitive Neuroscience	2	VO	3			3			x	Inf.
Wahl	Data Analysis and Introduction to R	2	VO	3			3			x	Inf.
Wahl	Data Analysis and Introduction to R	1	UE	2			2			x	Inf.
Wahl	Information Search and Retrieval	3	VU	5			5			x	Inf.
Wahl	Advanced Information Retrieval	3	VU	5			5			x	Inf.
Wahl	Machine Learning 1	2	VO	3		3				x	Inf.
Wahl	Machine Learning 1	1	UE	1,5		1,5				x	Inf.
Wahl	Network Science	3	VU	5			5			x	Inf.
Wahl	Natural Language Processing	3	VU	5		5				x	Inf.
Wahl	Knowledge Discovery and Data Mining 2	3	VU	5			5			x	Inf.
Wahl	Secure Product Lifecycle	2	VO	3			3			x	Inf.
Wahl	Secure Product Lifecycle	1	KU	2			2			x	Inf.
Total Module 2.C.3				**min. 11**		**min. 11**					
Total 2.C Specialisation in Human Factors				**42**		**42**					

* Courses offered in the German language

		SSt.	Typ	ECTS	I	II	III	IV	KFU	TUG	Area
2.D Specialisation in Law and Computer Science											
Module 2.D.1: Fundamental Rights and the Data Economy									**KFU**	**TUG**	**Area**
Wahl	Special Topics in Law and Computer Science 1	2	SE/KS	5		5	5		x		Law
Wahl	Special Topics in Law and Computer Science 2	2	SE/KS	5		5	5		x		Law
Wahl	Special Topics in Law and Computer Science 3	2	SE/KS	5		5	5		x		Law
Wahl	Special Topics in Law and Computer Science 4	2	SE/KS	5		5	5		x		Law
Wahl	Special Topics in Law and Computer Science 5*	2	SE/KS	5		5	5		x		Law
Wahl	Special Topics in Law and Computer Science 6*	1	VO	1,5		1,5			x		Law
Total Module 2.D.1						**min. 10**					
Module 2.D.2: Computer Science for Law and Computer Science											
Wahl	Data Analysis and Introduction to R	2	VO	3			3			x	Inf.
Wahl	Data Analysis and Introduction to R	1	UE	2			2			x	Inf.
Wahl	Information Security	2,5	VO	4			4			x	Inf.
Wahl	Information Security	2,5	KU	3			3			x	Inf.
Wahl	Data Structures and Algorithms 1	2	VO	3			3			x	Inf.
Wahl	Data Structures and Algorithms 1	1	UE	1,5			1,5			x	Inf.
Wahl	Machine Learning 1	2	VO	3		3				x	Inf.
Wahl	Machine Learning 1	1	UE	1,5		1,5				x	Inf.
Wahl	Visual Analytics	3	VU	5		5				x	Inf.
Wahl	Knowledge Discovery and Data Mining 2	3	VU	5			5			x	Inf.
Wahl	Recommender Systems	2	VU	3		3				x	Inf.
Wahl	Grundlagen der Artificial Intelligence und Logik*	2	VU	3		3				x	Inf.
Wahl	Information Search and Retrieval	3	VU	5			5			x	Inf.
Wahl	Social Media Technologies	2	VU	3		3				x	Inf.
Wahl	Advanced Information Retrieval	3	VU	5			5			x	Inf.
Wahl	Natural Language Processing	3	VU	5		5				x	Inf.
Wahl	Network Science	3	VU	5			5			x	Inf.
Total Module 2.D.2						**min. 10**					
Module 2.D.3: Law by Design											
Pflicht	Legal Lab 1	2	SE	6		6			x	x	CSS
Pflicht	Legal Lab 2	4	SE	8			8		x	x	CSS
Total Module 2.D.3: Law by Design		**6**		**14**		**6**	**8**				
Total 2.D Specialisation in Law and Computer Science				**42**			**42**				

* Courses offered in the German language

Total all Modules				**30**	**30**	**30**		**KFU**	**TUG**	**Area**
Master's thesis colloquium	1	SE					**2**	x	x	CSS
Master's thesis (Masterarbeit)							**27**			
Master's examination (Masterprüfung)							**1**			
Free electives (Freie Wahlfächer gem. § 9)			**6**							
Total Master Computational Social Systems			**120**	**30**	**30**	**30**	**30**			

(7) In order to achieve a total of 300 ECTS credits for the postgraduate studies, it is not possible to assign one and the same course to the bachelor's degree programme (enabling admission to the master's degree programme) and to the master's degree programme in question. If the compulsory courses for the master's degree programme in question have already been completed in the bachelor's degree programme (enabling admission to the master's degree programme), these must be replaced by other elective courses with a similar scope with the agreement of the officers responsible for study matters.

§ 9 Free-choice subjects

(1) The courses to be taken as part of the free-choice subjects in the Master's Degree Programme in CSS help the students refine their individual focus and support further development. These can be freely chosen from among the courses offered by recognised domestic and foreign universities as well as by recognised post-secondary educational institutions. Annex III contains recommended courses in the free-choice subjects.

