Jaar 1, semester I			
Vakcode	**Vaknaam**	**Beoogde leeruitkomsten**	**Wijze van toetsen**
LIX012P05	Inleiding Informatiekunde	1. Onderwerpen die onder het vakgebied Informatiekunde vallen te benoemen en in globale termen uit te leggen wat de wetenschappelijke en maatschappelijke vragen zijn die deze onderwerpen oproepen (1.1-4 kennis en inzicht , 3.1. oordeelsvorming) 2. Wetenschappelijke literatuur te zoeken en te raadplegen over een Informatiekunde-onderwerp met behulp van Smartcat (UB) en Google Scholar. (5.1. leervaardigheden, 3.1. oordeelsvorming) 3. Een eenvoudig wetenschappelijk verslag over een onderwerp in de Informatiekunde te schrijven (incl. onderzoeksvraag, motivering, methode en resultaten, discussie, en literatuurverwijzingen). (2.1. toepassing, 4.1 communicatie) 4. Kennis over de belangrijkste begrippen van het vakgebied Informatiekunde te reproduceren. (1.1 kennis en inzicht) 5. De opmaaktaal Latex (en het platform overleaf) te gebruiken voor het schrijven van een verslag. (4.1. communicatie)	weekly assignments, 1 short and 1 large report; multiple choice exam
LIX021P05	Inleiding Programmeren I	1. describe, define, and illustrate fundamental computer science and programming concepts accurately, while making use of the appropriate computer science and programming terminology (1.3); 2. identify and describe different programming paradigms correctly (1.3, 5.1); 3. solve small-scale problems involving numeric and textual data and design effective and efficient algorithms for them (2.1, 5.1); 4. read, understand program code, in particular Linux command sequences and Python code, and add succinct complementary descriptions and comments in natural language to it, in order to clarify the code, when code is not readable by itself (2.1, 2.5, 4.1, 5.1); 5. design and write bug-free, and readable program code in Linux and / or Python, that complies with programming style guidelines, and is the result of applying correctly fundamental design techniques, structuring techniques and control structures (2.1).	weekly assignments (testing 3, 4, 5); final exam (testing 1, 2, 3, 4).
LCX009P05	Digital Communication	1. Identify how information is processed by computers and transmitted via the internet (1.1) 2. Identify how information is grounded between humans in face-to-face interaction (1.1) 3. Identify how information is grounded between humans in mediated interaction (1.1) 4. Identify how information is exchanged between users and conversational agents (1.1) 5. Identify how information is exchanged between users and interfaces (1.1) 6. Explain how the language of computers (code) differs from language spoken by humans (natural language) (1.2) 7. Use Reddy's (1969) notion of the "conduit metaphor" to explain why human-human interaction is not simple information transmission (2.1) 8. Apply Clark's theory of grounding to the analysis of face-to-face and mediated interaction and to interaction with dialogue agents (2.1) 9. Apply Pariser's notion of filter bubbles and social algorithms to identify how social media platforms inhibit and promote the propagation of information in social media platforms (2.1)	exam containing multiple-choice and open-ended questions.

