Study plan

Name of study plan: Master specialization Computer Systems and Networks, in Czech, 202

Faculty/Institute/Others: Department: Branch of study guaranteed by the department: Welcome page Garantor of the study branch: Program of study: Informatika Type of study: Follow-up master full-time Required credits: 98 Elective courses credits: 22 Sum of credits in the plan: 120 Note on the plan: Tato verze studijního plánu je ur ena pro ro níky, které byly p ijaty ke studiu od akademického roku 2020/2021 do prezen ní formy studia magisterského programu. . Garant: prof. Ing. Pavel Tvrdík, CSc., email: pavel.tvrdik@fit.cvut.cz

Name of the block: Compulsory courses in the program Minimal number of credits of the block: 63 The role of the block: PP

Code of the group: NI-PP.2020

Name of the group: Compulsory Courses of Master Study Program, Version 2020, in Czech Requirement credits in the group: In this group you have to gain 63 credits Requirement courses in the group: In this group you have to complete 6 courses Credits in the group: 63

Note on the group:

Code	Name of the course / Name of the group of courses (in case of groups of courses the list of codes of their members) Tutors, authors and guarantors (gar.)	Completion	Credits	Scope	Semester	Role
NI-KOP	Combinatorial Optimization Jan Schmidt, Ji í Vysko il, Petr Fišer Jan Schmidt Jan Schmidt (Gar.)	Z,ZK	6	2P+2C	Z	PP
NI-DIP	Diploma Project Zden k Muziká Zden k Muziká Zden k Muziká (Gar.)	Z	30	270ZP	L,Z	PP
NI-MPR	Master Project Zden k Muziká Zden k Muziká (Gar.)	Z	7		Z,L	PP
NI-MPI	Mathematics for Informatics Št pán Starosta, Jan Sp vák Št pán Starosta Št pán Starosta (Gar.)	Z,ZK	7	3P+2C	Z	PP
NI-PDP	Parallel and Distributed Programming Pavel Tvrdík Pavel Tvrdík Pavel Tvrdík (Gar.)	Z,ZK	6	2P+2C	L	PP
NI-VSM	Selected statistical Methods Jitka Hrabáková, Petr Novák, Daniel Vašata, Ivo Petr, Pavel Hrabák, Jana Vacková Pavel Hrabák Pavel Hrabák (Gar.)	Z,ZK	7	4P+2C	L	PP

Characteristics of the courses of this group of Study Plan: Code=NI-PP.2020 Name=Compulsory Courses of Master Study Program, Version 2020, in Czech

NI-KOP	Combinatorial Optimization	Z,ZK	6
The students will gain k	nowledge and understanding necessary deployment of combinatorial heuristics at a professional level. They will be able not	only to select and	implement but
also to apply and evaluate	ate heuristics for practical problems.		
NI-DIP	Diploma Project	Z	30
NI-MPR	Master Project	Z	7
1. At the beginning of th	e semester, a student reserves her/his final thesis topic and gets together with its supervisor. Together they decide on partial	I tasks that should	I be carried out
during the semester. If the	ne requirements they agreed upon are met, the supervisor awards the student an assessment for the course MI-MPR at the e	nd of the semeste	r. 2. The external
supervisor enters the in	formation on granting the credit using the form "Granting credit from the external supervisor of the final thesis" (http://fit.cvut.	cz/student/studijn	i/formulare). The
completed and signed for	orm must be delivered in person or by email to the SZZ coordinator, who will arrange for the credit to be granted. 3. If the FT t	opic that the stude	ent has reserved
is rather general, the im	mediate tasks the supervisor assigns to the student for the upcoming semester should aim at fine-tuning the FT topic so that	t the FTT will be c	omplete and
approvable at the end o	f the semester.		
NI-MPI	Mathematics for Informatics	Z,ZK	7
The course comprises t	opics from general algebra with focus on finite structures used in computer science. It includes topics from multi-variate analy	ysis, smooth optin	nization and
multi-variate integration	The third large topic is computer arithmetics and number representation in a computer along with error manipulation. The last	topic includes se	lected numerical
algorithm and their stab	ility analysis. The topics are completed with demonstration of applications in computer science. The course focuses on clear	presentation and	argumentation.

NI-PDP Parallel and Distributed Programming

Z,ZK

6

21st century in computer architectures is primarily influenced by the shift of the Moore's law into parallelization of CPUs at the level of computing cores. Parallel computing systems are becoming a ubiquitous commodity and parallel programming becomes the basic paradigm of development of efficient applications for these platforms. Students get acquainted with architectures of parallel and distributed computing systems, their models, theory of interconnection networks and collective communication operations, and languages and environments for parallel programming of shared and distributed memory computers. They get acquainted with fundamental parallel algorithms and on selected problems, they will learn the techniques of design of efficient and scalable parallel algorithms and methods of performance evaluation of their implementations. The course includes a semester project of practical programming in OpenMP and MPI for solving a particular nontrivial problem.

NI-VSM Selected statistical Methods

Z,ZK

The course leads the student through advanced probabilistic and statistical methods used in information technology praxis. Particularly it deals with multivariate normal distribution, application of entropy in coding theory, hypothesis testing (T-tests, goodness of fit tests, independence test). Second part of the course deals with random processes with focus on Markov chains. The high point of the course is the Queuing theory and its application in networks.

Name of the block: Compulsory courses in the specialization Minimal number of credits of the block: 35 The role of the block: PS

Code of the group: NI-PS-PSS.20

Name of the group: Compulsory Courses of Master Specialization Computer Systems and Networks, version 2020, in Czech

Requirement credits in the group: In this group you have to gain 35 credits Requirement courses in the group: In this group you have to complete 7 courses Credits in the group: 35

Note on the group:

Code	Name of the course / Name of the group of courses (in case of groups of courses the list of codes of their members) Tutors, authors and guarantors (gar.)	Completion	Credits	Scope	Semester	Role
NI-DSV	Distributed Systems and Computing Pavel Tvrdík Jan Fesl Pavel Tvrdík (Gar.)	Z,ZK	5	2P+1C	Z	PS
NI-EPC	Effective C++ programming Daniel Langr Daniel Langr (Gar.)	Z,ZK	5	2P+1C	Z	PS
NI-MTI	Modern Internet Technologies Viktor erný, Alexandru Moucha Alexandru Moucha Alexandru Moucha (Gar.)	Z,ZK	5	2P+1C	Z	PS
NI-GPU	GPU Architectures and Programming Ivan Šime ek Ivan Šime ek Ivan Šime ek (Gar.)	Z,ZK	5	2P+1C	L	PS
NI-SIB	Network Security Ji í Dostál, Simona Forn sek, Martin Šutovský, Martin Holec Simona Forn sek Ji í Dostál (Gar.)	Z,ZK	5	2P+1C	L	PS
NI-VCC	Virtualization and Cloud Computing Tomáš Vondra, Jan Fesl Tomáš Vondra Tomáš Vondra (Gar.)	Z,ZK	5	2P+1C	L	PS
NI-MCC	Multicore CPU Computing Daniel Langr, Ivan Šime ek Ivan Šime ek Ivan Šime ek (Gar.)	Z,ZK	5	2P+1C	Z	PS

Characteristics of the courses of this group of Study Plan: Code=NI-PS-PSS.20 Name=Compulsory Courses of Master Specialization Computer Systems and Networks, version 2020, in Czech

NI-DSV	Distributed Systems and Computing	Z,ZK	5					
Students are introduced to methods for coordination of processes in distributed environment characterised by nondeterministic time responses of computing processes and communication								
channels. They learn basic algorithms that assure correctness of computations realized by a group of loosely coupled processes and mechanisms that support high availability of both								
data and services, and	safety in case of failures.							
NI-EPC	Effective C++ programming	Z,ZK	5					
Students learn how to u	se the modern features of contemporary versions of the C++ programming language for software development. The course f	ocuses on progra	mming effectivity					
and efficiency in the form	n of writing maintainable and portable source code and creating correct programs with low memory and processor time requ	irements.						
NI-MTI	Modern Internet Technologies	Z,ZK	5					
SYNOPSIS The subject	"Modern Internet Technologies" is designed on four major pillars of networking: 1. Unified Communication and Collaboration	- A single netwo	rk, oriented on					
TCP/IP is able to carry	whatever types of protocols for whatever purposes. This architecture is able to be protocol independent and carries voice, vic	leo and data to ad	chieve seamless					
integrated services. 2. D	besign of Extremely Scalable Networks - This provides the insights of network architectures which can accommodate hundre	ds of millions of u	sers and billions					
of devices. Thus, there i	s a paradigm switch from LANs (Local Area Networks) to SPs (Service Providers). 3. Traffic Segregation, Traffic Matching an	d Traffic Prioritisa	tion - These					
technologies allow serv	ce providers to create private channels of communication between customers, with guaranteed parameters (bandwidth, dela	ay, jitter, type of pr	otocol). 4.					
Acceleration Technologi	es - They allow traffic to be carried at the optimal speed and allow for graceful degradation of service parameters in case of	failures.						
NI-GPU	GPU Architectures and Programming	Z,ZK	5					
Students will gain knowl	edge of the internal architecture of modern massively parallel GPU processors. They will learn to program them mainly in the	CUDA programm	ing environment,					
which is already a wides	pread programming technology of GPU processors. As an integral part of the effective computational use of these hierarchical	computational stru	uctures, students					
will also learn optimizati	on programming techniques and methods of programming multiprocessor GPU systems.							
NI-SIB	Network Security	Z,ZK	5					

	dge of architectures of large computer systems that are used in data centers and computer	ter infrastructure o	of companie		izations. They	will get
°	tion principles, tools and technologies that serve to facilitate and automate configuration,			•		•
	of modern computer systems. Theoretically and practically, they will get acquainted with					
	computer systems and with specific technologies of cloud systems. Finally, they will learn t	he principles and g	gain practica	al skills in the	e use of moder	n integration
	ontinuous integration and development). Aulticore CPU Computing			7	Z,ZK	5
1	ed in detail with hardware support and programming technologies for the creation of para	llel multithreaded	computatior			-
	ories, which are today the most common computing nodes of powerful (super)computer		-			
	sed to reduce the performance drop due to the widening gap between the computational	-	nulti-core Cl	PUs and me	emory interface	throughput.
On specific non-trivial mul	tithreaded programs, students will also learn the basics of the art of creating these appli	cations.				
Name of the blo	ock: Elective courses					
Minimal number	r of credits of the block: 0					
The role of the I	block: V					
Code of the gro	up: NI-PSS-VS.20					
•	oup: Elective Vocational Courses for Master Speciali	zation Con	nputer	System	ns and N	etworks
Requirement cr	edits in the group:		-	-		
•	ourses in the group:					
Credits in the g						
Note on the gro	•	lizations with	the exc	eption o	f this spec	ialization
	Name of the course / Name of the group of courses					
Code	(in case of groups of courses the list of codes of their members)	Completion	Credits	Scope	Semester	Role
	Tutors, authors and guarantors (gar.) Data Mining Algorithms					
NI-ADM	Pavel Kordík, Daniel Vašata, Rodrigo Augusto Da Silva Alves Daniel Vašata Pavel Kordík (Gar.)	Z,ZK	5	2P+1C	L	V
NI-AIB	Algorithms of Information Security Martin Jure ek, Róbert Lórencz, Olha Jure ková Martin Jure ek Róbert Lórencz (Gar.)	Z,ZK	5	2P+1C	z	V
NI-ADP	Architecture and Design patterns Filip K ikava, Jan Kurš, Jan Zimolka, Tomáš Chvosta, Ji í Borský Jan Kurš Filip K ikava (Gar.)	Z,ZK	5	2P+1C	Z	V
NI-AM1	Middleware Architectures 1 Jaroslav Kucha , Tomáš Vitvar (Gar.)	Z,ZK	5	2P+1C	Z	V
NI-AM2	Middleware Architectures 2 Jaroslav Kucha , Tomáš Vitvar Jaroslav Kucha Tomáš Vitvar (Gar.)	Z,ZK	5	2P+1C	L	V
NI-BML	Bayesian Methods for Machine Learning Ond ej Tichý, Kamil Dedecius Ond ej Tichý Kamil Dedecius (Gar.)	КZ	5	2P+1C	L	V
NI-BVS	Embedded Security Martin Novotný Martin Novotný Martin Novotný (Gar.)	Z,ZK	5	2P+2C	L	V
NI-BKO	Error Control Codes Pavel Kubalík Pavel Kubalík Pavel Kubalík (Gar.)	Z,ZK	5	2P+1C	L	V
NI-DDW	Web Data Mining Jaroslav Kucha, Milan Doj inovski Jaroslav Kucha Jaroslav Kucha (Gar.)	Z,ZK	5	2P+1C	L	V
NI-EVY	Efficient Text Pattern Matching Jan Holub Jan Holub Jan Holub (Gar.)	Z,ZK	5	2P+1C	Z	V
NI-FME	Formal Methods and Specifications Stefan Ratschan Stefan Ratschan Stefan Ratschan (Gar.)	Z,ZK	5	2P+1C	L	V
NI-GEN	Code Generators Petr Máj, Jan Janoušek Petr Máj Jan Janoušek (Gar.)	Z,ZK	5	2P+1C	Z	V
NI-GAK	Graph theory and combinatorics Michal Opler Tomáš Valla Tomáš Valla (Gar.)	Z,ZK	5	2P+2C	L	V
NI-HWB	Hardware Security Ji í Bu ek Ji í Bu ek Ji í Bu ek (Gar.)	Z,ZK	5	2P+2C	L	V
NI-KOD	Data Compression Jan Holub Jan Holub Jan Holub (Gar.)	Z,ZK	5	2P+1C	L	V
NI-MKY	Mathematics for Cryptology Martin Jure ek, Róbert Lórencz Róbert Lórencz (Gar.)	Z,ZK	5	3P+1C	L	V
NI-MVI	Computational Intelligence Methods Pavel Kordík Pavel Kordík (Gar.)	Z,ZK	5	2P+1C	Z	V
NI-MEP	Modelling of Enterprise Processes Robert Pergl, Marek Suchánek Robert Pergl Robert Pergl (Gar.)	Z,ZK	5	2P+1C	Z	V
NI-MPJ	Modelling of Programming Languages	Z,ZK	5	2P+1C	Z	V
NI-NUR	User Interface Design Josef Pavlí ek Josef Pavlí ek (Gar.)	Z,ZK	5	2P+1C	Z	V
NI-NON	Nonlinear Continuous Optimization and Numerical Methods Jaroslav Kruis Jaroslav Kruis (Gar.)	Z,ZK	5	2P+1C	Z,L	V