(2) If no ECTS credits are assigned to a free-choice course, each semester hour (SSt.) for this course is assigned one ECTS credit. However, if such courses are lectures (VO), they are assigned 1.5 ECTS credits per SSt.

(3) It is possible to recognise additional performance items (up to 6 ECTS credits) in the free-choice subject areas according to § 2 para. 2.

(4)

§ 10 Master's thesis

(1) The master's thesis serves as proof of the student's ability to work independently and correctly on scientific topics regarding the content and methodology. The topic of the master's thesis should be chosen in such a way that it is possible and reasonable for the student to complete the work within six months.

(2) The topic of the master's thesis must be assigned to the chosen specialisation (2.A, 2.B, 2.C or 2.D) according to § 4; thus, it must have an interdisciplinary character. The officers responsible for study matters make decisions regarding exceptions.

(3) The master's thesis topic must be registered with the relevant dean's office with the involvement of the respective officers responsible for study matters before the work begins. Information about the topic, the specialisation to which the topic is assigned, and the supervisor (including detailed information about the institute) must be provided.

(4) All master's theses are supervised by one supervisor from one of the participating universities and a co-supervisor from the other university.

(5) The research concept of the master's thesis must be presented in the seminar "Master's Thesis Colloquium" before the completed thesis is submitted.

(6) 27 ECTS credits are assigned to the master's thesis.

11 Registration requirements for the specialisations and the master's examination before a committee

(1) With reference to the specialisations 2.A through 2.D, the registration requirements for the modules listed in the following table apply in modules 2.A.1, 2.B.1, 2.C.1 and 2.D.1:

Module/ Specialisation:	**The following modules are prerequisite for registration:**	
For module 2.A.1 in the specialisation Business Analytics	1.2	Introduction to Business Analytics for students with computer science background *or* Preliminary studies in business administration according to § 2 para. 3 lit. b
	and	
	1.6	Introduction to Computer Science for students with background in business administration, law, sociology, psychology and comparable fields *or* Preliminary studies in information technology according to § 2 para. 3 lit. a

For module 2.B.1 in the specialisation Societies, Technologies and Social Research	1.3	Introduction to Societies, Technologies and Social Research for students with computer science background *or* Preliminary studies in sociology according to § 2 para. 3 lit. c
	and	
	1.6	Introduction to Computer Science for students with background in business administration, law, sociology, psychology and comparable fields *or* Preliminary studies in information technology according to § 2 para. 3 lit. a

For module 2.C.1 in the specialisation Human Factors	1.4	Introduction to Human Factors for students with computer science background *or* Preliminary studies in psychology according to § 2 para. 3 lit. d
	and	
	1.6	Introduction to Computer Science for students with background in business administration, law, sociology, psychology and comparable fields *or* Preliminary studies in information technology according to § 2 para. 3 lit. a

For module 2.D.1 in the specialisation Law and Computer Science	1.5	Introduction to Law and Computer Science for students with computer science background *or* Preliminary studies in law according to § 2 para. 3 lit. e
	and	
	1.6	Introduction to Computer Science for students with background in business administration, law, sociology, psychology and comparable fields *or* Preliminary studies in information technology according to § 2 para. 3 lit. a

(2) The admission requirement for the master's examination in front of a committee is proof of a positive assessment in all required modules according to § 8, the free-choice subjects, the master's thesis and the master's thesis colloquium.

12 Stays abroad and practical experience

(1) Recommended studies abroad

Students are recommended to complete a stay abroad during the period of their studies. In this master's degree programme, the third and fourth semesters are particularly suitable for these stays abroad.

Furthermore, upon application to the competent officers responsible for study matters, it is also possible for performance items achieved during shorter study stays abroad, such as active participation in international summer or winter schools, to be recognised as part of the free-choice subjects.

(2) Practical experience

Students are recommended to gain practical experience in their field as part of the free-choice subjects.

In this context, 1.5 ECTS credits correspond to each working week in terms of full employment. Active participation in an academic event is also considered as practical experience. This practical experience must be approved by the competent officers of the study matters and must supplement the degree programme in a meaningful way.

IV. Examination regulations and degree

§ 13 Examination regulations

Courses are assessed individually.

(1) For courses held in the form of lectures (VO), the examination covers the entire content of the course. Examinations may be given in oral, written, or the form of an examination paper. A combination of examination methods can be used.

(2) Courses held in the form of lectures with integrated exercises (VU), exercises (UE), design exercises (KU), classes (KS), proseminars (PS) and seminars (SE) are assessed continuously based on the student's contributions and/or by their performance in the accompanying tests. In any case, the assessment must consist of at least two partial performances.