		10. Apply Bailenson's theory of Presence and Transformed Social Interaction to the analysis of interactions in virtual media. (2.1) 11. Use Clark and Brennan's (1991) concepts of Grounding constraints and grounding costs to evaluate the efficacy and suitability of different forms of mediated interaction (2.2) 12. Apply Norman's interaction design heuristics to evaluate the usability of simple technologies and make design recommendations (2.2, 3.1)	
LIX005P05	Tekstmanipulatie	1. Work with the Linux/Unix operating system. They will be able to edit text files at a basic level in order to: - create glossaries and sorted frequency lists of single words as well as word pairs and word sequences - search in text files using regular expressions - manipulate text files (by deleting/replacing letters and/or words) 2. Work with Unix pipes to connect commands to each other. 3. Work with XML files. They will acquire knowledge of XML and XML applications and will be able to use XSLT for converting XML documents. (1.3, 2.5, 5.1)	weekly assignments and final exam
LIX022P05	Inleiding Programmeren II	Course specific: 1. Advanced knowledge and deeper insight into general programming concepts and techniques that occur in computer science. 2. Solving problems of varying complexity, in particular with regard to language, text and communication. 3. Setting up clear algorithms to solve linguistic and textual problems of limited size. 4. Modular design and implementation of moderately complex computer programs. 5. Advanced Python programming knowledge and skills. Generic: 1. Problem solving, logical, and analytical thinking. 2. Responsible and efficient use of ICT (including the Unix operating system) as a study and communication tool. 3. Independent study of literature. 4. Handing in assignments on time. 5. Independent planning and execution of study activities. (1.3, 2.1, 2.5, 4.2, 5.1)	Programming assignments (weekly) Final exam (multiple-choice + open questions)
LCX014P05	Taaloptimalisatie	1. describe basic concepts from the descriptive grammar(s) of English (and of Dutch, in the Dutch track) (CIS 1.1; IS 1.1) 2. describe basic concepts from subdisciplines within linguistic theory (morphology, semantics, syntax) (CIS 1.1; IS 1.1) 3. describe linguistic structures (words, phrases and sentences) by using basic analytical procedures from linguistic theory (CIS 1.2, 2.3, 3.2; IS 1.2, 2.2, 2.4, 3.3) 4. describe forms and effects of language use by applying basic concepts from descriptive grammar and linguistic theory CIS 1.2, 2.3, 3.2; IS 1.2, 2.2, 2.4, 3.3)	Written exam
Jaar 1, semester II			

Vakcode	Vaknaam	Beoogde leeruitkomsten	Wijze van toetsen
LIX019P05	Webtechnologie	1. Develop static webpages using HTML and CSS (1.1, 1.2, 1.3, 1.5, 2.1, 3.3, 5.1, 5.2). 2. Develop simple interactive webpages using JavaScript and jQuery (1.3, 1.5, 2.1, 3.3, 5.1, 5.2). 3. Understand and apply renowned usability heuristics (1.2, 1.4, 3.3). 4. Evaluate a user interface using common User Interface Evaluation techniques (1.4, 2.1, 3.3). 5. Understand the basic techniques behind the world wide web (2.1, 3.3). 6. Gain experience in common software development practices (1.3, 2.1, 2.5, 3.3). 7. Understand how webpages and usability techniques are used in real-world applications (1.2, 2.6, 3.3). 8. Reflect on the development of a website and report on this in a scientific way (4.1, 4.2, 4.3).	- 4 Weekly Assignments - Final Project
LIX016P05	Gevorderd Programmeren	1. Kennis en begrip van gevorderde programmeerbegrippen en -technieken (1.3). 2. Vermogen om verworven kennis, begrip en vaardigheden toe te passen bij het zelfstandig en in een groep ontwikkelen van programma's in Python voor een probleem dat gerelateerd is aan taal en communicatie (2.1) 3. Vaardigheden om effectief gebruik te maken van algemene ICT-applicaties en van een versiebeheersysteem (2.5) 4. Vaardigheden die verband houden met persoonlijke verantwoordelijkheid, zelfdiscipline, creativiteit, eigen initiatief e.d. (2.6) 5. Vermogen om kritisch te reflecteren op oplossingen voor taal- en communicatieproblemen (3.1) 6. Vermogen om kennis, inzicht en vaardigheden te gebruiken bij het kiezen van de juiste datastructuren en algoritmen voor een taal- of communicatiegerelateerd probleem (3.3) 7. Vermogen om een demonstratie en presentatie te geven van ontwikkelde programma's (4.1) 8. Vermogen om volledige documentatie te geven bij ontwikkelde programma's (4.2) 9. Vermogen om zelfstandig zich nieuwe programmeertalen en -technieken eigen te maken (5.1)	- wekelijkse opdrachten - groepsopdracht - tentamen
LIX024P05	Inleiding Wetenschappelijk Onderzoek	1. Knowledge and understanding of the scientific process (1.4) 2. Knowledge of how to formulate and operationalize a research question (1.4) 3. Carry out a literature review (2.4); 4. Ability to carry out a small research study in information science (2.2; 2.6; 4.1; 4.3) 5. Understand and explain the importance of replicability and ethics in research (3.1)	- 5 weekly assignments (pass/fail) - individual final project - written exam (multiple choice; true/false + open questions)
LIX018P05	Webprogrammeren	1. Develop interactive webpages using PHP, JavaScript, HTML and CSS (1.1, 1.2, 1.3, 1.4, 1.5, 2.1, 3.3, 5.1, 5.2). 2. Use jQuery, AJAX, JSON and templating to achieve faster, more efficient and more robust development of interactive webpages (1.3, 1.5, 2.1, 3.3, 5.1, 5.2). 3. Apply experience with a virtual Apache server, using FTP and employing relevant software development tools (1.3, 1.5, 2.1, 2.5, 3.3, 5.1, 5.2). 4. Gain experience in common software development practices (1.3, 2.1, 2.5, 3.3). 5. Understand how interactive websites and -apps are used in real-world cases (1.2, 2.6, 3.3).	- 3 Weekly Assignments - Group Project