Z,ZK

5

NI-VCC

Virtualization and Cloud Computing

NI-NSS	Normalized Software Systems Robert Pergl, Marek Suchánek, Jan Verelst Robert Pergl Robert Pergl (Gar.)	ZK	5	2P	L	v
NI-OSY	Operating Systems and Systems Programming Petr Zemánek, Tomáš Martinec Petr Zemánek Petr Zemánek (Gar.)	Z,ZK	5	2P+1C	Z	V
NI-BUI	Business Informatics Petra Pavlí ková Petra Pavlí ková Petra Pavlí ková (Gar.)	Z,ZK	5	2P+2C	L	V
NI-PIS	Enterprise Information Systems Vlastimil Jinoch, Martin Závrbský, Martin Mach, Martin Hasaj David Buchtela David Buchtela (Gar.)	Z,ZK	5	2P+1C	L	v
NI-KRY	Advanced Cryptology Ji í Bu ek, Róbert Lórencz Ji í Bu ek Róbert Lórencz (Gar.)	Z,ZK	5	2P+2C	Z	V
NI-PAS	Advanced Aspects of Business David Buchtela, Št pánka Havlíková, Dominik Vítek, Ji í Maršál, Jana Soukupová, Zden k Ku era David Buchtela Zden k Ku era (Gar.)	Z,ZK	4	2P+1C	Z	v
NI-PDB	Advanced Database Systems Yelena Trofimova, Michal Valenta Michal Valenta (Gar.)	Z,ZK	5	2P+1C	Z	V
NI-PDD	Data Preprocessing Marcel Ji ina Marcel Ji ina Marcel Ji ina (Gar.)	Z,ZK	5	2P+1C	Z	V
NI-REV	Reverse Engineering Josef Kokeš Josef Kokeš (Gar.)	Z,ZK	5	1P+2C	Z	V
NI-RUN	Runtime Systems Filip K ikava Fili p K ikava Filip K ikava (Gar.)	Z,ZK	5	2P+1C	L	V
NI-SWE	Semantic Web and Knowledge Graphs Milan Doj inovski, Jakub Klímek Milan Doj inovski Milan Doj inovski (Gar.)	Z,ZK	5	2P+1C	Z	V
NI-SIM	Digital Circuit Simulation and Verification Martin Kohlik Martin Kohlik Martin Kohlik (Gar.)	Z,ZK	5	2P+1C	L	V
NI-SCR	Statistical Analysis of Time Series Kamil Dedecius Kamil Dedecius (Gar.)	Z,ZK	5	2P+1C	Z	V
NI-SYP	Parsing and Compilers Jan Janoušek Jan Janoušek Jan Janoušek (Gar.)	Z,ZK	5	2P+1C	Z	V
NI-SBF	System Security and Forensics Simona Forn sek, Marián Svetlík Simona Forn sek Róbert Lórencz (Gar.)	Z,ZK	5	2P+1C	Z	V
NI-DSS	Decision Support Systems Petra Pavlí ková, Robert Pergl, David Buchtela David Buchtela Robert Pergl (Gar.)	Z,ZK	5	2P+1C	Z	v
NI-TES	Systems Theory Ji í Vysko il, Stefan Ratschan Stefan Ratschan Stefan Ratschan (Gar.)	Z,ZK	5	2P+1C	Z	V
NI-TSP	Testing and Reliability Petr Fišer Martin Da hel Petr Fišer (Gar.)	Z,ZK	5	2P+2C	Z	V
NI-TSW	Software Product Development Petra Pavlí ková Ond ej Pluha Petra Pavlí ková (Gar.)	KZ	4	1P+2C	Z	V
NI-UMI	Artificial intelligence Pavel Surynek Pavel Surynek Pavel Surynek (Gar.)	Z,ZK	5	2P+1C	Z	V
NI-EHW	Embedded Hardware Jan Schmidt Jan Schmidt Jan Schmidt (Gar.)	Z,ZK	5	2P+1C	Z	V
NI-ESW	Embedded Software Hana Kubátová, Miroslav Skrbek Miroslav Skrbek Hana Kubátová (Gar.)	Z,ZK	5	2P+1C	Z	V
NI-APR	Selected Methods for Program Analysis Filip K ikava Filip K ikava Filip K ikava (Gar.)	Z,ZK	5	2P+1C	Z	V
NI-PON	Selected Topics in Optimization and Numerical mathematics Karel Klouda, Št pán Starosta, Daniel Vašata Daniel Vašata Št pán Starosta (Gar.)	Z,ZK	5	2P+1C	L	v
NI-VMM	Retrieval from Multimedia Ji (Novák, Tomáš Skopal Jaroslav Kucha Tomáš Skopal (Gar.)	Z,ZK	5	2P+1C	Z	V

Characteristics of the courses of this group of Study Plan: Code=NI-PSS-VS.20 Name=Elective Vocational Courses for Master Specialization Computer Systems and Networks

NI-ADM	Data Mining Algorithms	Z,ZK	5
The course focuses on	algorithms used in the fields of machine learning and data mining. However, this is not an introductory course, and the stude	nts should know r	nachine learning
basics. The emphasis is	put on advanced algorithms (e.g., gradient boosting) and non-basic kinds of machine learning tasks (e.g., recommendation	systems) and mo	dels (e.g., kernel
methods).			
NI-AIB	Algorithms of Information Security	Z,ZK	5
Students will get acquai	nted with the algorithms of secure key generation and cryptographic error (not only biometric) data processing. Furthermore, st	udents will learn t	he mathematical
principles of cryptograp	hic protocols (identification, authentication, and signature schemes). Another part of the course is dedicated to malware dete	ction and the use	of machine
learning in detection system	stems. The last topic includes practical steganographic methods and attacks on steganographic systems.		
NI-ADP	Architecture and Design patterns	Z,ZK	5
The objective of this co	urse is to provide students with both work knowledge about the underlying foundations of object-oriented design and analysis	s as well as with u	inderstanding of
the challenges, issues,	and tradeoffs of advanced software design. In the first part of the course, the students will refresh and deepen their knowledge	e of object-orient	ed programming
and get familiar with the	commonly used object-oriented design patterns that represent the best practices for solving common software design problem	ns. In the second	part the students
will be introduced to the	principles of software architecture design and analysis. This includes the classical architectural styles, component based syste	ems, and some ad	vanced software
architectures used in la	rge-scale distributed systems.		
NI-AM1	Middleware Architectures 1	Z,ZK	5
Students will study new	trends, concepts, and technologies in the area of service-oriented architectures. The will gain an overview of information sys	tem architecture,	web service
architecture and aplicati	on servers. The will also study principles and technologies for middleware focused on application integrations, asynchronous co	mmunications an	d high availability
of applications.			

	ware Architectures 2	Z,ZK	5
	I technologies on the Web including theoretical foundations. They will gain an overview of Web application architect he and databases, smart contracts, realtime communication and web security.	tures, concepts a	ina technologies
	an Methods for Machine Learning	KZ	5
	I use of basic Bayesian modeling methods in the dynamically evolving machine learning theory. In particular, it studi		-
	al phenomena, as well as their subsequent use, e.g., for forecasting of future evolution or learning about the hidder		
-	emphasis is put on understanding of explained principles and methods and their practical adoption. For this purpose		
and applications will be presented	to students, for instance, 2D/3D object tracking, radiation source term estimation, or separation in medical imaging	g. The students w	ill try to solve
some of them.			
	ded Security	Z,ZK	5
	selected topics of cryptography and cryptanalysis. The course focuses particularly on efficient implementations of cry		
	ns). Students gain a good overview of functionality of (hardware) cryptographic accelerators, smart cards, and resour	ces for securing i	nternal functions
of computer systems.		7 71/	-
	ontrol Codes	Z,ZK	5
	nt various ways to detect or correct individual errors and burst errors in data stored into memories or transmitted via		F
1	ata Mining and technologies for web data acquisition, analysis and utilization of the discovered knowledge. Students will gain	Z,ZK	/eb mining
	structure analysis, Web usage analysis, Web content mining and information extraction. Students will also gain an over		-
in the field of social web and recor			
	t Text Pattern Matching	Z,ZK	5
	t algorithms for text pattern matching. They learn to use so called succinct data structures that are efficient in both acc		-
They will be able to use the knowle	edge in design of applications that utilize pattern matching.		
NI-FME Formal	Methods and Specifications	Z,ZK	5
Students are able to describe sem	antics of software formally and to use sound reasoning for construction of correct software. They learn to use some	software tools th	at allow to prove
basic properties of software.			
NI-GEN Code G	Generators	Z,ZK	5
	g programs written in high-level programming languages are essential for understanding the field of systems progr		-
	techniques used to translate more complex programming constructs of modern languages employed in systems pro	ogramming. Stud	ents will become
	nd practical aspects of implementing the back-end of optimizing compilers for programming languages.		
	theory and combinatorics	Z,ZK	5
-	the most important topics in graph theory, combinatorics, combinatorial structures, discrete models and algorithm	-	-
	es but also on applications in problem solving and algorithm design. The topics include: generating functions, selected ion to probabilistic method, properties of various special classes of graphs and combinatorial structures. The theor		
of combinatorics on words, formal		y will be also app	
	are Security	Z,ZK	5
	je needed for the analysis and design of computer systems security solutions. Students get an overview of safegua		-
-	be able to safely use and integrate hardware components into systems and test them for resistance to attacks. Stud	-	-
the cryptographic accelerators, PL	JF, random number generators, smart cards, biometric devices, and devices for internal security functions of the co	omputer.	
NI-KOD Data C	ompression	Z,ZK	5
	sic principles of data compression. They will learn the necessary theoretical background and get an overview of data	-	-
· ·	rers principles of integer coding and of statistical, dictionary, and context data compression methods. In addition, st	udents learn the	fundamentals of
	used in image, audio, and video compression.		
	natics for Cryptology	Z,ZK	5
	lge of algebraic procedures solving the most important mathematical problems concerning the security of ciphers. I n of polynomial equations over a finite field, the problem of factorization of large numbers and the problem of discre	-	
	elliptic curves. Students will further become familiar with modern encryption systems based on lattices.	ete logantinin. The	
	tational Intelligence Methods	Z,ZK	5
	and techniques of computational intelligence that are mostly nature-inspired, parallel by nature, and applicable to		1
	to apply them to problems related to data mining, control, intelligen games, optimizations, etc.		
NI-MEP Modelli	ng of Enterprise Processes	Z,ZK	5
	tion to the discipline of Enterprise Engineering. Students learn the importance of a proper methodological approad		ring and
implementation of processes, orga	anisation structures and information support in big enterprises and institutions.		
NI-MPJ Modelli	ng of Programming Languages	Z,ZK	5
The analysis, transformation, and	code generation processes depend on the semantics of the language; in particular, they are correct if they preserv	e the semantics of	of the language.
	s of programming languages. The students will learn the language models with emphasis on functional languages, stu	-	
	and here get acquainted with the advanced lambda calculus. The students also get hands-on-experience with semai		
1	terface Design	Z,ZK	5
	ical background of human-computer interaction and user interface (UI) design, will learn formal description of UIs, for		
	acquainted with graphical, speech, and multimodal UIs. Thanks to the gained knowledge, the students will be able		5
	ear Continuous Optimization and Numerical Methods	Z,ZK	-
	ethod and the finite difference method used for solving ordinary and partial differential equations in engineering. Th		
	se from discretization of the continuous problems by direct and iterative algorithms. They will also learn to implement	-	-
as well as in parallel.		-	-
NI-NSS Normal	ized Software Systems	ZK	5
1	s of normalized systems theory that studies the evolvability of modular structures based on concepts from engineer	ing, such as stab	ility from system
	namics. Students will understand a set of principles that indicate where violations of stability and entropy-related is		-
	the course, students learn how to construct software architectures using a set of 5 design patterns called elements.		-
	s in terms of storing data, executing actions, workflows, connectors, and triggers, while handling violations of the stabi	inty and entropy-re	elated principles.
This knowledge allows students to	prealize new levels of evolvability in software architectures.		