(3) If a module consists of several examinations, the module grade is determined by

a. multiplying the grade assigned to each performed examination associated with the module by the ECTS credits assigned to the corresponding course,
b. adding the values calculated according to lit. a,
c. dividing this sum by the sum of the ECTS credits assigned to the courses and,
d. if necessary, rounding the result of this division to a whole number. Values following the decimal point above 0.5 are rounded up and below 0.5, rounded down.
e. A positive module grade can only be awarded if each individual performed examination has been positively assessed.
f. Courses in which the assessment only confirms successful or unsuccessful participation cannot be included in this calculation according to lit. a to d.

(4) The master's examination is an oral examination held in front of a committee and consists of the

- Presentation of the master's thesis (maximum 25 minutes) and the
- Defence of the master's thesis (examination interview).

As a rule, the total time of the master's examination in front of a committee will be 60 minutes and should not exceed 75 minutes.

(5) The board of examiners consists of the master's thesis supervisor, the co-supervisor from the respective other university and at least one additional member who is nominated by officers responsible for study matters after hearing the candidate and who chairs the committee.

(6) The assessment made by this examination committee is determined by the committee on the basis of the overall impression.

(7)

§ 14 Degree

(1) The master's degree programme is completed once the courses for all required modules according to § 8, the free-choice subjects, the master's thesis, the master's thesis colloquium and the master's examination in front of a committee have received positive assessments.

(2) A degree certificate is issued once the degree programme has been successfully completed. The degree certificate for the Master's Degree Programme in CSS contains

a. a list of all modules listed in § 8 (including ECTS credits) and their assessments,
b. the title and assessment of the master's thesis,
c. the assessment of the master's thesis colloquium,
d. the assessment of the final examination in front of a committee,
e. the total number of ECTS credits assigned to free-choice subjects according to § 9, as well as
f. the overall assessment based on the performance in modules, the master's thesis, the master's examination and the master's thesis colloquium.

V. Entry into force

§ 15 Entry into force

This Curriculum 2021 (UNIGRAZonline and TUGRAZonline abbreviation “2021W”) enters into force on 1st October 2021.

Appendix to the Curriculum for the Master's Degree Programme in Computational Social Systems

Appendix I: Module Descriptions

1 Introduction to Computational Social Systems

Modules 1.1	General Introduction to Computational Social Systems
ECTS credits	15
Contents	• Overview of the subject areas of Computational Social Systems, Business Analytics, Societies, Technologies and Social Research, Human Factors and Law and Computer Science • Overview of methods: Qualitative, quantitative, experimental and literature-based/hermeneutical research • Concepts of social systems and their relevance in relation to informatics technologies and digitalisation • Theoretical foundations of collective behaviour, social influence, emotional expression and structures of social networks • Methods for generating social data and informatics processes used to examine these data • Statistical methods used to test hypotheses about social behaviour and to better understand the behaviour of social systems
Learning objectives	Upon completion of the module, students will be able to: • Provide an explanatory overview of the subject areas of the degree programme. • Describe different research methods. • Fundamentally assess the potentials and limitations of informatics methods for analysing human behaviour. • Operationalise simple research questions on social systems that can be investigated using informatics methods. • Integrate and process social data, then model a small social data project. • Critically assess results and relate them to economic and societal applications.
Teaching and learning activities, methods	• (Teaching) Lectures • Tasks or exercises
Prerequisites for participation	none
Frequency of the module	Each academic year

Modules 1.2	Introduction to Business Analytics for students with computer science background
ECTS credits	12
Contents	Compulsory area: • Basics of business management and the tradition of business management research

	• Fundamental knowledge about business problems, analytical methods and approaches that can be taken to find solutions • Overview of the most important core areas of business administration Free-choice area: • Accounting, Finance, Marketing, Production and Logistics, Management
Learning objectives	Compulsory area: Upon completion of the module, students will be able to: • Explain the basic principles of business management. • Interpret and classify problems from the perspective of business administration. • Define and contrast the core areas of business administration. Free-choice area: Students will be able to do the following after completing the module, depending on the courses chosen: • Analyse and systematically solve simple problems taken from the fields of marketing, accounting, finance, or production and logistics. • Analyse and systematically solve simple management problems.
Teaching and learning activities, methods	• (Teaching) Lectures • Course with assigned tasks
Prerequisites for participation	none
Frequency of the module	Each academic year

Modules 1.3	**Introduction to Societies, Technologies and Social Research for students with computer science background**
ECTS credits	At least 12
Contents	Compulsory area: • Basic approaches and terms of sociology • The social relevance of social research • Procedures and methods of empirical social research • Sociological problems Free-choice area: • Basic features of the social structure of Austrian society as well as its position in the international context; consideration of its historical development and the aspect of globalisation • Social problems faced by contemporary societies • Introduction to univariate, bivariate and multivariate statistical data analysis and the use of statistical software; classification of empirical social research in sociology; linking empirical social research with sociological theories • Core areas and interdependencies of micro-, meso- and macrosociological phenomena as well as new developments in the respective field • Microsociology: focus on single individuals in their immediate social context as well as small social groups; questions about