Vakcode	Vaknaam	Beoogde leeruitkomsten	Wijze van toetsen
		6. Cooperate with others in software development projects (2.1, 2.5, 2.6). 7. Propose for and reflect on the development of a software application and present this in a scientific way (4.1, 4.2, 4.3).	
LIX017P05	Project Tekstanalyse	The student who masters the theory and techniques given in this course will be able to process language data with NLTK, from simple actions like tokenisation, to more complex ones like sense tagging against the WordNet database or Named Entity Recognition, possibly importing external taggers. The student will be able to understand, perform, and evaluate data annotation, and set up a project involving data creation and processing from scratch. The final project worked in groups will also equip the student with some competences in teamwork, and in designing and running a larger scale NLP system, partially using off-the-shelf tools. The student will also be aware of current issues in text processing. (1.3, 1.5, 2.1, 2.2, 2.5, 2.6, 3.1, 4.2, 5.1)	- weekly assignments in groups - final project + presentation (in groups)
LIX025P05	Annotation for Machine Learning	Upon successful completion of the course unit, students are able to define an annotation goal for a given NLP task (1.1), how to collect a dataset(1.5), define an annotation model (1.3, 2.2), carry out actual annotation (2.3), evaluate and adjudicate the annotations (3.1, 3.2), create a gold standard corpus (2.3), perform a variety of statistical analytics over the corpus, set up a machine learning (ML) experiment, train ML algorithms on the dataset by selecting effective features drawn from the annotations (1.3, 1.4, 2.5), evaluate the learned ML models and compare their evaluation results (1.4, 3.1, 5.1), come up with a (strong) baseline model for the initial NLP task (1.3). The students will know steps for building an annotated natural language dataset (aka corpus) for automatically learning a particular task (1.5, 5.3).	- 3-4 weekly assignments - final exam

Jaar 2, semester I			
Vakcode	Vaknaam	Beoogde leeruitkomsten	Wijze van toetsen
LIX022B05	Databases	Upon successful completion of the course unit, students are able to 1. Knowledge and understanding of the theory and practice of digital data storage, data treatment and analysis (1.1) 2. Knowledge and application of the E-R Model, design and implement relational databases (1.3, 1.4, 2.1, 2.3, 4.1) 3. Knowledge and use of SQL for queries and data manipulation (1.3, 2.5, 5.1) 4. Understanding and application of Functional Dependencies and Normalization (1.1, 2.1, 2.3) 5. Become familiar with non-relational database management systems (NoSQL) (1.1, 5.1)	- 2/3 individual assignments - final project (group) - written exam (exercises)
LIX019B05	Zoekmachines	At the end of the course, students will be able to critically understand and compare search engines, and key components of search engines. They will be able to experiment with important algorithms and compute with relevant formulas, using real data and concrete but small-scale programs written in Python. Special attention is placed on the complexity of algorithms (and Python programs), by considering very large data sets.	Wekelijkse opdrachten en schriftelijk tentamen