	d Systems Programming	Z,ZK	5
	ronment. Emphasis is given on kernel development with focus on kernel architecture and kern		
	rations and architecture of modern file systems, device drivers and network programming. The		
	ernel booting, debugging using dynamic instrumentation, and techniques to guarantee portabil		
	o discussed. Theoretical and general principles are demonstrated on the LINUX kernel. Within I	abs, students will	work on projects
focused on development of LINUX kernel modules.			
NI-BUI Business Informatics		Z,ZK	5
	al and strategic management of business informatics. Students will gain knowledge in the areas		-
	cs. They will also learn about the principles, models and standards (ITIL, COBIT) in IT manage		•
	. Students will learn the process of creating and implementing information strategy, IT Governa	-	
	global business strategy. They will also gain knowledge in the areas of economic IT management	ent, revenue and i	nvestment
management, IT investment evaluation and human re			-
NI-PIS Enterprise Information	5	Z,ZK	5
	of large companies in the Czech Republic (Top 100). The basis is Data management, storage		-
	the overall architecture of information systems in the banking, insurance and telecommunicati		-
	ted with the life cycle of information systems in the company / organization and its impact on the		
	e proven themselves in the elimination of basic risks in the planning, implementation and oper	ation of mormatio	n systems in the
company / organization.		7 71	-
NI-KRY Advanced Cryptology	.	Z,ZK	5
	the mathematical principles of constructing symmetric and asymmetric ciphers. They will know		
	w of cryptanalysis methods, elliptic curve cryptography and quantum cryptography, which they	can apply to the i	ntegration of
their own systems or to the creation of their own softw			
NI-PAS Advanced Aspects of		Z,ZK	4
-	anced (compared to the bachelor's degree) knowledge and skills needed to establish and run t	heir own business	or business
	sary steps and documents), business economics, foreign trade and related aspects.		
NI-PDB Advanced Database S		Z,ZK	5
	and optimization of SQL queries. The next part of the course deals with new concepts of data		
	graph databases, column databases) and languages for working with them (XQuery, XPath, C	YPHER, Gremlin).	The last part of
the course deals with performance evaluation of data	base machines.		
NI-PDD Data Preprocessing		Z,ZK	5
Students learn to prepare raw data for further process	ing and analysis. They learn what algorithms can be used to extract information from various da	ata sources, such a	as images, texts,
time series, etc., and learn the skills to apply these th	eoretical concepts to solve specific problems in individual projects - e.g., extraction of characte	eristics from image	s or from web
pages.			
NI-REV Reverse Engineering		Z,ZK	5
Students will get acquainted with the essentials of rev	erse engineering of computer software. They will learn how processes start and what happens	before and after the	he main function
is called. Students will understand how executable file	is are organized and how they interact with 3rd party libraries. Another part of the course is de	dicated to reverse	engineering of
applications written in C++. Students will also underst	and principles of disassemblers and obfuscation techniques. A part of the course will also be o	dedicated to debug	gers: how
	an be used to detect it. One of the lectures will be dedicated to the latest trends on the compu	ter malware scene	e. The focus of
the course is on the seminars, where students will so	ve practically oriented tasks from the real world.		
NI-RUN Runtime Systems		Z,ZK	5
This course is an introduction to the world of virtual mad	hines (VM) for high-level programming languages. There are two goals: Give you hands-on exper	ience in design and	d implementation
	ct Syntax Tree (AST) interpretation Byte code (BC) design and interpretation AST to BC comp		
	ques Through a series of guest lectures, introduce you to various advanced topics and implemen	tations of real-worl	d VMs, including
	tions Language implementation frameworks Read-world VMs		
NI-SWE Semantic Web and Kn	owledge Graphs	Z,ZK	5
The students will learn the most recent concepts and	technologies of the Semantic Web. The course will provide an overview of the Semantic Web t	echnologies, meth	ods and best
practices for modelling, integration, publishing, queryi	ng and consumption of semantic data. The students will also gain skills in creation of knowledg	ge graphs and thei	r systematic
quality assurance.			
NI-SIM Digital Circuit Simulati	on and Verification	Z,ZK	5
The aim of the course is to acquaint the students with	principles of digital circuit simulation at RTL (Register Transfer Level) and TLM (Transaction Level)	evel Modeling) leve	els and with the
properties of proper tools. The course covers recent v	erification methods, too.		
NI-SCR Statistical Analysis of	Time Series	Z,ZK	5
The course deals with the practical use of the basic ti	me series modelling theory in engineering tasks, ranging from economics (stock exchange pric	ces, employment)	and industrial
	puter networks (network components load, attacks detection). The students learn to select a co	•	
its parameters, analyze its properties and use it for fore	ecasting of future or intermediate values. The stress is put on understanding and adoption of the	main principles ba	ased on practical
real-world examples. Both the lab classes and the lec	tures exploit freely available software packages in order to provide easy and straightforward tra	ansfer of students'	knowledge from
the academic to the real world.			
NI-SYP Parsing and Compilers	3	Z,ZK	5
The module builds upon the knowledge of fundamental	s of automata theory, formal language and formal translation theories. Students gain knowledge	of various variants	and applications
of LR parsing and are introduced to special application			
NI-SBF System Security and F	ns of parsers, such as incremental and parallel parsing.		
Students will get familiar with aspects of system secu		Z,ZK	5
students will not for illen with formation and with some the		1 ' 1	-
students will get familiar with forensic analysis as a to	orensics	ation concepts). F	urthermore,
importance of operating system/operating system arti	Forensics rity (principles of end station security, principles of security policies, security models, authentic ol for investigating security incidents (techniques used by malicious software/attackers and for	ation concepts). F	urthermore,
importance of operating system/operating system arti	Forensics rity (principles of end station security, principles of security policies, security models, authentic ol for investigating security incidents (techniques used by malicious software/attackers and for facts or file system for attack analysis and detection).	ation concepts). F ensic analysis tech	urthermore,
importance of operating system/operating system arti NI-DSS Decision Support Syst	Forensics rity (principles of end station security, principles of security policies, security models, authentic ol for investigating security incidents (techniques used by malicious software/attackers and for facts or file system for attack analysis and detection).	ation concepts). F ensic analysis tech	urthermore, nniques and the 5
Importance of operating system/operating system article NI-DSS Decision Support System The aim of the course is to provide students with known	Forensics rity (principles of end station security, principles of security policies, security models, authentic ol for investigating security incidents (techniques used by malicious software/attackers and for facts or file system for attack analysis and detection). ems	ation concepts). F ensic analysis tech Z,ZK s of data-oriented	urthermore, nniques and the 5 , model-oriented
Importance of operating system/operating system artic NI-DSS Decision Support System The aim of the course is to provide students with know and knowledge-oriented decision support systems. Students	Forensics rity (principles of end station security, principles of security policies, security models, authentic ol for investigating security incidents (techniques used by malicious software/attackers and for facts or file system for attack analysis and detection). ems vledge and skills in decision support systems, their classification (Powerova), selected principle	ation concepts). F ensic analysis tech Z,ZK s of data-oriented will also learn abo	urthermore, nniques and the 5 , model-oriented
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	sting and Reliability				Z,ZK	5
	e about circuit testing and about methods for increasing reliability and security. They w in and to use an ATPG for automatic test generation. They will be able to design easily					
	lyze, and control the reliability and availability of the designed circuits.		ind systems	with built-in	-sell-lest eq	upment. mey
NI-TSW Sc	ftware Product Development				KZ	4
The course is presented in (Czech.					
	tificial intelligence			1	Z,ZK	5
	nd inference algorithms in major formal paradigms used in artificial intelligence such a	s logic theories, c	onstraint pro	ogramming	and automat	ed planning.
· · · ·	ctical applications of discussed techniques will be illustrated. nbedded Hardware				Z,ZK	5
	s that govern digital design and basic techniques to use them. It deals with both large	and small scale s	vstems. This		· · · · · · · · · · · · · · · · · · ·	
systems, that profit from the	ir specialized structure for effective computation and acceleration. Design of fast custo	m computing mac	hines is dis	cussed, incl	luding standa	ardized means
	arallelism extraction and utilization in special structures and system architectures.					
	nbedded Software				Z,ZK	5
	acquainted students with the specifics of software development for embedded systems. T imizations, through typical areas as the reliable software development, embedded ope				-	
combined with artificial intel		iatilig of otorilo, of	griai procoo	5g, up to t	opinonou cue	looninquoo
NI-APR Se	lected Methods for Program Analysis			Z	Z,ZK	5
	o program analysis, i.e., the automated reasoning about the behavior of a computer pr	•				
	soning about computer programs without running them. We will look at the analyses fo analyses considering individual program runs using a concrete environment and input		anding, opti	mizations,	error detectio	on. In Dynamic
	ected Topics in Optimization and Numerical mathematics				Z,ZK	5
	ization problems that appear in the field of machine learning and artificial intelligence. S	tudents broaden th	neir knowled		· ·	-
	or informatics. The methods are explained and described along with the details on how	they are impleme	ented on cor	nputers. He	ence, the rele	evant concepts
	ainly numerical linear algebra, are explained too.				7 71/	
	etrieval from Multimedia knowledge regarding interfaces of portals providing multimedia content, the principles c	of similarity search	the method		Z,ZK	5 om multimedia
-	ure of distributed search engines.		, 110 1101100			
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Requirement cou Credits in the grou Note on the grou NI-AOA NI-ATH NI-AFP NI-AFP NI-APH NI-VGA NI-BPS NIE-BLO NI-CTF NI-DPH	 P: In addition to the courses listed here, you can enroll a your study program and form of study that you did not program/branch/specialization or a compulsory electin has completed in the bachelor study at CTU cannot be accessed in case of groups of courses the list of codes of their members) Tutors, authors and guarantors (gar.) Completing a professional event Zden k Muziká AlgorithmicTheories of Games Dušan Knop, Tomáš Valla Tomáš Valla Tomáš Valla (Gar.) Applied Functional Programming Robert Pergl, Marek Suchánek, Daniel N mec Robert Pergl Robert Pergl (Gar.) Architecture of computer games Adam Vesecký Adam Vesecký Adam Vesecký Gar.) Video Games Architecture Jan Matoušek Wireless Computer Networks Ji í Kašpar, Alexandru Moucha Alexandru Moucha (Gar.) Blockchain Róbert Lórencz, Jakub R ži ka, Josef Gattermayer, Marek Bielik Josef Gattermayer Róbert Lórencz (Gar.) Game Design Adam Vesecký I (Gar.) 	t enroll as a ve course.Correcomplete enroll as a ve course.Correct end of the re-complete end of the re-completion of the re-complete end of the re-complete en	compuls ourses o ted. Credits 1 4 5 4 5 4 5 4 5	Sory sub f this gri Scope 2P+2C 2P+1C 2P+1C 2P+1C 2P+1C 1P+2C 3C 2P+1C	ject in the oup that Semeste L L Z Z L Z L	e student r Role V V V V V V V V V V V V V V V V V V V
Requirement cou Credits in the grou Note on the grou Code NI-AOA NI-ATH NI-AFP NI-AFP NI-APH NI-VGA NI-BPS NIE-BLO NI-CTF	 P: In addition to the courses listed here, you can enroll a your study program and form of study that you did not program/branch/specialization or a compulsory electin has completed in the bachelor study at CTU cannot to has completed in the bachelor study at CTU cannot to find the course / Name of the group of courses (in case of groups of courses the list of codes of their members) Tutors, authors and guarantors (gar.) Completing a professional event Zden k Muziká AlgorithmicTheories of Games Dušan Knop, Tomáš Valla Tomáš Valla Tomáš Valla (Gar.) Applied Functional Programming Robert Pergl, Marek Suchánek, Daniel N mec Robert Pergl Robert Pergl (Gar.) Architecture of computer games Adam Vesecký Adam Vesecký Adam Vesecký (Gar.) Video Games Architecture Jan Matoušek Wireless Computer Networks Ji í Kašpar, Alexandru Moucha Alexandru Moucha Alexandru Moucha (Gar.) Blockchain Róbert Lórencz (Gar.) Capture The Flag Ji í Dostál (Gar.) Game Design Adam Vesecký Design Sprint Ond State Marka Marda Michal Manda David Pešek (Gar.) 	t enroll as a ve course.Correcomplete enroll as a ve course.Correct end of the re-complete end of the re-completion of the re-completion of the re-complete end	compuls ourses o ted. Credits 1 4 5 4 5 4 5 4 5	Scope Scope 2P+2C 2P+1C 2P+1C 2P+1C 2P+1C 1P+2C 3C	ject in the oup that Semeste L L Z Z L Z Z	e student r Role V V V V V V V V V V V V V V V V V V V
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Requirement cou Credits in the grou Note on the grou NI-AOA NI-ATH NI-AFP NI-AFP NI-APH NI-VGA NI-BPS NIE-BLO NI-CTF NI-DPH NI-DSW NI-PSD	 P: In addition to the courses listed here, you can enroll a your study program and form of study that you did not program/branch/specialization or a compulsory electin has completed in the bachelor study at CTU cannot to has completed in the bachelor study at CTU cannot to find the course / Name of the group of courses (in case of groups of courses the list of codes of their members) Tutors, authors and guarantors (gar.) Completing a professional event Zden k Muziká AlgorithmicTheories of Games Dušan Knop, Tomáš Valla Tomáš Valla Tomáš Valla (Gar.) Applied Functional Programming Robert Pergl, Marek Suchánek, Daniel N mec Robert Pergl Robert Pergl (Gar.) Architecture of computer games Adam Vesecký Adam Vesecký Adam Vesecký (Gar.) Video Games Architecture Jan Matoušek Wireless Computer Networks Ji í Kašpar, Alexandru Moucha Alexandru Moucha Alexandru Moucha (Gar.) Blockchain Róbert Lórencz (Gar.) Capture The Flag Ji í Dostál (Gar.) Game Design Adam Vesecký Design Sprint Ond State Marka Marda Michal Manda David Pešek (Gar.) 	t enroll as a ve course.Correcompletion Completion Z,ZK Z,ZK Z,ZK Z,ZK Z,ZK Z,ZK Z,ZK Z,Z	compuls ourses o ted. Credits 1 4 5 4 5 4 5 4 5 4 5 4 5 4 5 2 4	Sory sub f this gri Scope 2P+2C 2P+1C 2P+1C 2P+1C 2P+1C 3C 3C 2P+1C 30B 1P+2C	ject in the oup that Semeste L L Z Z L Z L Z	e student r Role V V V V V V V V V V V V V V V V V V V
Requirement cou Credits in the grou Note on the grou NI-AOA NI-ATH NI-AFP NI-AFP NI-APH NI-VGA NI-BPS NIE-BLO NI-CTF NI-DPH NI-DSW	 P: In addition to the courses listed here, you can enroll a your study program and form of study that you did not program/branch/specialization or a compulsory election has completed in the bachelor study at CTU cannot be has completed in the bachelor study at CTU cannot be seen to the course / Name of the group of courses (in case of groups of courses the list of codes of their members) Tutors, authors and guarantors (gar.) Completing a professional event Zden k Muziká AlgorithmicTheories of Games Dušan Knop, Tomáš Valla Tomáš Valla Tomáš Valla (Gar.) Applied Functional Programming Robert Pergl, Marek Suchánek, Daniel N mec Robert Pergl Robert Pergl (Gar.) Architecture of computer games Adam Vesecký Adam Vesecký (Gar.) Video Games Architecture Jan Matoušek Wireless Computer Networks Ji í Kašpar, Alexandru Moucha Alexandru Moucha (Gar.) Blockchain Röbert Lórencz (Gar.) Capture The Flag Ji í Dostál, Martin Šutovský, Ivana Trummová, Ladislav Marko, František Ková Ji í Dostál, Martin Šutovský, Ivana Trummová, Ladislav Marko, František Ková Ji í Dostál (Gar.) Game Design Adam Vesecký Design Sprint Ond ej Brém, Michal Manda Michal Manda David Pešek (Gar.) Digital drawing Denisa Nová ková Denisa Nová ková 	t enroll as a ve course.Correcomplete enroll as a ve course.Correct end of the re-complete	compuls ourses o ted. Credits 1 4 5 4 5 4 5 4 5 4 5 2	Sory sub f this gri Scope 2P+2C 2P+1C 2P+1C 2P+1C 2P+1C 3C 3C 2P+1C 30B	ject in the oup that Semeste L L Z Z L Z L	e student r Role V V V V V V V V V V V V V V V V V V V
Requirement cou Credits in the grou Note on the grou NI-AOA NI-ATH NI-AFP NI-AFP NI-APH NI-VGA NI-BPS NIE-BLO NI-CTF NI-DPH NI-DSW NI-PSD	 hup: 0 p: In addition to the courses listed here, you can enroll a your study program and form of study that you did no program/branch/specialization or a compulsory election has completed in the bachelor study at CTU cannot the second study at CTU cannot study at CTU cannot the second study at the second study at CTU cannot study at the second study at the sec	t enroll as a ve course.Correcompletion Completion Z,ZK Z,ZK Z,ZK Z,ZK Z,ZK Z,ZK Z,ZK Z,Z	compuls ourses o ted. Credits 1 4 5 4 5 4 5 4 5 4 5 4 5 4 5 2 4	Sory sub f this gri Scope 2P+2C 2P+1C 2P+1C 2P+1C 2P+1C 3C 3C 2P+1C 30B 1P+2C	ject in the oup that Semeste L L Z Z L Z L Z	e student r Role V V V V V V V V V V V V V V V V V V V