	the interaction between the individual and society; focus on interpersonal relationships • Mesosociology: sociology of institutions and organisations; covering their internal structure and processes and their interactions with individuals and society • Macrosociology: focus on larger entities, such as societies or cultural groups; theories and empirical studies on phenomena of social change
Learning objectives	Compulsory area: Upon completion of the module, students will be able to: • Describe basic terms and approaches of sociology, as well as to reproduce these in a detailed and differentiated manner. • Describe the process followed to conduct empirical research as well as different research designs theoretically; critically examine the most important methods of empirical social research and link them to concrete questions. • Identify the sociological aspects of a problem and distinguish these from other aspects (e.g. psychological or pedagogical). • Carry out an initial, rough analysis of social problems by using the essential basic principles of sociological thinking. Free-choice area: Students will be able to do the following after completing the module, depending on the courses chosen: • Analyse Austrian society and its social structure, applying international comparisons. • Apply their theoretical and methodological expertise to the diagnosis of social problems. • Apply essential qualitative and quantitative social research methods as well as data evaluation methods to existing social constructs; interpret the results of empirical studies published in the specialist literature and evaluate them with regard to their methodological quality. • Describe basic concepts and fundamental questions of micro-, meso- and macrosociology and provide an overview of the central positions of the three main areas and their representatives. • Reflect on study results and publication contents and apply these reflections to develop their own sociological questions. • Compile content materials with others and subject these contents to critical reflection. • Develop innovative and creative ways of thinking based on sociological ideas and perspectives.
Teaching and learning activities, methods	• (Teaching) Lectures • Oral presentations/speeches • Reading and discussion of specialised texts • Working in small groups • Conducting small studies • Oral presentations of results • Individual study/e-learning • Composing written papers as well as detailed research reports
Prerequisites for participation	Completion of the course “Elementary Data Analysis” is recommended before attending the course “Multivariate Data Analysis”.

Frequency of the module	Each academic year

Modules 1.4	**Introduction to Human Factors for students with computer science background**
ECTS credits	At least 12
Contents	Compulsory area: • Introduction to the core areas of psychology, and in particular human cognitive architecture • Introduction to human factors psychology Free-choice area: • Selected chapters of human factors psychology
Learning objectives	Compulsory area: Upon completion of the module, students will be able to: • Identify core issues in psychology. • Interpret and classify problems from the perspective of human factors psychology. • Define and contrast the core areas of cognitive psychology. Free-choice area: Students will be able to do the following after completing the module, depending on the courses chosen: • Critically evaluate basic research findings in psychology. • Critically evaluate the most important methods of the relevant fields of psychology.
Teaching and learning activities, methods	• (Teaching) Lectures • Practical exercises • Composing written work and oral presentations of results
Prerequisites for participation	none
Frequency of the module	Each academic year

Modules 1.5	Introduction to Law and Computer Science for students with computer science background
ECTS credits	12
Contents	• Basics of normative sciences (ethics, law) as well as basic knowledge of technical standards, analytical methods and approaches taken to find solutions • Overview of the most important normative core areas
Learning objectives	After completing the module, students will be able to: • Enumerate the main features of normative sciences and technical standards. • Interpret and classify problems from the perspective of ethics and law. • Define and contrast the normative core areas. • Distinguish between moral norms, legal norms and technical norms and assign them appropriately.
Teaching and learning activities, methods	• (Teaching) Lectures • Practical exercises • Course with assigned tasks
Prerequisites for participation	none
Frequency of the module	Each academic year

Modules 1.6	Introduction to Computer Science for students with backgrounds in business administration, law, sociology, psychology and comparable fields
ECTS credits	12.5
Contents	• Introduction to the history of computer science, terminology of computer science, software and information systems • Programming methods and basics of problem solving and programme modelling • Basics of programming in Python with a focus on statistics and data processing • Knowledge representations and their use in machine learning • Basics of information retrieval and social recommender systems • Database design and relational algebra. SQL queries and interfaces for application programming • Basics of informatic methods for statistics, use of software to perform simple significance tests
Learning objectives	Upon completion of the module, students will be able to: • Solve simple mathematical and practical problems using programming languages. • Use information technology terms and work in a safe computer environment. • Explain data science and artificial intelligence and name machine learning methods in an overview. • Explain how database systems work and use this knowledge to store and access structured data. • Request and integrate data from different structured data sources.