		Key algorithms and formulas that students will be able to understand, implement, and use with real data are: - boolean retrieval, posting lists, efficient intersection of ordered lists - decoding, tokenization and normalization; sub-linear posting list intersection; phrase queries - dictionaries, wildcard queries, spell correction, Levenshtein distance - scoring and term-weighting, tf-idf, vector space models - evaluation of search engines (f-score), annotater agreement (kappa) - page rank (1.1, 1.3, 1.4, 2.2, 2.4, 2.5, 3.1, 3.3)	
LIX030B05	Introduction to Neural Networks	1) Describe the workings of simple linear classifiers, feed-forward neural networks, and simple recurrent NNs, in their own words and by means of the appropriate mathematical formulas (1.1); 2) Describe the workings of basic NN training techniques (such as stochastic gradient descent) (1.1); 3) Implement, train and test simple NN models of various kinds using a Python-based deep learning framework (e.g. PyTorch) (2.2, 2.3, 2.5); 4) Explain the conceptual differences between the abovementioned models and more advanced NN architectures (such as LSTMs) (1.1, 1.2); 5) Choose the right (family of) NN architectures to solve a given text classification problem 2.1, 2.2, 3.1); 6) Explain the implications/ strengths/drawbacks of using deep learning versus other machine learning techniques in the context of NLP (3.1, 5.1, 5.2).	- Practical assignments (bi-weekly) - Mid-term multiple-choice test - Final written exam (multiple-choice + open questions)
LIX021B05	Database-driven Webtechnology	1. Develop interactive server-side web applications with a relational database back end (1.1, 1.2, 1.3, 1.5, 2.1, 3.3, 5.1, 5.2). 2. Develop a relational database for a real-world application (1.2, 1.3, 1.5, 2.1, 2.5). 3. Understand what happens behind the browser in a web-based application (2.1). 4. Identify and avoid potential security problems in web-based applications (2.1, 3.3). 5. Be familiar with performance issues for large scale web-based applications (2.1, 3.3). 6. Gain experience in common software development practices (1.3, 2.1, 2.5, 2.6). 7. Cooperate with others in software development projects (2.1, 2.5, 2.6). 8. Propose for and reflect on the development of a software application and report on this in a scientific way (2.3, 4.1, 4.2, 4.3).	- 3 Weekly Assignments - Group Project
LIX003B05	Logisch Programmeren	Na afronding van deze module is de student vertrouwd met de basisterminologie en datastructuren van logisch programmeren en kan deze ook op de juiste manier toepassen. De student is bekend met typische technieken van logisch programmeren zoals unificatie, recursie en backtracking. De student is verder bekend met zoekstrategieën en is in staat deze te optimaliseren. De student kan (eenvoudige) Prolog programma's analyseren en op juistheid controleren en kan zelf ook (kleine) Prolog programma's schrijven voor niet-triviale problemen (bijvoorbeeld logische puzzels). (1.3, 2.1, 4.2, 5.1)	Final written exam

Vakcode	Vaknaam	Beoogde leeruitkomsten	Wijze van toetsen
LIX029B05	Conversational Interfaces	(1) aware of the history and the state-of-the-art of conversational interfaces (1.4); (2) able to create a chatbot or spoken dialogue systems for certain applications (1.3, 2.1, 5.1); (3) capable of connecting speech-based interfaces to language technology applications (1.2, 1.5); (4) informed about the linguistic theory behind conversation (1.1); (5) equipped with a critical view of the capabilities and limitations of current conversational agents (1.4, 2.2, 3.1, 3.2, 3.3).	Weekly assignments and final exam