NI-DDM	Distributed Data Mining	KZ	4	3C	L	V
NI-PAM	Tomáš Borovi ka Efficient Preprocessing and Parameterized Algorithms	Z,ZK	4	2P+1C	L	v
NI-ESC	Ond ej Suchý Ond ej Suchý Ond ej Suchý (Gar.) Experimental Project Course	KZ	8	0P+31R+52C		v
NI-GLR	Jan Matoušek, Ond ej Brém Ond ej Brém Ond ej Brém (Gar.) Games and reinforcement learning	Z,ZK	4	2P+2C		v
	Juan Pablo Maldonado Lopez Graph Neural Networks					
NI-GNN	Miroslav epek Miroslav epek Miroslav epek (Gar.)	Z,ZK	4	1P+1C	L	V
NI-GRI	Grid Computing André Sopczak, Petr Fiedler Pavel Tvrdík André Sopczak (Gar.)	Z,ZK	5	2P+1C	Z	V
NI-HCM	Mind Hacking Marcel Ji ina, Josef Holý Marcel Ji ina Marcel Ji ina (Gar.)	ZK	5	2P+1C	Z	V
NI-HSC	Side-Channel Analysis in Hardware Vojt ch Miškovský, Petr Socha Petr Socha Vojt ch Miškovský (Gar.)	Z,ZK	4	2P+2C	Z	V
NI-HMI2	History of Mathematics and Informatics Alena Šolcová Alena Šolcová Alena Šolcová (Gar.)	ZK	3	2P+1C	Z	V
NI-IBE	Information Security Igor ermák	ZK	2	2P	Z	V
NI-IVS	Intelligent embedded systems Miroslav Skrbek Miroslav Skrbek (Gar.)	KZ	4	1P+3C	L	V
NI-IKM	Internet and Classification Methods Martin Hole a Martin Hole a Martin Hole a (Gar.)	Z,ZK	4	1P+1C	L	V
NI-IAM	Internet and Multimedia	Z,ZK	4	2P+1C	L	V
NI-IOT	Internet of Things Jan Jane ek	Z,ZK	4	2P+1C	L	V
FITE-EHD	Introduction to European Economic History Tomáš Evan	Z,ZK	3	2P+1C	L	V
NI-KTH	Combinatorial Theories of Games Tomáš Valla Tomáš Valla Tomáš Valla (Gar.)	Z,ZK	4	2P+1C	L	V
NI-FMT	Finite model theory Tomáš Jakl Tomáš Jakl (Gar.)	Z,ZK	4	2P+1C	L	V
NI-CCC	Creative Coding and Computational Art Radek Richtr, Josef Kortán Radek Richtr Radek Richtr (Gar.)	KZ	4	1P+2C	Z,L	V
NI-KYB	Cybernality	ZK	5	2P	Z	V
NI-LSM2	Statistical Modelling Lab Kamil Dedecius Kamil Dedecius (Gar.)	KZ	5	3C	Z,L	V
NI-LOM	Linear Optimization and Methods Dušan Knop Dušan Knop Dušan Knop (Gar.)	Z,ZK	5	2P+1C	Z	V
NI-MPL	Managerial Psychology Jan Fiala Jan Fiala Jan Fiala (Gar.)	ZK	2	2P	Z,L	V
NI-MSI	Mathematical Structures in Computer Science Jan Starý	Z,ZK	4	2P+1C	L	V
NI-MZI	Mathematics for data science Št pán Starosta	Z,ZK	4	2P+1C	L	V
FIT-ITI	Modern IT infrastructure Ivan Šime ek	Z,ZK	5	2P+1C	Z,L	V
NI-MOP	Modern Object-Oriented Programming in Pharo Jan Blizni enko Robert Pergl Robert Pergl (Gar.)	KZ	4	3C	Z	V
NI-NLM	Neural Language Models	Z	5	2P+1C	L	V
NI-NMS	Neural Networks, Machine Learning and Randomness Martin Hole a	Z,ZK	4	1P+1C	Z	V
NI-NMU	New media in art and design Zden k Svejkovský Zden k Svejkovský Zden k Svejkovský (Gar.)	ZK	3	2P+0C	Z	V
NI-OLI	Linux Drivers Jaroslav Borecký, Miroslav Skrbek Jaroslav Borecký Miroslav Skrbek (Gar.)	Z,ZK	4	2P+2C	L	V
NIE-PML	Personalized Machine Learning Rodrigo Augusto Da Silva Alves Karel Klouda Rodrigo Augusto Da Silva Alves (Gar.)	Z,ZK	5	2P+1C	Z	V
NI-ARI	Computer arithmetic Pavel Kubalík Pavel Kubalík Alois Pluhá ek (Gar.)	Z,ZK	4	2P+1C	Z,L	V
NI-PG1	Computer Grafics 1 Radek Richtr Radek Richtr Radek Richtr (Gar.)	ZK	4	2P+1C	L	v
NI-PIV	Computer Vision Radek Richtr	Z,ZK	5	2P+2C	Z	V
NI-EDW	Enterprise Data Warehouse Systems Jakub Krej í, Robert Kotlá Jakub Krej í Magda Friedjungová (Gar.)	Z,ZK	5	1P+1C	L	V
NI-PVR	Advanced Virtual Reality Petr Pauš Petr Pauš Petr Pauš (Gar.)	KZ	4	2P+1C	Z	V
NI-AML	Advanced machine learning Zden k Buk, Miroslav epek, Rodrigo Augusto Da Silva Alves, Petr Šimánek, Vojt ch Rybá Miroslav epek Miroslav epek (Gar.)	Z,ZK	5	2P + 1C	L	v

NI-IOS	Advanced techniques in iOS applications Rostislav Babá ek, Jakub Olejník, Igor Rosocha Martin P Ipitel Martin P Ipitel (Gar.)	KZ	4	2P+2C	L	V
NI-APT	Advanced Program Testing Pierre Donat-Bouillud Pierre Donat-Bouillud Pierre Donat-Bouillud (Gar.)	Z,ZK	5	2P+1C	Z	V
NI-PVS	Advanced embedded systems Miroslav Skrbek	Z,ZK	4	2P+2C	Z	V
NI-DNP	Advanced .NET David Šenký , Nikolas Jíša David Šenký Nikolas Jíša (Gar.)	Z,ZK	4	2P+1C	Z	V
NI-PYT	Advanced Python Miroslav Hron ok	KZ	4	3C	Z	V
NIE-PDL	Practical Deep Learning Martin Barus, Yauhen Babakhin Karel Klouda Karel Klouda (Gar.)	KZ	5	2P+1C	Z	V
NI-GOL	Programming of distributed systems in GO	KZ	5	0P+3C	Z	V
NI-PSL	Programming in Scala Jií Dan ek Jií Dan ek Jií Dan ek (Gar.)	Z,ZK	4	2P+1C	Z	V
NI-RUB	Programming in Ruby Cyril erný Cyril erný Cyril erný (Gar.)	KZ	4	3C	Z	V
NI-ROZ	Pattern Recognition Radek Richtr, Michal Haindl Michal Haindl Michal Haindl (Gar.)	Z,ZK	5	2P+1C	Z	V
NI-PLS1	Programming Language Seminar	Z	2	0P+1C	Z	V
NI-PLS3	Pierre Donat-Bouillud Programming Language Seminar	Z	2	0P+1C	Z	V
NI-PLS2	Pierre Donat-Bouillud Programming Language Seminar	 Z	2	0P+1C	L	v
	Pierre Donat-Bouillud Programming Language Seminar	L	2	01 +10	L	v
NI-PLS4	Pierre Donat-Bouillud, Filip K ikava Pierre Donat-Bouillud Pierre Donat-Bouillud (Gar.)	Z	2	0P+1C	L	V
NI-SCE1	Computer Engineering Seminar Master I Hana Kubátová Miroslav Skrbek Hana Kubátová (Gar.)	Z	4	2C	L,Z	V
NI-SCE2	Computer Engineering Seminar Master II Hana Kubátová Hana Kubátová Hana Kubátová (Gar.)	Z	4	2C	L,Z	V
NI-SZ1	Knowledge Engineering Seminar Master I Pavel Kordík Magda Friedjungová (Gar.)	Z	4	2C	L,Z	V
NI-SZ2	Knowledge Engineering Seminar Master II Pavel Kordík Magda Friedjungová (Gar.)	Z	4	2C	L,Z	V
PI-SCN	Seminars on Digital Design Petr Fišer Petr Fišer (Gar.)	ZK	4	2P+1C	Z,L	V
NI-MLP	Machine Learning in Practice Jan Hu ín Daniel Vašata Daniel Vašata (Gar.)	Z,ZK	5	2P+1C	Z	V
FIT-SEP	World Economy and Business Tomáš Evan	Z,ZK	4	2P+2C	L	V
NI-SEP	World Economy and Business Tomáš Evan Tomáš Evan Tomáš Evan (Gar.)	Z,ZK	4	2P+1C	Z,L	V
NI-TVR	Virtual Reality Technology Tomáš Nová ek Tomáš Nová ek Tomáš Nová ek (Gar.)	Z,ZK	3	1P+1C	L,Z	V
NI-TS1	Theoretical Seminar Master I Dušan Knop, Ond ej Suchý, Tomáš Valla Tomáš Valla Tomáš Valla (Gar.)	Z	4	2C	Z	V
NI-TS2	Theoretical Seminar Master II	Z	4	2C	L	V
NI-TS3	Ond ej Suchý, Tomáš Valla Tomáš Valla Tomáš Valla (Gar.) Theoretical Seminar Master III	Z	4	2C	Z	V
NI-TS4	Ond ej Suchý, Tomáš Valla Tomáš Valla Tomáš Valla (Gar.) Theoretical Seminar Master IV	Z	4	2C	L	V
NI-TKA	Ond ej Suchý, Tomáš Valla Tomáš Valla Ond ej Suchý (Gar.) Category Theory	Z,ZK	4	2P+1C	L	V
NI-TNN	Jan Starý Jan Starý Jan Starý (Gar.) Theory of Neural Networks	Z,ZK	5	2P+1C	L	V
NI-CPX	Martin Hole a Martin Hole a Martin Hole a (Gar.) Complexity Theory	Z,ZK	5	3P+1C	Z	V
FI-TOP	Dušan Knop, Ond ej Suchý Ond ej Suchý Ond ej Suchý (Gar.) Academic writing	Z	2	10B	Z	V
	Tomáš Nová ek Introduction to Discrete and Computational Geometry					
NI-DVG	Maria Saumell Mendiola Maria Saumell Mendiola Maria Saumell Mendiola (Gar.)	Z,ZK	5	2P+1C	L	V
NI-VOL	Elections Dušan Knop Dušan Knop Dušan Knop (Gar.)	Z,ZK	5	2P+1C	L	V
NI-VYC	Computability Jan Starý Jan Starý Jan Starý (Gar.)	Z,ZK	4	2P+2C	L	V
NI-VPR	Research Project Št pán Starosta Št pán Starosta Št pán Starosta (Gar.)	Z	5		Z,L	V
NI-ZS10	Master internship abroad for 10 credits Zden k Muziká Zden k Muziká (Gar.)	Z	10		Z,L	V
NI-ZS20	Master internship abroad for 20 credits Zden k Muziká Zden k Muziká (Gar.)	Z	20		Z,L	v