	• Create simple programmes that perform statistical analyses using informatics methods.
Teaching and learning activities, methods	• (Teaching) Lectures • Practical exercises
Prerequisites for participation	none
Frequency of the module	Each academic year

Modules 1.7	**Joint module Computational Social Systems**
ECTS credits	15
Contents	• Basics of the representation of human behaviour and social interaction in computer models • Aggregated social dynamics and their calibration with empirical data • Basic concepts of social network dynamics • Concepts of dynamic systems applied to models of social interaction • Mathematical methods in data mining • Knowledge acquisition process • Classification and grouping of text • Semantic analysis of text documents • Recommender systems • Basic legal framework for the use of information and communication technology • Selected case law in data protection law, e-commerce law, copyright law, media law and computer criminal law, as well as internet governance • Basics on the topic of fundamental rights and the Internet • Basics on the following topics: factors of inclusion and exclusion in the digital world, social inequality regarding access to and use of digital technologies, questions of the gender gap and diversity, as well as concrete ethical problems faced when dealing with, evaluating, or interpreting digital data
Learning objectives	Upon completion of the module, students will be able to: • Implement simple aspects of social theory and behavioural theory in algorithms. • Convert individual aspects of human behaviour into informatics models in Python. • Mathematically analyse model dynamics and visualise these behaviours. • Explain the mathematical foundations of data mining algorithms. • Reflect on the necessary steps in the knowledge acquisition process. • Name data mining algorithms. • Set up a simple knowledge generation project. • Apply basic legal knowledge to the lawful use of information and communication technology. • Apply the acquired legal knowledge to comparable practical

	cases. • Fundamentally discuss central questions of inclusion and exclusion in the digital world. • Reflect on issues of gender and diversity and develop a sensitivity for solving ethical problems when dealing with, evaluating, or interpreting digital data.
Teaching and learning activities, methods	• (Teaching) Lectures • Oral presentations/speeches • Practical exercises
Prerequisites for participation	none
Frequency of the module	Each academic year

2. Specialisations

2.A Specialisation in Business Analytics

Modules 2.A.1	**Business Analytics**
ECTS credits	12
Contents	• Theories and technologies for data-based business models • Process models for the creation of data-based business models • Research methods from the field of business analytics • Research methods from the field of Data Science • Theories and technologies of interactive systems • Software development of interactive systems
Learning objectives	Upon completion of the module, students will be able to: • Select and apply appropriate methods for the conceptualisation and implementation of data-based business models. • Set up a research design for a business analytics or data science problem. • Select appropriate methods for the design and implementation of interactive systems. • Implement simple prototypical solutions to address business analytics issues. • Assess the quality of business analytics solutions and evaluate them personally if necessary.
Teaching and learning activities, methods	• Proseminars with written assignments, group work and discussions

Prerequisites for participation	Registration requirements see § 11
Frequency of the module	Each academic year

Modules 2.A.2	**Elective Module Business Analytics**
ECTS credits	At least 12
Contents	Free-choice area: • Concepts, technologies and application of data-based decision support systems • Concepts, technologies and application of business intelligence • Concepts, technologies and application of data science from a business perspective • Concepts and technologies for big data management • Contents of a special business administration
Learning objectives	Students will be able to do the following after completing the module, depending on the courses chosen: • Plan the creation of data-based decision support systems to address business management problems and select appropriate technologies. • Set up a business intelligence concept to address business management problems. • Create a data management concept to address a business problem and select appropriate technologies. • Implement simple prototype solutions for data management and decision support systems. • Apply and implement theories and concepts to solve real problems in the subject area of an SBWL.
Teaching and learning activities, methods	• Proseminars with written assignments, group work and discussions
Prerequisites for participation	none
Frequency of the module	Each academic year

Modules 2.A.3	**Computer Science for Business Analytics**
ECTS credits	At least 11
Contents	Free-choice area: • Statistical analyses: basics and implementation with real data; collection and processing of unstructured data on social interactions and behaviour • Basic concepts of machine learning and the use of machine learning in data analysis, text processing and data collection • Theoretical and practical foundations of recommender systems; methods used to visualise data and present findings based on data on social interactions and human behaviour • Modelling social systems, social interaction, decision-making and social systems structures • Technologies and interfaces for collecting data and measuring social interactions and human behaviour • Data processing and collection from socio-technical systems • Interfaces and systems for interacting with people
Learning objectives	Students will be able to do the following after completing the module, depending on the courses chosen:

	• Analyse data sets and test hypotheses using statistical methods. • Independently compile data sets from different social data sources. • Process unstructured data using machine learning to quantify relevant variables of human behaviour. • Understand recommender systems and deal competently with information overload. • Communicate knowledge extracted from social and behavioural data. • Identify relevant technologies used to measure human behaviour, analyse data on social interactions and behaviours, and technologies applied to interact with people.
Teaching and learning activities, methods	• (Teaching) Lectures • Practical exercises
Prerequisites for participation	none
Frequency of the module	Each academic year

2.B Specialisation in Societies, Technologies and Social Research

Modules 2.B.1	**Societies, Technologies and Social Research**
ECTS credits	10
Contents	The research seminar covers: • Examples of how to apply the methodological and content-related knowledge learnt so far. • How to jointly develop all phases of an empirical research project, which will be carried out independently by the students. • An in-depth interdisciplinary examination of a specific subject area. Culture, social change, technology covers: • The terms, concepts, models and theories associated with "culture", "social change" and "technology". • An analysis of how culture(s) and technology relate to one another and the role of new technologies in modernisation processes. • The cultural patterns of interpretation of technology/progress/social change. • The optimism regarding progress and criticism of civilisation.
Learning objectives	After completing the module, students will be able to: • Absorb and critically question the current literature and theory on the relationship between "culture", "social change" and "technology". • Comprehend the results of studies published in the specialist literature and evaluate these with regard to their methodological quality, as well as work on conceptualising empirical studies based on these results. • Conduct an empirical research project from the point of developing a research question to presenting the results in a small group.