Jaar 2, semester II			
Vakcode	**Vaknaam**	**Beoogde leeruitkomsten**	**Wijze van toetsen**
LIX001X05	Statistiek I	1. Basisbegrippen van de beschrijvende en inferentiële statistiek begrijpen zodanig dat deze kunnen worden toegepast. De student weet onder andere wat p-waardes zijn, wat hypothese toetsen inhoudt, wat z-scores zijn, en hoe data gevisualiseerd kan worden. (Eindkwalificaties IK: 1.4, 3.3, 5.3) 2. Diverse statistische methoden (o.a. z-toets, t-toets, chi-kwadraat toets, Mann-Whitney toets en Wilcoxon rangtekentoets, correlatie en Cronbach's α) begrijpen zodanig dat deze kunnen worden toegepast. (Eindkwalificaties IK: 1.4, 3.3, 5.3) 3. Diverse statistische methoden (o.a. z-toets, t-toets, chi-kwadraat toets, Mann-Whitney toets en Wilcoxon rangtekentoets) toepassen op bestaande data verzamelingen. (Eindkwalificaties IK: 3.3, 5.3) 4. De resultaten van deze statistische methoden en technieken volledig en correct rapporteren. Deze rapportage dient de volgende elementen te bevatten: de onderzoeksvraag, de nulhypothese en alternatieve hypothese, het significantieniveau, de keuze en verantwoording van de statistische toets, de resultaten van de statistische toets, de effectgrootte en de conclusie van de toets (nulhypothese verwerpen of juist niet). (Eindkwalificaties IK: 4.1, 4.3, 5.3) 5. Wetenschappelijke literatuur waarin statistische resultaten worden besproken kritisch kunnen beschouwen. (Eindkwalificaties IK: 3.1, 5.3) 6. Het programma R gebruiken om de in de cursus besproken statistische analyses uit te voeren, met specifieke aandacht voor het automatisch genereren van een verslag. (Eindkwalificaties IK: 2.5, 4.1, 4.3, 5.3)	Multiple choice tentamen Wekelijkse practicumverslagen
LIX025B05	Computationele Grammatica	The student who masters the theory and techniques given in this course will be able to critically understand and compare grammar formalisms such as CFG, DCG, and dependency grammar. They will also understand the issues at stake in automatic parsing, which is a key component of most Natural Language Processing systems. More specifically, they will be able to write context-free grammars and definite clause grammars. Understand the CFG and DCG formalism, and the formalism of dependency grammar. They will also be able to write simple parsers in Prolog, and evaluate them. They will know what treebanks are, how they are built, and how they can be exploited in NLP. To summarize: - Understand why grammatical analysis is important for applications in natural language processing. (1.4, 1.5)	Meerdere assignment sets, en schriftelijk tentamen.

		- Understand the concepts of context-free grammar, rewrite-rules, definite clause grammars. (1.4) - Be able to write or expand grammar fragments, and to work with grammars in Prolog. (2.1, 2.2, 3.2, 3.3) - Understand the notion of a probabilistic CFG, and how probabilities can be estimated from a treebank. (1.4, 1.5, 2.2) - Be able to work with treebanks and probabilistic CFGs. (1.5) - Understand the notion of dependency analysis and dependency parsing. (1.4) - Be able to work with a dependency treebank and parser. (3.2, 3.3) - Be able to describe syntactic phenomena and difficulties for parsers. (4.2)	
LIX026B05	Human-Computer Interaction	1. Design and implement simple, stand-alone user interfaces in python, using the tkinter toolkit 2. Integrate user interfaces programmed in tkinter with python applications 3. Use theories of human computer interaction to inform the design and evaluation of a simple graphical user interface (1.1, 1.2, 1.5, 2.1, 2.2, 2.4, 2.6, 3.2, 4.1, 5.2)	Three practical courseworks, two quizzes, Final project
LIX013B05	Statistiek II	1. understand basic concepts of multivariate statistics (IK: 3.3, 5.3; CIW: 2.2; TW: 1.3); 2. interpret and report the results of analyses in studies and experiments (IK: 3.3, 5.3; CIW: 2.2, 2.3; TW: 1.3); 3. use effectively the R statistics software package (IK: 2.5, 5.3; CIW: 2.6; TW: 1.3); 4. present the results of scientific research in writing (IK: 4.1, 4.3, 5.3; CIW: 4.1; TW: 1.3); 5. assess the value of scientific literature, in particular statistical quality (IK: 3.1, 5.3; CIW: 3.1; TW: 1.3).	Formative (primarily), based on the weekly lab assignments and quizzes. Summative, by means of an exam (multiple choice questions) in which all the learning outcomes previously introduced are assessed
LIX031B05	Caleidoscoop Informatiekunde	1. Onderwerpen te noemen die onder Informatiekunde vallen en met de juiste terminologie uitleggen wat de wetenschappelijke en maatschappelijke vragen zijn omtrent deze onderwerpen (1.1; 1.2) 2. Onderzoeksvragen te formuleren en operationaliseren (1.4) 3. Kennis en inzicht te verschaffen over verschillende onderzoeksmethoden, hun verbanden en toepassingen te noemen in verschillende contexten om onderzoeksvragen te beantwoorden (3.1; 3.2; 3.3) 4. Kennis te nemen van actuele trends in wetenschappelijk onderzoek in het vakgebied Informatiekunde (1.6) 5. Wetenschappelijke resultaten te rapporteren in geschreven vorm (4.1)	Wekelijkse opdrachten en schriftelijk tentamen
LIX017B05	Social Media	1. demonstrate knowledge and understanding of the most important theoretical and methodological approaches to the study of mediated interaction [1.1] 2. demonstrate understanding of how communicative and social phenomena are impeded, transformed and augmented by social media, [2.1] 3. conduct basic empirical research by gathering, processing and analysing information from a social media platform [2.6]	2 courseworks, written exam