NI-ZS30	Master internship abroad for 30 credits Zden k Muziká Zden k Muziká (Gar.)	Z	30		Z,L	V
Characteristics of the	courses of this group of Study Plan: Code=NI-V.2021 Name=P	urely Electiv	e Master (Courses		
NI-AOA Co	mpleting a professional event			;	Z	1
	n a one-off professional event, usually a lecture by a foreign guest of the FIT CTU, con e by the vice-dean for pedagogical activities or the vice-dean for science and research		-	-	-	
NI-ATH Alg	orithmicTheories of Games			Ζ,	ZK	4
	branch of mathematics, which has broad applications in economy, biology, politics and	-	-			-
	itive process by designinng a mathematical model and investigating the strategies. The		•	,		
-	ame where no player wants to deviate from his strategy. Due to the recent development or concepts the algorithmic point of view is gaining attention. In addition to existential q	-				-
	irse we introduce the basics of game theory of many players, solution concept (usually	-	-		-	
· · · · · ·	plied Functional Programming				Z	5
1	Czech. Functional programming represents one of the traditional programming paradig	ms. Traditional an	d novel funct			-
	inctional paradigm becomes an important construct of traditionally imperative language					
necessary competence of a	software engineer: the theory and especially the practice.					
NI-APH Arc	chitecture of computer games			Z,	ZK	4
-	lerstanding of the various issues in the field of computer games development, especially	-			-	
	rasp of component-oriented and functional-oriented architecture, game mechanics, dec			-		-
	Il also understand the basics of pathfinding, networking and scripting and apply them in name, with a strong focus on nontrivial game mechanics.	n practical exercis	ses (labs). An	important p	bart of the c	ourse is an
	leo Games Architecture			7	ZK	5
	nge of topics, procedures and methodologies related to the development of computer	games - from a te	echnical point		1	-
	the lectures, students will be guided through the history of development, the structure	-				-
game development, physics,	graphics, artificial intelligence and multiplayer. The exercises will then cover selected to	echnological topic	cs in greater d	letail, includ	ling ways of	implementing
some game mechanics, in th	e form of practical demonstrations.					
NI-BPS Wi	reless Computer Networks			Z,	ZK	4
	modern technologies, protocols, and standards for wireless networks. They will under	•				
	data flow control mechanisms. They will also learn about principles of communication			nowledge o	of security m	nechanisms
	t skills of configuration of wireless network elements and simulation of wireless network	rks using suitable	toois.	7	71/	
1	ockchain foundations of blockchain technology, smart contract programming, and gain an overvi	ow of most notabl	o blockchoin i			5 able to design
	ecentralized application, and assess whether integration of a blockchain is suitable for			-	-	-
	nains and information security. It is concluded with a defense of a research or applied s		-		-	
	of blockchain-based solutions in both academia and business.					Ū
NI-CTF Ca	pture The Flag			k	(Z	4
	troduce students to CTF competitions and let them gain practical experience in the fiel	ld of cyber securi	ty.		. <u></u>	
	me Design			1 1	ZK	5
	NI-APH (Architecture of Computer Games) and BI-VHS (Virtual gaming worlds) cours			•		
	lge of the principles used for games design, such as: level design, gameplay design, c ents will get an overview of game development from the designer's perspective, from th	-	-	-		-
projects.	ents will get an overview of game development norm the designer's perspective, norm t	leoretical concep		Implemente		u lo semestiai
· · · ·	sign Sprint				7	2
	s using the Design Sprint method, developed by Google. THanks to this method the tea	ams are able to g	o from idea to	validated p	rototype in a	5 days. During
	get familiar with the method as participants. Through practical challenges they will try the	-				
testing the prototypes (plus f	inal presentation).					
-	blic Services Design				KZ	4
	dents to specifics of UX, Service design and development for public sector. We will loc	-		-		
	sr) as well as clients. In small teams students will work on projects from partner organi	zations and will tr	y out collabo	ration with c	lient repres	entatives.
Course is aimed at students-					7	<u> </u>
	jital drawing dents to the basic principals of digital drawing and graphical design. Students will gain	understanding o	f composition	1	Z	2 theory which
	heir own design works. Students will also gain experience in drawing and painting with					
	painting. The course is organized as a thematic practices covering parts of theory an	-	-		-	
NI-DZO Dig	ital Image Processing			Ζ,	ZK	4
This course presents a comp	prehensive overview of modern methods for interactive editing of digital images and vio	deo. It mainly dea	Is with practic	al algorithm	ns that are b	ooth easy to
	esting theoretical basis. Visually attractive applications provide better understanding of b		•			
	This course will introduce algorithms solving the following practical applications: edge-a	-		-		-
	on, hybrid images, gradient domain editing, seamless image stitching and cloning, digit le image deformation, free-form image registration, texture synthesis, interactive segment of the segment of the		-	-		
	tributed Data Mining		allon, painting		Z	4
	he-art approaches for distributed data mining and parallelization of machine learning a	algorithms Stude	nts will gain h		- 1	-
	Apache Spark and with existing distributed DM / ML algorithms. They will learn principle	-	-	-		-
	her algorithms. The course is prezented in czech language.				·	
NI-PAM Eff	icient Preprocessing and Parameterized Algorithms			Ζ,	ZK	4
	problems for which no polynomial time algorithms are known (e.g. NP-complete probl	ems). Despite tha	at it is often ne			problems
	emonstrate that many problems can be solved much more effectively than by naively tr					
	n practice-e.g., all solutions are relatively small. Parameterized algorithms exploit that b				-	
	size (which can be huge). Parameterized algorithms also represent a way to formalize lassical complexity. Such a polynomial time preprocessing is then a suitable first step,			-		
	gorithm design methods and we will also show how to prove that for some problem (ar					-
1. · · ·	tions to other approaches to hard problems such as moderately exponential algorithm	-	-			

	Experimental Project Course	KZ	8	
	urse offers a holistic exploration of the design process, providing students with a well-rounded understanding of the principles	-		
	r-driven solutions that are user-centric and industry-relevant. Throughout the semester, students will work on real-world design tegrate theory with practical application. Through a hands-on, project-based learning approach, students will develop their sk			
	tion, as well as gain experience working in a team to design and prototype a functional solution."		eu uesigit anu	
NI-GLR	Games and reinforcement learning	Z,ZK	4	
-	ent learning is very hot recently, because of advances in deep learning, recurrent neural networks and general artificial intellig		•	
	al and practical background so you can participate in related research activities. Presented in English.	-		
NI-GNN	Graph Neural Networks	Z,ZK	4	
The course introduces	students to advanced artificial intelligence techniques for working with graphs. Lectures will focus on the latest graph neural r	networks for creati	ng vector	
	es, edges and entire graphs. The techniques discussed cover various types of graphs, including time-varying graphs. The last	part of the course	e also covers	
	nterpretability of graph neural networks. In the exercises, students will try out selected techniques and problems.			
NI-GRI	Grid Computing	Z,ZK	5	
	in knowledge about the world-wide network and computing infrastructure.	71/	5	
NI-HCM	Mind Hacking emerging discipline that is closely related to cyber security. While the domain of cyber security is the protection of networks,	ZK	5	
	security is the protection of the human mind from intentional and unintentional digital manipulation. The topic of cognitive sec	-		
-	on warfare, increasing digital dependence and the development of artificial intelligence, where these phenomena from the Inter		-	
	tion of social cohesion, threats to democracy or war.			
NI-HSC	Side-Channel Analysis in Hardware	Z,ZK	4	
This course is dedicate	d to so-called side-channel information leakage in hardware devices. It focuses on both theoretical analysis and practical atta	cks. Students get	familiar with	
	nannels and they get deeper insight in power attacks. Students learn to implement various profiled and non-profiled attacks ar	-	n higher-order	
	practice in both designing the SCA countermeasures and analyzing the amount and characteristics of the side-channel inform			
NI-HMI2	History of Mathematics and Informatics	ZK	3	
	ed in Czech. Selected topics (Infinitesimal calculus, probability, number theory, general algebra, different examples of algorithr s, etc.) note on possibilities of applications of some mathematical methods in informatics and its development.	ms, transformation	is, recursive	
· ·		71/	2	
NI-IBE Students learn informa	Information Security tion and IS/ICT security management systems (ISMS), methods for information access control, and basic norms and internat	ZK ZK	2 this area. They	
	r management of internal and external security threats, for IS/IT security audits, and for application security testing (e.g., pen		this area. They	
NI-IVS	Intelligent embedded systems	KZ	4	
	stems course for master's degree is focused on high-level technology embedded systems integrating artificial intelligence. The	I I	·	
of the Intelligent embed	Ided system fundamentals course for the bachelor degree. The aim of the course is to teach students humanoid robot progra	mming and advan	ce application	
	provide basis of motion control, sensor reading, application interfaces, robot navigation and development tools. In labs, studer	nts develop advan	ced applications	
	of various courses like nature inspired algorithms, data mining algorithms, image recognition and web technologies			
NI-IKM	Internet and Classification Methods	Z,ZK	4	
	ents get acquainted with classification methods used in four important internet, or generally network applications: in spam filte	-	-	
in malware detection systems and in intrusion detection systems. However, they will learn more than only how classification is performed when solving these four kinds of problems.				
-		-		
On the background of t	hese applications, they get an overview of the fundamentals of classification methods. The course is taught in a 2-weeks cycl	le with 2-hour lectu		
On the background of t	hese applications, they get an overview of the fundamentals of classification methods. The course is taught in a 2-weeks cycl xercises, the students on the one hand implement simple examples to topics from the lectures, on the other hand consult the	le with 2-hour lectu		
On the background of t exercises. During the e NI-IAM	hese applications, they get an overview of the fundamentals of classification methods. The course is taught in a 2-weeks cycl	ir semester tasks.	ures and 2-hour	
On the background of t exercises. During the e NI-IAM The NI-IAM course is fo	hese applications, they get an overview of the fundamentals of classification methods. The course is taught in a 2-weeks cycl xercises, the students on the one hand implement simple examples to topics from the lectures, on the other hand consult the Internet and Multimedia	e with 2-hour lectu ir semester tasks. Z,ZK cquisition of AV sig	ures and 2-hour 4 gnals (input),	
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UHME Mathematical Structures in Computer Science Z_ZK 4 international semantical or programming anguages. Data types as continuous latices, Scott topology. Procedures as continuous mapping. The Scott model of lambdas calculus. International semantical semantics for data science Z_ZK 4 International semantical semantical series of the science of th	NH-MSI Mathematical Structures in Computer Science ZZK 4 Mathematica encode of programming languages. Data types as continuous latices. Scott topology. Procedures as continuous mappings. The Scott model of lambda calculus. NH-M2I Mathematics for data science. ZZK 4 In this cours, students are introduced to those fields of mathematics that are necessary for understanding standard methods and approxes to student standard. ZZK 5 NH-M2I Mathematics for data science. ZZK 5 NH-M0P Modern Thinfastructure ZZK 4 Object-Oriented Programming is currently and statistics. KZ 4 Collect-Oriented Programming is currently and statistics. KZ 4 Object-Oriented Programming is currently approach to statistics. KZ 4 Collect-Oriented Programming is currently approach to statistics. KZ 4 Dispect-Oriented Programming is currently approach to statistics. KZ 4 Dispect-Oriented Programming is currently approach to statistics. KZ 4 Dispect-Oriented Programming is currently approach to statistics. KZ 4 Dispect-Oriented Programming is currently approach to statistis approach to interesting pro				
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	in virtual reality or directly create a complex name for VR	-		e knowledge gain	ed in this subject
		in virtual reality, or dire	ctly create a complex game for VR.		