	• Apply different qualitative and/or quantitative research methods. • Present research results according to scientific standards. • Work on complex tasks in small groups.
Teaching and learning activities, methods	• Courses with work assignments
Prerequisites for participation	Registration requirements, see § 11
Frequency of the module	Each academic year

Modules 2.B.2	**Digital Societies: Theories, Methods and Critical Reflections**
ECTS credits	At least 12
Contents	Free-choice area: • Central concepts of the sociology of science and technology • Analysis of and reflection on social and technological change • Science and technology as social institutions and social practical experience • The social constitution of scientific knowledge and technical artefacts • The increasingly interconnected nature of science and technology with other social systems, such as the economy, politics and the media • Philosophical and socio-political perspectives of modern information technologies and their applications • Technologies for personal measurement and optimisation of the body from a philosophical and sociological perspective • Historical development of feminist theory and the theory of gender as an analytical category in the social sciences • Key sociological areas, such as family, physicality and sexuality, culture, education, work and institutions, and politics from a gender perspective • Selected fields of sociology and current sociological theories and models • Advanced quantitative methods of sociology: linear regression: variable transformations and third variable effects (confounding effects, interaction); logistic regression; cluster analysis, correspondence analysis • Advanced qualitative methods of sociology: basic concepts, procedures and results of social network analysis; visual representation of networks; theoretical implications of the network concept for the study of social life
Learning objectives	Students will be able to do the following after completing the module, depending on the courses chosen: • Understand social aspects of technology and science and deal with them as sociological questions. • Present an overview of the most important approaches taken in the sociology of science and technology and apply these to current problems. • Develop a deeper understanding of the current literature in data science and place this in context with the subject-related study content. • Apply advanced quantitative and qualitative methods in specific

	projects. • Independently absorb and critically question the current literature in the sociology of science and technology and independently collect further literature. • Critically reflect on the pursuit of self-optimisation, analyse its normative implications and interpret it against the background of philosophical and social science theories. • Apply gender perspectives to the field of social phenomena. • Critically discuss current sociological theories and models.
Teaching and learning activities, methods	• (Teaching) lectures • Oral presentations/speeches • Reading and discussion of specialised texts • Working in small groups • Conducting small studies • Oral presentations of results • Self-study/e-learning • Composing written papers as well as detailed research reports
Prerequisites for participation	none
Frequency of the module	Each academic year

Modules 2.B.3	**Computer Science for Societies, Technologies and Social Research**
ECTS credits	At least 11
Contents	Free-choice area: • Basics of statistical analysis and how to conduct analyses with "real" data sets • Retrieval and processing of unstructured social and behavioural data • Basic machine learning concepts and implementation of machine learning methods for data analysis, including text processing and data mining. • Theoretical and practical principles of social recommender systems • Methods for data visualisation and presentation of findings based on social and behavioural data Regarding data-generating technologies: • Modelling social systems, including social interaction, decision-making and social network structures • Measurement technologies and interfaces for capturing human behaviour and social interaction • Data processing and retrieval of existing data in computer-based social systems; interface and interactive system design for interactions with individuals
Learning objectives	Students will be able to do the following after completing the module, depending on the courses chosen: • Generate their own data sets from various social data sources. • Process unstructured data using machine learning methods to quantify relevant variables related to human behaviour. • Develop a basic understanding of the use of recommender systems and technologies to cope with information overload.

	• Comprehend the results of studies published in the literature and evaluate these with regard to their methodological quality.
Teaching and learning activities, methods	• (Teaching) Lectures • Practical exercises
Prerequisites for participation	none
Frequency of the module	Each academic year

2.C Specialisation in Human Factors

Modules 2.C.1	**Human Factors Basics**
ECTS credits	10
Contents	• Selected chapters of cognitive psychology • Methods and technologies used to design and develop interactive computer systems • Current topics in decision research, findings from behavioural and neuroscientific studies
Learning objectives	After completing the module, students will be able to: • Name core topics of cognitive psychology and provide an overview of the current state of theories, models and methods. • Set up a research design for decision research. • Explain and discuss activity theory in the context of HCI (Human Computer Interfaces). • Understand and apply contextual design methods and design and develop innovative interactive systems against this background.
Teaching and learning activities, methods	• Introductory and supplementary teaching lectures • Oral presentations of the work progress • Composing written reports • Group work on selected topics • Presentation of (team) results
Prerequisites for participation	Registration requirements, see § 11
Frequency of the module	Each academic year