		4. examine research findings in the study of social media interfaces, form an opinion concerning the implications of their use [1.4] [2.2] [3.1] 5. communicate information and ideas in a clear, straightforward and well-argued manner, in writing [4.2]	

Jaar 3, semester I			
Vakcode	**Vaknaam**	**Beoogde leeruitkomsten**	**Wijze van toetsen**
variabel	Minor	Variable, 1.6	variabel

Jaar 3, semester II			
Vakcode	**Vaknaam**	**Beoogde leeruitkomsten**	**Wijze van toetsen**
LIX999B10	Bachelorscriptie met onderzoekswerkgroep	Na succesvolle afronding van het studieonderdeel zijn studenten in staat om: 1 .1 - 1 .5; 2.1 – 2.6; 3.1 – 3.3; 4.1 – 4.3; 5.2.	presentation of relevant article, research proposal and thesis report
LIX028B05	Machine Learning Project	1. Understand the role of text classification, clustering and recommender systems. 2. Implement the basic techniques for text classification, clustering and recommender systems. 3. Study, summarize, compare and critically evaluate academic literature in the field of Machine Learning and to report on this orally and in writing. (1.1, 1.3, 1.4, 2.2, 2.4, 2.5, 3.1, 3.3)	assignments, the project proposal, the project presentation and the project report
LIX32B05	Machine Translation	1. Describe the characteristics of the three main historical paradigms i n machine translation: rule-based, statistical and neural. 1 .1 2. Describe the workings of the two main architectures used i n neural machine translation: recurrent with attention and Transformer. 1 .1, 1.4 3. Train and test neural machine translation systems using a Python-based neural machine translation framework (e.g. fairseq) 1.5, 2.1, 2.2 4. Describe the workings of the main automatic and human evaluation metrics used i n machine translation. 1 .1, 1.2, 1.4 5. Understand and be able to present to peer students research conducted i n the field of machine translation. 3.1, 2 .4, 4.1 6. Explain the implications, advantages and disadvantages of the wide usage of machine translation in society. 3.2, 5 .2	Paper presentations, assignments, written exam
LIX020B05	Taaltechnologie	(1) Understanding the scope of factoid question answering systems and being able to formulate relevant questions. (2) Understanding of the role of syntactic analyses in question answering systems and applying this in a working system. (3) The ability to integrate the output of an automatic parser into a question answering system. (4) Being able to formulate SPARQL queries over RDF data.	4 weekly assignments (individual) and final (group) project (presentation, code, report)

		(5) The ability to work with Sparql endpoints, and with libraries to approach them from within an application. (1.1, 1.2, 1.3, 1.5, 2.1, 2.2, 3.1, 3.2, 4.2, 4.3)	
LIX033B05	Ethical Aspects in Natural Langage Processing	1. Understand the ethical challenges involved in working with language technology (1.2, 1.4) 2. Identify the ethical challenges posed by NLP research and how to address them in practice and in theory (in models and in papers) both as developer and as user/reader (2.1, 2.3, 2.4). Data, privacy, bias in models of various kinds. 3. Report on ethical issues (such as data statements, bias statements, etc) (2.1, 4.1, 4.2, 5.2) 4. Be aware of the state-of-the-art discussion on ethics in the NLP community (1.4, 2.4, 4.1, 4.2, 5.2) 5. Reflect on sociodemographic aspects of language and on the tradeoff between successful research and legitimate 'behaviour'. (3.1, 3.2, 3.3, 3.4) 6. Reflect on what is responsible behaviour and the dangers of potential third-party misuse (2.1, 2.4, 3.1, 3.2, 3.3, 3.4). 7. Understand the importance of model interpretability, and know which techniques are available for achieving it, for detecting bias in models, and for debiasing models (2.1, 2.3) Note that 3.4 is to be added to Dublin Descriptors in OER BSc Informatiekunde of 2022-2023.	weekly assignments and written exam