	Z,ZK	5
The course introduces students to selected advanced topics of machine learning and artificial intelligence. The topics present techniques processing, control and interconnection of physical laws with the field of machine learning. The aim of the exercise is to familiarize students are students at the field of machine learning.		tems, image
NI-IOS Advanced techniques in iOS applications	KZ	4
Students will learn the latest trends in mobile development technologies for iOS platform. Class covers advanced topics, students need	to know all the basics from the beg	inners class
BI-IOS. NI-APT Advanced Program Testing	Z.ZK	5
Testing a program is essential to ensure that a program respects its specification, that changes do not introduce regressions or security	I ' I	-
advanced program testing techniques, beyond writing unit tests, especially fuzzing and symbolic execution.		
NI-PVS Advanced embedded systems	Z,ZK	4
The course is focused on ARM processors and microcontrollers and their usage in wide range of applications. The course includes a si working with mass storage devices, motor control, system control and industrial communication. The students obtain both theoretical a		
systems.		
NI-DNP Advanced .NET	Z,ZK	4
Students will acquire an overview of platform .NET and will gain knowledge about technologies ASP.NET Core, Entity Framework Core get notions of Azure DevOps and GIT. Students will get practical experience in semestral work where they will create a client-server ap		
Entity Framework Core and (Blazor, .NET MAUI or WPF) and also Azure DevOps and GIT.		
NI-PYT Advanced Python	KZ	4
The goal of this course is to learn various advanced techniques and methods in Python. The course indirectly continues where Program		
very hands-on and it has only tutorials, everything is demonstrated on examples. Classification is based on work in class as well as seme teachers from Red Hat.	strai coursework. The course is lea	a by external
NIE-PDL Practical Deep Learning	KZ	5
This course is designed to provide students with a comprehensive understanding of Deep Learning using PyTorch, a popular open-sou	-	-
the course, students will develop practical skills in building and training deep neural networks, using PyTorch to solve real-world probler language processing.	ns in fields such as computer visior	and natural
NI-GOL Programming of distributed systems in GO	KZ	5
NI-PSL Programming in Scala	Z,ZK	4
The course introduces the modern programming language Scala which exploits object-functional paradigm. Scala comprises advance	· · · ·	ching and
advance standard library. Scala enables to use of applications functional patterns e.g. H-List, Monads, etc. Scala is used by many powerful	Il frameworks and libraries e.g. Play	Cassandra,
Scalaz, etc. NI-RUB Programming in Ruby	KZ	4
This course is presented in Czech.		4
NI-ROZ Pattern Recognition	Z,ZK	5
The aim of the module is to give a systematic account of the major topics in pattern recognition with emphasis on problems and application with a systematic account of the major topics in pattern recognition with emphasis on problems and application with a systematic account of the major topics in pattern recognition with emphasis on problems and application with a systematic account of the major topics in pattern recognition with emphasis on problems and application with emphasis on pro		-
recognition. Students will learn the fundamental concepts and methods of pattern recognition, including probability models, parameter NI-PLS1 Programming Language Seminar	estimation, and their numerical asp	ects. 2
The Programming Language Seminar aims to introduce students to research in programming languages. It has the format of a reading		_
about programming languages and related fields. Participating students are expected to present a paper of their interest and actively p		
	articipate in the discussions. The re	ading group
is a joint venue between FIT and MFF CUNI. It is open to all students and researchers interested in programming languages.		
NI-PLS3 Programming Language Seminar	Z	2
	group in which we discuss scientif	2 ic papers
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NI-MLP Machine Learning in Practice	Z,ZK	5
Applying machine learning methods to real projects in practice involves many other necessary tasks - from understanding the intentions of the client t		-
The course guides students through all phases of a project according to the standard CRISP-DM methodology, not only theoretically but also pract		
data processing and learn how to describe the whole process from exploration to evaluation of the model performance in the form of a clear and ur		
FIT-SEP World Economy and Business	Z,ZK	4
This course is presented in Czech. The course introduces students of technical university to the international business. It does that predominantly business are considered with the international business.	1 ' 1	
and key regions of world economy. Students get to know about different religions and cultures, necessary for doing business in diverse societies as w		
corruption and economic development, which are needed for the right investment decision. Seminars help to improve on the knowledge in the form		
readings. It is advised to take bachelor level of this course BIE-SEP as a prerequisite.		
NI-SEP World Economy and Business	Z,ZK	4
This course is presented in Czech. However, there is an English variant in the program Informatics (N1801 / 4793). The course introduces students	1 · · · ·	-
international business. It does that predominantly by comparing individual countries and key regions of world economy. Students get to know about		-
necessary for doing business in diverse societies as well as indexes of economic freedom, corruption and economic development, which are need	-	
Seminars help to improve on the knowledge in the form of discussions based on individual readings. It is advised to take bachelor level of this cour	•	
NI-TVR Virtual Reality Technology	Z,ZK	3
Students will be introduced to the basic concepts of virtual reality. Techniques for displaying virtual worlds (CAVE, HMD,) and the possibilities of	controlling virtual a	vatars (position
tracking, hand tracking, eye tracking) will be discussed. Furthermore, the concepts of mixed and augmented reality will be introduced. Finally, ways	of using virtual and	augmented
reality will be presented.		
NI-TS1 Theoretical Seminar Master I	Z	4
Theoretical seminar is intended for students which want to come in deeper contact with contemporary theoretical computer science. It is mostly a cl	assical reading grou	up. The students
are treated individually and concern themselves with interesting topics from the latest research in the area. Therefore, an integral part of the course		
other scholarly literature. The capacity is limited by the the potentials of the teachers of the seminar.		
NI-TS2 Theoretical Seminar Master II	7	4
Theoretical seminar is intended for students which want to come in deeper contact with contemporary theoretical computer science. It is mostly a cl	assical reading grou	up. The students
are treated individually and concern themselves with interesting topics from the latest research in the area. Therefore, an integral part of the course		· .
other scholarly literature. The capacity is limited by the the potentials of the teachers of the seminar.		
NI-TS3 Theoretical Seminar Master III	Z	4
Theoretical seminar is intended for students which want to come in deeper contact with contemporary theoretical computer science. It is mostly a cl	1 – 1	-
are treated individually and concern themselves with interesting topics from the latest research in the area. Therefore, an integral part of the course		
other scholarly literature. The capacity is limited by the the potentials of the teachers of the seminar.		nine papere ana
NI-TS4 Theoretical Seminar Master IV	7	4
Theoretical seminar is intended for students which want to come in deeper contact with contemporary theoretical computer science. It is mostly a cl	1 – 1	
are treated individually and concern themselves with interesting topics from the latest research in the area. Therefore, an integral part of the course		
other scholarly literature. The capacity is limited by the the potentials of the teachers of the seminar.		nine papers and
	7.71/	4
NI-TKA Category Theory	Z,ZK	4
NI-TNN Theory of Neural Networks	Z,ZK	5
NI-TNN Theory of Neural Networks In this course, we study neural networks from the point of view of the theory of function approximation and from the point of view of probability theory	Z,ZK ry. At first, we recal	5 I basic concepts
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NI-ZS10Master internship abroad for 10 creditsZEach student can once within his / her master's degree have a foreign internship at a foreign university or other foreign scientific and/or research institution. Before the Dean of the FIT, or the vice-dean for study affairs assesses the professional content. The student must provide evidence of the professional content and extent of the inter courses MI-ZS10, MI-ZS20, MI-ZS30 are used used for the evidence and evaluation of the internship in IS KOS. Every 10 credits correspond to 4 weeks of full-time er a foreign institution. The maximum number of credits a student can earn for one internship is 30 credits. This amount can be divided into two subjects if the internship academic year's dead-line.NI-ZS20Master internship abroad for 20 creditsZEach student can once within his / her master's degree have a foreign internship at a foreign university or other foreign scientific and/or research institution. Before the Dean of the FIT, or the vice-dean for study affairs assesses the professional content. The student must provide evidence of the professional content and extent of the inter courses MI-ZS10, MI-ZS20, MI-ZS30 are used used for the evidence and evaluation of the internship in IS KOS. Every 10 credits correspond to 4 weeks of full-time er a foreign institution. The maximum number of credits a student can earn for one internship in IS KOS. Every 10 credits correspond to 4 weeks of full-time er a foreign institution. The maximum number of credits a student can earn for one internship is 30 credits. This amount can be divided into two subjects if the internship academic year's dead-line.NI-ZS30Master internship abroad for 30 creditsNI-ZS30Master internship abroad for 30 creditsNI-ZS30Master internship abroad for 30 creditsNI-ZS3	must provide evidence of the professional content and extent of the internship. Auxiliary nship in IS KOS. Every 10 credits correspond to 4 weeks of full-time employment with
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List of courses of this pass:

Code	Name of the course	Completion	Credits	
FI-TOP	Academic writing	Z	2	
Publishing is an im	portant and required part of research activity. It is not only about obtaining research results but also about applying them in the form of	of publication. Writi	ng scientific	
publications can be	e useful for students not only in their own publishing activities but also in the preparation of a bachelor's or master's thesis. In the cou	rse, students will le	earn how to	
write a scientific art	icle, what parts such an article should have, and how the peer review process works. Students will also try their hand at presenting an	article and reviewing	ng someone	
else's article. The	course will be taught in blocks, with one lecture at the beginning of the semester and one practicum in the middle of the semester. Da	ates will be determ	ined based	
	on the availability of enrolled students.			
FIT-ITI	Modern IT infrastructure	Z,ZK	5	
FIT-SEP	World Economy and Business	Z,ZK	4	
	sented in Czech. The course introduces students of technical university to the international business. It does that predominantly by co			
, ,	world economy. Students get to know about different religions and cultures, necessary for doing business in diverse societies as well as			
corruption and eco	nomic development, which are needed for the right investment decision. Seminars help to improve on the knowledge in the form of di	scussions based of	on individual	
	readings. It is advised to take bachelor level of this course BIE-SEP as a prerequisite.			
FITE-EHD	Introduction to European Economic History	Z,ZK	3	
The course introdu	ices a selection of themes from the European economic history. It gives the student basic knowledge about forming of the global eco	nomy through the	description	
	in history. As European countries have been dominant actors in this process it focuses predominantly on their roles in the economic	, ,		
	pire to fragmentation of the Middle Ages, from destruction of WWII to the current affairs, the development of modern financial instituti			
does not cover de	tailed economic history of particular European countries but rather the impact of trade and role of particular events, institutions and c	rganizations in his	tory. Class	
	meetings will consist of a mixture of lecture and discussion.		r	
NI-ADM	Data Mining Algorithms	Z,ZK	5	
	s on algorithms used in the fields of machine learning and data mining. However, this is not an introductory course, and the students s		•	
basics. The empha	sis is put on advanced algorithms (e.g., gradient boosting) and non-basic kinds of machine learning tasks (e.g., recommendation syst	tems) and models	(e.g., kernel	
	methods).			
NI-ADP	Architecture and Design patterns	Z,ZK	5	
	s course is to provide students with both work knowledge about the underlying foundations of object-oriented design and analysis as		0	
	ues, and tradeoffs of advanced software design. In the first part of the course, the students will refresh and deepen their knowledge o		• •	
e e e e e e e e e e e e e e e e e e e	the commonly used object-oriented design patterns that represent the best practices for solving common software design problems. I			
will be introduced to	the principles of software architecture design and analysis. This includes the classical architectural styles, component based systems	, and some advanc	ed software	
	architectures used in large-scale distributed systems.			
NI-AFP	Applied Functional Programming	KZ	5	
	ented in Czech. Functional programming represents one of the traditional programming paradigms. Traditional and novel functional p			
the rise nowadays	and the functional paradigm becomes an important construct of traditionally imperative languages (C++, C#, Java). As such, master	ing this paradigm	becomes a	
	necessary competence of a software engineer: the theory and especially the practice.	7 71/	-	
NI-AIB	Algorithms of Information Security	Z,ZK	5	
Students will get acquainted with the algorithms of secure key generation and cryptographic error (not only biometric) data processing. Furthermore, students will learn the mathematical				
principles of cryp	tographic protocols (identification, authentication, and signature schemes). Another part of the course is dedicated to malware detec		machine	
	learning in detection systems. The last topic includes practical steganographic methods and attacks on steganographic syste			
NI-AM1	Middleware Architectures 1	Z,ZK	5	
	ly new trends, concepts, and technologies in the area of service-oriented architectures. The will gain an overview of information syste			
architecture and ap	lication servers. The will also study principles and technologies for middleware focused on application integrations, asynchronous comm	iunications and hig	n availability	
	of applications.	7 71/	-	
NI-AM2	Middleware Architectures 2	Z,ZK	5	
Students will learn	new trends and technologies on the Web including theoretical foundations. They will gain an overview of Web application architecture	es, concepts and te	ecnnologies	
	for microservices, distrubuted cache and databases, smart contracts, realtime communication and web security.			