Modules 2.C.2	**Psychology for Human Factors**
ECTS credits	At least 11
Contents	Compulsory area: • Empirical seminar: Extensive empirical work in the PSYLAB on a psychological question Free-choice area: • Modelling complex systems: modelling complex psychological system dynamics with the computer • Selected topics in robotics: e.g. historical background of artificial life, the Turing machine, pattern-forming processes, multi-agent systems, evaluation of robotics experiments • Quantitative research methods: mathematical methods of modelling trajectories in complex environments • Selected subject areas of human factors psychology

Learning objectives	Students will be able to do the following after completing the module, depending on the courses chosen: • Conduct an empirical study in the psychology of human factors. • Apply the principles of artificial life and robotics. • Assess the effect of behavioural feedback and understand how adaptation processes work. • Name essential aspects about complex systems in nature and how they can be modelled, as well as explain optimisation procedures based on natural phenomena. • Reflect on test and item construction at an advanced level. • Effectively use the acquired knowledge to study the psychology of human factors, e.g. to design and evaluate a neurofeedback-based intervention. • Critically reflect on the most important theories and empirical findings learnt and assess their scientific and practical significance.
Teaching and learning activities, methods	• (Teaching) Lectures • Practical exercises • Group work on selected topics • Presentation of (team) results
Prerequisites for participation	none
Frequency of the module	Each academic year

Modules 2.C.3	**Computer Science for Human Factors**
ECTS credits	At least 11
Contents	Elective area: • Introduction to human-computer interaction, with a focus on user interface design and usability engineering methods • Concepts on interfaces for human-machine interaction. The user interface as an extension of human capabilities, considering the theory of human perception and action, visual, auditory, olfactory, haptic user interfaces • Introduction to the topics of human-aware interaction; concepts and principles of interfaces using machine intelligence • Methods and techniques used in the design and implementation of wearable computing devices • Design of visual user interfaces for data analysis; techniques for visual analysis of temporal, multidimensional, textual and network data • Methods and skills required for game development; creation of 3D objects and environments and the basics of game design • Concepts and statistical methods using the programming language R • General introduction to brain signals (electrical, magnetic, metabolic) and measurement methods (invasive and non-invasive), experimental strategies, hardware, visualisation, real-time processing and signal processing (parameter extraction, classification, optimisation), applications and functional brain research • Overview of selected theories and the practical application of

	information search and retrieval • Concepts and methods from the field of machine learning • Concepts and methods from the field of network science, function and structure of complex networks, routing function in complex networks, decentralised search, epidemics in complex networks, information dissemination models • The subject area of text analysis with a focus on written text; presentation of algorithms that enable structured information to be extracted from unstructured, textual resources • Overview of all elements of a safe product life cycle and in-depth coverage of selected topics
Learning objectives	Students will be able to do the following after completing the module, depending on the courses chosen: • Reproduce the theory of human-computer interaction, design usable interfaces and perform heuristic evaluations and thinking aloud tests of user interfaces. • Design and develop the hardware, software drivers and prototype of a user interface. • Design and implement visualisations and visual analysis systems. • Design and implement wearable computing devices that incorporate some form of data processing as well as sensing and/or feedback. • Explain methods of game design and development. • Name basic methods of functional brain research. • Apply concepts and techniques in the field of cognitive neuroscience. • Conduct analyses of real data problems, applying statistical techniques that enable the evaluation and inferential interpretation of individual effects. • Explain and apply the following concepts: (1) the basic model of modern information retrieval, (2) the processing chain from text documents to the search index, (3) the performance characteristics, (4) the architecture of web search services, and (5) how to conduct literature reviews on selected topics as part of information retrieval. • Apply the most important machine learning methods to practical problems. • Explain and contrast the relationship between the function and structure of complex networks and the common scientific methods in the science of networks. • Explain areas such as automatic analysis of text, the general understanding of natural language text and the application areas of natural language processing. • Reflect on the concept and importance of a safe product life cycle.
Teaching and learning activities, methods	• (Teaching) Lectures • Practical exercises
Prerequisites for participation	none
Frequency of the module	Each academic year

2.D Specialisation in Law and Computer Science

Modules 2.D.1	Fundamental Rights and the Data Economy
ECTS credits	Min. 10
Contents	• Theories of fundamental and human rights • Conventions and legal acts (especially ECHR and GRC) • Basics of the application of human and fundamental rights in specific IT matters • Case law on fundamental and human rights (ECJ and ECtHR) • Artificial intelligence and discrimination • Data protection • Fundamentals of the Digital Single Market • Data markets and the antitrust law • Intellectual property • Other relevant law courses
Learning objectives	Students will be able to do the following after completing the module, depending on the courses chosen: • Understand and distinguish the concept of fundamental and human rights. • Name the legal foundations of fundamental and human rights as well as the decisions made in the IT context by the ECJ and the ECtHR. • Apply fundamental and human rights in specific scenarios. • Examine and describe the data protection requirements for a system. • Assess the importance of an IT product in the digital single market. • Identify the factors of an IT product that are relevant for liability. • Apply the relevant norms from antitrust, liability and licensing laws under justifiable consideration of fundamental rights interests.
Teaching and learning activities, methods	• (Teaching) Lectures • Seminars with written seminar papers, group work, discussion • Courses with work assignments
Prerequisites for participation	Registration requirements, see § 11
Frequency of the module	Each academic year