NI-AML	Advanced machine learning	Z,ZK	5
	ces students to selected advanced topics of machine learning and artificial intelligence. The topics present techniques in the field of rec	1 1	ems, image
processing,	control and interconnection of physical laws with the field of machine learning. The aim of the exercise is to familiarize students with	the methods discus	ssed.
NI-AOA	Completing a professional event	Z	1
The subject is part	icipation in a one-off professional event, usually a lecture by a foreign guest of the FIT CTU, concluded with a workshop, a test, drafti	ng a report, etc.Su	ch an event
must be approved	in advance by the vice-dean for pedagogical activities or the vice-dean for science and research and is presented within the FIT three states are stated within the state are stated within the FIT three states are stated within the state are stated within the stated within the state are stated within the stated within the state are stated within the stated w	ough a website, infe	omail, etc.
NI-APH	Architecture of computer games	Z,ZK	4
Students will gain a	basic understanding of the various issues in the field of computer games development, especially from a technical point of view, but also	o from design and p	hilosophical
	vill get a grasp of component-oriented and functional-oriented architecture, game mechanics, decision-making processes and base co		-
part of most game	es. They will also understand the basics of pathfinding, networking and scripting and apply them in practical exercises (labs). An impo	ortant part of the co	ourse is an
	implementation of a simple game, with a strong focus on nontrivial game mechanics.		_
NI-APR	Selected Methods for Program Analysis	Z,ZK	5
	ices you to program analysis, i.e., the automated reasoning about the behavior of a computer program. We will cover static and dynar	-	-
we will look at the a	art of reasoning about computer programs without running them. We will look at the analyses for program understanding, optimization	hs, error detection.	In Dynamic
NI-APT	Analysis, we will look at the analyses considering individual program runs using a concrete environment and inputs.	774	F
	Advanced Program Testing	Z,ZK	5 to procent
l resung a program	n is essential to ensure that a program respects its specification, that changes do not introduce regressions or security issues. The go	al of the course is	to present
	advanced program testing techniques, beyond writing unit tests, especially fuzzing and symbolic execution.	774	4
NI-ARI	Computer arithmetic Students will learn various data representations used in digital devices and will be able to design arithmetic operations implementa	Z,ZK	4
NI-ATH			4
	AlgorithmicTheories of Games theory is a branch of mathematics, which has broad applications in economy, biology, politics and computer science. This theory stu	Z,ZK	-
	ain competitive process by designing a mathematical model and investigating the strategies. The traditional task of classical game t		U U
	s of the game where no player wants to deviate from his strategy. Due to the recent development of computers, internet, social network	-	-
	s and other concepts the algorithmic point of view is gaining attention. In addition to existential questions we study the problems of el		0
	concepts. In this course we introduce the basics of game theory of many players, solution concept (usually equilibria) and methods c		
NI-BKO	Error Control Codes	Z,ZK	5
-	al of the course is to present various ways to detect or correct individual errors and burst errors in data stored into memories or transr	1 / 1	-
NI-BML	Bayesian Methods for Machine Learning	KZ	. 5
	sed on practical use of basic Bayesian modeling methods in the dynamically evolving machine learning theory. In particular, it studies	1 1	-
	description of real phenomena, as well as their subsequent use, e.g., for forecasting of future evolution or learning about the hidden is		
	tions etc.). The emphasis is put on understanding of explained principles and methods and their practical adoption. For this purpose, a		-
	will be presented to students, for instance, 2D/3D object tracking, radiation source term estimation, or separation in medical imaging.		
	some of them.		
NI-BPS	Wireless Computer Networks	Z,ZK	4
Students will lear	n about the modern technologies, protocols, and standards for wireless networks. They will understand the routing mechanisms in ad	l-hoc networks, mu	lticast and
broadcast mecha	nisms, and data flow control mechanisms. They will also learn about principles of communication in sensor networks. They get knowle	edge of security me	echanisms
	for wireless networks and get skills of configuration of wireless network elements and simulation of wireless networks using suitable	ole tools.	
NI-BUI	Business Informatics	Z,ZK	5
The aim of the cour	se is to focus on operational, tactical and strategic management of business informatics. Students will gain knowledge in the areas of b	usiness process ma	anagement,
	architectures in enterprise informatics. They will also learn about the principles, models and standards (ITIL, COBIT) in IT manageme		•
	nd resource management (sourcing). Students will learn the process of creating and implementing information strategy, IT Governan		
business and th	e context of information strategy with global business strategy. They will also gain knowledge in the areas of economic IT manageme management, IT investment evaluation and human resources management in IT (roles CIO, CEO, CFO).	nt, revenue and inv	/estment
		774	F
NI-BVS	Embedded Security c knowledge in selected topics of cryptography and cryptanalysis. The course focuses particularly on efficient implementations of crypto	Z,ZK	5 in bardwara
-	bedded systems). Students gain a good overview of functionality of (hardware) cryptographic accelerators, smart cards, and resources		
	of computer systems.	s for securing intern	
NI-CCC	Creative Coding and Computational Art	KZ	4
	practical tasks, get acquainted with creative and yet proven methods of visualizing various types of data. The course freely follows the	1	
	ices students to suitable visualization methods for traditional as well as for open data. It combines well-known visualization technique		
.,	es. The aim is to create an interesting visualization project. It is planned to work closely with IPR CAMP (Center of Architecture and I		•
	(Institute of Intermedia FEL).	·	0,
NI-CPX	Complexity Theory	Z,ZK	5
	n about the fundamental classes of problems in the complexity theory and different models of algoritms and about implications of the	1 1	
	(in)tractability of difficult problems.	,	,
NI-CTF	Capture The Flag	KZ	4
	The course is designed to introduce students to CTF competitions and let them gain practical experience in the field of cyber se	1	•
NI-DDM	Distributed Data Mining	KZ	4
	e state-of-the-art approaches for distributed data mining and parallelization of machine learning algorithms. Students will gain hands (1	-
	amework Apache Spark and with existing distributed DM / ML algorithms. They will learn principles of their parallel implementations a		
	approaches to parallelize other algorithms. The course is prezented in czech language.		
NI-DDW	Web Data Mining	Z,ZK	5
	arn latest methods and technologies for web data acquisition, analysis and utilization of the discovered knowledge. Students will gain	1 1	
	crawling, Web structure analysis, Web usage analysis, Web content mining and information extraction. Students will also gain an overvie		-
	in the field of social web and recommendation systems.		
NI-DID	Digital drawing	Z	2
	oduce students to the basic principals of digital drawing and graphical design. Students will gain understanding of composition, persp	pective and color th	
they will practically	apply in their own design works. Students will also gain experience in drawing and painting with digital and analog tools. The course	is fit for anyone wh	no wants to
-	r learn drawing and painting. The course is organized as a thematic practices covering parts of theory and practical exercise to practi	ce gained knowled	ge.
NI-DIP	Diploma Project	Z	30

NI-DNP	Advanced .NET	Z,ZK	4
Students will acqui	ire an overview of platform .NET and will gain knowledge about technologies ASP.NET Core, Entity Framework Core, .NET MAUI (W	PF, UWP), Blazor a	ind also will
get notions of Azu	re DevOps and GIT. Students will get practical experience in semestral work where they will create a client-server application utilizing	technologies ASP	NET Core,
	Entity Framework Core and (Blazor, .NET MAUI or WPF) and also Azure DevOps and GIT.		
NI-DPH	Game Design	Z,ZK	5
	ements the NI-APH (Architecture of Computer Games) and BI-VHS (Virtual gaming worlds) course, while focusing primarily on game of the principles used for games design, such as: level design, gameplay design, character design, game mechanics c	-	
	The students will get an overview of game development from the designer's perspective, from theoretical concepts to practical imple		-
	projects.		
NI-DSS	Decision Support Systems	Z,ZK	5
	rse is to provide students with knowledge and skills in decision support systems, their classification (Powerova), selected principles of		
-	ented decision support systems. Students will also gain knowledge of multicriterial decision-making methods and game theory. They will		e principles
	conceptually and ontologically oriented decision support systems and the basics of distribution, optimization and evolution methods a		
NI-DSV	Distributed Systems and Computing uced to methods for coordination of processes in distributed environment characterised by nondeterministic time responses of computing	Z,ZK	5
	rn basic algorithms that assure correctness of computations realized by a group of loosely coupled processes and mechanisms that		
,,	data and services, and safety in case of failures.		
NI-DSW	Design Sprint	Z	2
Students will work	on projects using the Design Sprint method, developed by Google. THanks to this method the teams are able to go from idea to valida	ted prototype in 5 c	lays. During
the course the st	udents will get familiar with the method as participants. Through practical challenges they will try the whole 5 day process starting wit	h research and finis	shing with
	testing the prototypes (plus final presentation).		
NI-DVG	Introduction to Discrete and Computational Geometry	Z,ZK	5
The course intends	to introduce the students to the discipline of Discrete and Computational Geometry. The main goal of the course is to get familiar with of this discipline, and to be able to solve simple algorithmic problems with a geometric component.	the most fundame	ntal notions
NI-DZO	Digital Image Processing	Z,ZK	4
	ents a comprehensive overview of modern methods for interactive editing of digital images and video. It mainly deals with practical alg	'	-
	e an interesting theoretical basis. Visually attractive applications provide better understanding of basic theoretical background that is al		
of digital image	processing. This course will introduce algorithms solving the following practical applications: edge-aware editing, tone mapping, HDR	compression, de-b	lurring in
	abstraction, hybrid images, gradient domain editing, seamless image stitching and cloning, digital photo-montage, color-to-gray con-		
	gid-as-possible image deformation, free-form image registration, texture synthesis, interactive segmentation, colorization, painting, a		-
NI-EDW	Enterprise Data Warehouse Systems	Z,ZK	5
	ta Warehouses course focuses on the area of business intelligence. Students will be introduced to business intelligence methods an ing warehouses and various architectures, but also their deployment and maintenance. This course also includes an introduction to t		
not only in design	visualization.		g and data
NI-EHW	Embedded Hardware	Z,ZK	5
	basic laws that govern digital design and basic techniques to use them. It deals with both large and small scale systems. This is the	I ' I	embedded
systems, that profi	t from their specialized structure for effective computation and acceleration. Design of fast custom computing machines is discussed,	including standard	ized means
	of internal communication, parallelism extraction and utilization in special structures and system architectures.		
NI-EPC	Effective C++ programming v to use the modern features of contemporary versions of the C++ programming language for software development. The course focu		5
	ficiency in the form of writing maintainable and portable source code and creating correct programs with low memory and processor		ig ellectivity
NI-ESC	Experimental Project Course	KZ	8
"The Design Proje	ct course offers a holistic exploration of the design process, providing students with a well-rounded understanding of the principles, r	nethodologies, and	tools used
in designing techno	plogy-driven solutions that are user-centric and industry-relevant. Throughout the semester, students will work on real-world design pro	jects, collaborate v	vith industry
experts, and learn	n to integrate theory with practical application. Through a hands-on, project-based learning approach, students will develop their skills	in user-centered c	lesign and
	user experience evaluation, as well as gain experience working in a team to design and prototype a functional solution."	771	
NI-ESW	Embedded Software	Z,ZK	5
	e course acquainted students with the specifics of software development for embedded systems. The course covers the areas from the bar d code optimizations, through typical areas as the reliable software development, embedded operating systems, signal processing, u		
	combined with artificial intelligence.		
NI-EVY	Efficient Text Pattern Matching	Z,ZK	5
Students get knowl	edge of efficient algorithms for text pattern matching. They learn to use so called succinct data structures that are efficient in both acces	s time and memory	complexity.
	They will be able to use the knowledge in design of applications that utilize pattern matching.		
NI-FME	Formal Methods and Specifications	Z,ZK	5
Students are able t	to describe semantics of software formally and to use sound reasoning for construction of correct software. They learn to use some so	ttware tools that all	ow to prove
	basic properties of software.	776	4
NI-FMT The aim of the cou	Finite model theory rse is to introduce students to the basics of finite model theory. The original motivation is the questions expressibility and verifiability o	Z,ZK	
			or adiababe
	inception in the 1970s, the course has evolved rapidly and touched on many other areas of theoretical computer science, such as de		theory, the
			theory, the
NI-GAK	inception in the 1970s, the course has evolved rapidly and touched on many other areas of theoretical computer science, such as de Constraint Satisfaction Problem (CSP), the theory of algorithmic meta-theorems and combinatorics. Graph theory and combinatorics	Z,ZK	5
The goal of the cla	inception in the 1970s, the course has evolved rapidly and touched on many other areas of theoretical computer science, such as de Constraint Satisfaction Problem (CSP), the theory of algorithmic meta-theorems and combinatorics. Graph theory and combinatorics ss is to introduce the most important topics in graph theory, combinatorics, combinatorial structures, discrete models and algorithms	Z,ZK	5 be not only
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graph generation and memorybality of graph neural networks. In the secretion, statemet will by outsetted incluques and predents. IN-COU ICZ Secretion IC-OPU ON-COU GPU Architectures and Programming GENU Architectures and Programming ZZK 5 Addres will gave indexigned providedge of the instrain architectures distrained and instruction. GPU Architectures and Programming ZZK 5 NI-COL Gend composing and gain knowledge to the instrained and instruction. ZZK 5 Cognobs exempts in an energing discipline that is clearly without the plot security within the domain of plot accurity is the protection of nelworks, interment security is interment and and intermental discipline and intermentand discipline and intermental discipline and intermental discipli	The course intr	oduces students to advanced artificial intelligence techniques for working with graphs. Lectures will focus on the latest graph neural r	networks for creati	ng vector
NI-GQL Programming of distributed systems in GO I/Z I/S Students all gain knowledge at the lateral architecture of notion massively panel (SPL processors). They will latera to gragementing multicrossor (GP) systems. Students all gain knowledge at the lateral and the lateral or analysis in the CDM systems. ZZK 5 NI-GRI Grid computing and physical and the lateral analysis of lateranananananalysis of the latelateta analysis of the lateral	representations of			also covers
N-GPU GPU Antificetures and Programming CZK S Addets to algo antidepend programming activity and composition of the programming unitrovator of the program home with the CUDA programming and increases of antidepend programming unitrovators of the thermalitic antidepend programming activity and antidepend programming unitrovators of the programming unitrovators of theprograming unitrovators of theprograming unitrovators of theprog				
Students will gain knowledge at the internal acciliations of modern maskely parallel GPU processors. An integraph of the distribution provident and analysis in the compatibility acceleration of the distribution provident and the internal compatibility acceleration of the distribution provident and the internal compatibility acceleration of the distribution of the				5
which is drawy availagenerating operating and those and interests exceptionation of these themesiation of constructives, students will be an interpart of the file scale of the protein of the scale of th				-
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IN-HCM INd Hacking ZK 5 Cogete security is the protection of the human mind from instructural digital maniputators. The topic of cogital security is protection of the human mind from instructural digital maniputators. The topic of cogital security is protection of activation of instructures. The topic of cogital security is protection of activation of instructures in the contract of information warran increasing digital disperitories and the development of activation informations. There are cogital cogital instructures in the contract of information warran increasing informations. The topic of activation information intervents in information informations. The topic of activation information information information information information information. The topic of activation information informatinformation informatinformation information informa	NI-GRI		Z,ZK	5
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the senal of digital searching is the protection of the minima mark from iterational and uninterational digital manipulation. The topic of constite exacting to growing in ingrates used as discreption of acid a checkelon, threads to demonstrate marker thread and the more all constitutions and the more all constitutions. The topic of constitution and the constrate of informations are not development. Nere all code to the constrate information and the constrate of informatics and informatics. The constitution and the constrates of the constrates are the development. Nere all code to the constrates are the development. Nere all code to the constrates are the development. Nere all code to the constrates are the development. Nere all code to the constrate information in the constrate information and the development and the constrates are the development. Nere all code to the constrate information in the constrate in the constrate information in the constrate information in the constrate information in the constrate information in the constrate in the constrate in the constrate in the constrate information in the constrate		5	1	-
Ine context of information variation, nonexing digital dependence and the development of artificial intelligence, where these phetoments from the internet environment have real stacked internets where a discubation of social colorace, threase or war. NI-HM2 NI-HM2 History of Mathematics and Informatics ZK 3 NI-HM2 NI-H				
Initial Initial instant a disorder of hand metalics and Informatics IX 3 This course is presented in Cach. Sublecta topics (information cause) ZK 3 This course is presented in Cach. Sublecta topics (information and cache) ZKK 4 NI-HM2 Executive is presented in Cach. Sublecta topics (information discoprint topics) ZKK 4 NI-HM2 Executive is dedicated to accelerate information inclusciption information discoprint topics and marking the maximum and marking the market information inclusciption inclusciption inclusciption inclusciption information inclusciption information inclusciption information inclusciption inclusciptin inclusciption inclusciption i	-			
NI-HM2 History of Mathematics and Informatics ZK 3 The ocurse in presented in C2ech. Selected topic (information accuruls, prostavity, number hervy, prevent adjets, and ferrent examples of adjorntem, recurse information, eliptic curses, etc.) note on possibilities of applications of some mathematical methods in information and is devolupment. 4 4 NI-HSC Side C-home In Analysis in Hardware (2ZK 4 The ocurse is deficited to ocaled side channel information textage in hardware devices. It houses on tom thereartical analysis and parameterized and the side channel information textage in the analysis and testing in the analysis a			environment nave	
Nin Exacts is présented in Cachs, élected object (infinitedina dialut, probabilité, applications de som enthématian entodis ni Informatias and la devélopment. ZZK 4 NI-HSC Side-Channel Analysis in Hardware ZZK 4 NI-HSC Side-Channel Analysis in Hardware ZZK 4 NI-HSC Side-Channel Analysis in Hardware ZZK 5 NI-HWB Hardware Security ZZK 4 NI-HWB Hardware Security ZZK 5 NI-HM Inferret and Multimedia anaorial discussion of statigants abuse of the system security function of the computer. NI-HAM Inferret and Multimedia anaorial discussion of statigants abuse of the system security function of the computer. NI-HAM Inferret and Multimedia anaorial discussion of statigants abuse of the computer. NI-HAM Inferret and Multimedia August (statigants abuse of the system security function of statigants abuse of the system security function of statigants abuse of the system security function of statigants abuse of the system	NI-HMI2		7K	3
Interdect Side-Channel Analysis in Hardware ZZK 4 This course is dedicated to a called aide channel information taskage in hardware devices. It focuses on both theoretical analysis and particulal attacks. Students get namiler with prevent attacks. Students get analysis in the analysis and designing the SCA countermeasures and analysing the annual and chanacteristics of the adsechannel information taskage. 5 NI-HKM Hardware Security ZZK 5 The course provides the knowledge needed for the analysis and design of comporter systems socurity solutions. Students get an occentral students with private medicates and test intermed and the system solutions and test intermed and test			1	-
This course is decidented to accelled aids channel information leakage in hardware devices, it focuses on both theoretical analysis and decide and non-potiles attacks. They also get practice in both designing the SCA countermeasures and analyzing the amount and characteristics of the side-channel information leakage. NI-HWB Iterative approximation in the side of the side of the analysis and design of computer systems ascurity solutions. Students get an overview of asfigurates against abuse of the system and set them for measures and assistem for measing and the side of th				,
This course is decidented to accelled aids channel information leakage in hardware devices, it focuses on both theoretical analysis and decide and non-potiles attacks. They also get practice in both designing the SCA countermeasures and analyzing the amount and characteristics of the side-channel information leakage. NI-HWB Iterative approximation in the side of the side of the analysis and design of computer systems ascurity solutions. Students get an overview of asfigurates against abuse of the system and set them for measures and assistem for measing and the side of th	NI-HSC	Side-Channel Analysis in Hardware	Z.ZK	4
match They also get practice in both designing the SCA countermeasures and analyzing the amount and characteritized or the side-channel information leakage. NI-HWE Image: Comparison of the side of the analysis and design of computer systems security subtions. Students get an overview of safeguards against abuse of the system at the students of the analysis and design of computer systems and test them for resistance to attack. Subdemst edition in throwshop about the cryptographic accelerators, PUF, random number generators, smart cards, biometric devices for internal security functions of the computer. NI-HAM Internet and Multimedia Z_ZK A The Auditional State of the size students will learn thrend transactures of sub-dimes Multimedia Z_ZK A NI-HBE Information Security Z Z A NI-HBE Information security will solid a properties of the side-student security sub-distance A A NI-HOE Information security will solid a properiod student security will solid a properiod student security sub-distance <t< td=""><td></td><td>, · · · · · · · · · · · · · · · · · · ·</td><td>1 '</td><td></td></t<>		, · · · · · · · · · · · · · · · · · · ·	1 '	
NI-HWB Hardware Security Z,ZK 5 The course provides the knowledge needed for the analysis and design do nopuler systems acurity solutions. Students get an overview of stands. Students will gain knowledge about the crystographic accelerators, PUF, modom number generators, smart cards, binnetic devices, not devices to internal security functions of the computer. 5 NI-HAM Internet and Multimedia Z,ZK 4 The Ni-Mat course is focused on principles and modem technologies for network transmission of audiovisual transmissions for audiovisual transmission. Students will park how boy at the interferse, codies, site for advice transmission is and will be analysis and test the network of the standard or to be presentation of the students of the standard or to be presentation of the students of the standard or to be presentation of the students of the standard or to a transmission. Students will leach to be been derived to individe the standard or to advice the standard or to be presentation of the students of the standard or to the presentation of the students of the standard or to the presentation of the students of the standard or to the presentation of the students of the standard or the standard in the standard is in the area. They understand method to management system (StMS), methods to information access control, and basic norme and internation standard is in the area. They understandard or the standard or the standard or to the standard or total standards in the area. They understand method is the standard or total the standard or total standard is the terms. They underestand the standard is the standar	various kinds of s	ide channels and they get deeper insight in power attacks. Students learn to implement various profiled and non-profiled attacks and	get familiar with h	igher-order
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games, we record on metreform analysis of games and building the meory, not on the programming aspects of game Solving algorithms. The course requires independent work, ability [on theoretical analysis of games and building the theory, not on the programming aspects of game solving algorithms. The course req		