Modules 2.D.2	Computer Science for Law and Computer Science
ECTS credits	At least 10
Contents	Elective area: • Major in the field of computer science with a focus on the analysis of datasets and their application in data-driven applications • Theories and fundamentals in the areas of algorithms, data analysis, machine learning as well as central topics of information security • Application-oriented courses on different aspects of information systems
Learning objectives	Students will be able to do the following after completing the module, depending on the courses chosen: • Analyse the basic algorithms, their assumptions, prerequisites

	and behaviour. • Reflect on fundamental aspects of data analysis, consisting of statistical methods, machine learning methods and visual methods. • Identify suitable methods for analysing existing data and data sources and apply these in practical scenarios. • Reflect on search and recommendation technologies and assess their implications for existing use cases. • Analyse complex network structures. • Process user-generated data and analyse social media. • Identify appropriate methods for textual data sources and apply them.
Teaching and learning activities, methods	• (Teaching) Lectures • Practical exercises
Prerequisites for participation	none
Frequency of the module	Each academic year

Module 2.D.3	**Law by Design**
ECTS credits	14
Contents	• Deepening and applying the methodologies in computer science and law • Interdisciplinary application of IT legal standards in the form of legal prototyping in micro-projects
Learning objectives	After completing the module, students will be able to: • Apply and implement theories and concepts of computer science and apply the law to real problems in micro-projects. • Implement the legal requirements for an IT system in the system in interdisciplinary micro-projects (law/computational science). • Implement legal requirements for specific IT systems by applying simple prototypical solutions. • Assess the compliance of IT products and evaluate them personally if necessary.
Teaching and learning activities, methods	• Interdisciplinary seminars with written group work and discussions ("Legal Labs")
Prerequisites for participation	none
Frequency of the module	Each academic year

Appendix II: Sample curriculum

The following sample curriculum (example for preliminary studies in computer science and a specialisation in business analytics) is not a compulsory semester assignment, but merely serves as a recommendation and an orientation for students.

1. Semester	Modul	Lehrveranstaltung	SSt.	Typ	ECTS	KFU	TUG
	1.1	Introduction to Computational Social Systems	2	VU	5	x	x
	1.1	Foundations of Computational Social Systems	2	VU	5		x
	1.1	Research Design	2	VO	5	x	
	1.2	Introduction to Business Administration for Computer Scientists	2	KS	4	x	
	1.2	z.B. Masterkurs Finance	2	VO	4	x	
	1.2	z.B. Masterkurs Marketing	2	VO	4	x	
	1.7	Introduction to IT Law	2	VO	3	x	
1. Semester Summe			14		30		
2. Semester							
	1.7	Computational Modeling of Social Systems	3	VU	4,5		x
	1.7	Knowledge Discovery and Data Mining 1	2	VO	3		x
	1.7	Knowledge Discovery and Data Mining 1	1	KU	1,5		x
	2.A.1	Data-Driven Business Model Seminar	2	PS	4	x	x
	2.A.2	z.B. Business Intelligence and Analytics	2	PS	4	x	
	2.A.2	z.B. Data-Driven Decision Support	2	PS	4	x	
	2.A.3	z.B. Machine Learning 1	2	VO	3		x
	2.A.3	z.B. Visual Analytics	3	VU	5		x
2. Semester Summe			17		29		
3. Semester							
	1.7	Social Aspects of Digital Technologies: Gender, Diversity and Research Ethics	2	VU	3	x	
	2.A.1	Data Science in Business 1	2	PS	4	x	x
	2.A.1	Data Science in Business 2	2	PS	4	x	x
	2.A.2	z.B. Data Management for Business Analytics	2	PS	4	x	
	2.A.3	z.B. Network Science	3	VU	5		x
	2.A.3	z.B. Introduction to International Entrepreneurship	3	VU	5		x
		Freie Wahlfächer			6	x	x
3. Semester Summe					31		
4. Semester							
		Master’s thesis (Masterarbeit)			27		
		Master's thesis colloquium		SE	2		
		Master’s examination (Masterprüfung)			1		
4. Semester Summe			1		30		
Summe ECTS gesamt					120		

Appendix III: Recommended courses for the free-choice subjects

Free-choice subjects can be freely chosen from among the courses offered by recognised domestic and foreign universities as well as recognised domestic and foreign post-secondary educational institutions in accordance with § 9 of this curriculum.

To broaden the knowledge acquired in the modules of this degree programme, students are recommended to take courses from the areas of foreign languages, the TIMEGATE offer, social competence, technology assessment as well as women's and gender studies. In particular, students are encouraged to take advantage of offers from the Service Department of Languages, Key Competences and In-house Training at TU Graz, from the Science, Technology and Society Unit (STS Unit) at TU Graz, or from Treffpunkt Sprachen as well as the Centre for Social Competence at the University of Graz.