to mathematically analyse, think and proof. The course is also suitable for bachelors student in the third year, who attended introduction to graph theory, as well as for PhD students

	looking for research topics.		
NI-KYB	Cybernality	ZK	5
Students get acqu	ainted with the fundamentals of legislation and international activities in the area of fighting cybercrime. Students will understand the	classification of a	ttacks and
	systems for computer surveillance and traffic monitoring in the cyberspace. Students will also familiarize themselves with hacker activ		The course
	ill also discuss the cooperation of the state agencies and subjects dealing with defence of the cyberspace (especially CSIRT and CE		_
NI-LOM	Linear Optimization and Methods	Z,ZK	5
	applications of optimization methods in computer science, economics, and industry. They are aware of practical importance of linear and a straining of the software and one families with lenguage used in programming of the software. They get shills in formalization of actin		• •
	h optimization software and are familiar with languages used in programming of that software. They get skills in formalization of optirr cheduling of tasks to processors, analysis of network flows), distribution and allocation of resources (transportation problems, travelli	-	-
	nics, and modelling of conflicts via the game theory. They get an overview of computational complexity of optimization problems. They	-	-
	in linear programming.	y got ononiation i	raigonanno
NI-LSM2	Statistical Modelling Lab	KZ	5
	s advanced multiple target tracking (MTT). This domain covers simultaneous tracking of multiple targets using radar under the present		-
·	We aim at the state-of-the-art filters, in particular the PHD (Probability Hypothesis Density) and PMBM (Poisson Multi-Bernoulli)	filters.	
NI-MCC	Multicore CPU Computing	Z,ZK	5
Students will get ac	quainted in detail with hardware support and programming technologies for the creation of parallel multithreaded computations on mul	lticore processors	with shared
	ed memories, which are today the most common computing nodes of powerful (super)computer systems. Students will gain knowledge		
optimization technic	ues used to reduce the performance drop due to the widening gap between the computational requirements of multi-core CPUs and	memory interface	throughput.
	On specific non-trivial multithreaded programs, students will also learn the basics of the art of creating these applications.		
NI-MEP	Modelling of Enterprise Processes	Z,ZK	5
The subject is t	ocused on introduction to the discipline of Enterprise Engineering. Students learn the importance of a proper methodological approac implementation of processes, organisation structures and information support in big enterprises and institutions.	ch for (re)engineei	ring and
NI-MKY		7 74	5
	Mathematics for Cryptology deeper knowledge of algebraic procedures solving the most important mathematical problems concerning the security of ciphers. In p	Z,ZK	-
•	solving a system of polynomial equations over a finite field, the problem of factorization of large numbers and the problem of discret		
	factorization will also be solved on elliptic curves. Students will further become familiar with modern encryption systems based on		
NI-MLP	Machine Learning in Practice	Z,ZK	5
	arning methods to real projects in practice involves many other necessary tasks - from understanding the intentions of the client to, ide	,	-
	students through all phases of a project according to the standard CRISP-DM methodology, not only theoretically but also practically.		
data process	sing and learn how to describe the whole process from exploration to evaluation of the model performance in the form of a clear and the second se	understandable re	port.
NI-MOP	Modern Object-Oriented Programming in Pharo	KZ	4
Object-oriented pro	gramming is currently one of the most widespread paradigms of software creation, especially enterprise information systems, where it	ts ability to natura	abstraction
	plex modern applications. In this course, we build on the knowledge acquired in the course BI-OOP and aim to further deepen the skills	•	
	n modern pure object system Pharo (https://pharo.org). The course focuses on individual approach to students, their development ne		
			-+
-	ng object programming skills, which are generally applicable in other OO languages, students will also gain the opportunity to work o		
technologies in ter	ns of semestral work with the possibility of cooperation with practice and related bachelor, diploma, postgraduate our direct involvem	ent in the Pharo C	Consortium.
technologies in ter NI-MPI	ns of semestral work with the possibility of cooperation with practice and related bachelor, diploma, postgraduate our direct involvem Mathematics for Informatics	ent in the Pharo C Z,ZK	Consortium. 7
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NI-NLM Neural Language Models	Z	5
In this course, students will learn the technical foundations of the Transformer architecture as well as the practical aspects of using language models. The	1 – 1	
students how to use language models to solve problems, make informed risk assessments, and work critically with the scientific l	-	
	1	4
NI-NMS Neural Networks, Machine Learning and Randomness	Z,ZK	4
Stochastic methods, i.e. methods based on randomness, are extremely important for the construction and training of neural networks as well as a num		-
models. The course "Neural networks, machine learning and randomness" will discuss in sufficient depth a number of specific types of neural networks and machine learning. In the final two tonics, it evaluates the general		
randomness, as well as a number of specific stochastic methods for neural networks and machine learning. In the final two topics, it explains the general		-
neural networks and shows that, in addition to the use of randomness in neural networks and machine learning, machine learning models, including neural networks and machine learning, machine learning models, including neural networks and machine learning.		
	ZK	3
The course introduces students to the issue of using new media in artistic and design work. Key topics are moving image, internet, computer game a familiarize the student with the largest possible range of creative approaches in new media. The subject emphasizes dialogue with students, especially		-
art projects.		i to specific
	774	5
NI-NON Nonlinear Continuous Optimization and Numerical Methods Students will be introduced to nonlinear continuous optimization, principles of the most popular methods of optimization and applications of such method	Z,ZK	-
will also learn the finite element method and the finite difference method used for solving ordinary and partial differential equations in engineering. The		
linear algebraic equations that arise from discretization of the continuous problems by direct and iterative algorithms. They will also learn to implement		
as well as in parallel.	alcoe algoritantio o	equerniany
	ZK	5
NI-NSS Normalized Software Systems Students will learn the foundations of normalized systems theory that studies the evolvability of modular structures based on concepts from engineering	1 1	-
theory and entropy from thermodynamics. Students will understand a set of principles that indicate where violations of stability and entropy-related issu		-
architecture. In the second part of the course, students learn how to construct software architectures using a set of 5 design patterns called elements. The	, .	
functionality of information systems in terms of storing data, executing actions, workflows, connectors, and triggers, while handling violations of the stability		
This knowledge allows students to realize new levels of evolvability in software architectures.	and entropy-related	u principies.
	774	F
NI-NUR User Interface Design	Z,ZK	5 undomontol
Students will understand the theorical background of human-computer interaction and user interface (UI) design, will learn formal description of UIs, forma notions and procesures. They get acquainted with graphical, speech, and multimodal UIs. Thanks to the gained knowledge, the students will be ab		
NI-OLI Linux Drivers	Z,ZK	4
The Linux operating system is an important operating system for personal computer and also for embedded systems. Systems on chip and combining p		
increase the variability of peripheral subsystems requiring specific software drivers. This course is an advanced course in the Linux driver development of deve		ents. The
course provides knowledge of Linux operating system architecture, principles of development of various types drivers, including practic		
NI-OSY Operating Systems and Systems Programming	Z,ZK	5
The course covers system programming in UNIX environment. Emphasis is given on kernel development with focus on kernel architecture and kernel of		
process management, memory management, file operations and architecture of modern file systems, device drivers and network programming. The operations are a stability of the system of		
development process, upgrades of existing kernels, kernel booting, debugging using dynamic instrumentation, and techniques to guarantee portability.	-	
in embedded and real-time operating systems are also discussed. Theoretical and general principles are demonstrated on the LINUX kernel. Within labs focused on development of LINUX kernel modules.	, students will work	on projects
	774	4
		4 probleme
There are many optimization problems for which no polynomial time algorithms are known (e.g. NP-complete problems). Despite that it is often neces	-	-
exactly in practice. We will demonstrate that many problems can be solved much more effectively than by naively trying all possible solutions. Often on (parameter) of the inputs from practice-e.g., all solutions are relatively small. Parameterized algorithms exploit that by limiting the time complexity exponential explorements of the input sector.		
and polynomially in the input size (which can be huge). Parameterized algorithms also represent a way to formalize the notion of effective polynomial ti		, .
which is not possible in the classical complexity. Such a polynomial time preprocessing is then a suitable first step, whatever is the subsequent solution of the subsequent solution o		-
plethora of parameterized algorithm design methods and we will also show how to prove that for some problem (and parameter) such an algorithm (pi		-
will also not miss out the relations to other approaches to hard problems such as moderately exponential algorithms or approximation		
NI-PAS Advanced Aspects of Business	Z,ZK	4
The aim of the course is to provide students with advanced (compared to the bachelor's degree) knowledge and skills needed to establish and run th	1 1	
management, especially in law, administration (necessary steps and documents), business economics, foreign trade and related		Dusiness
NI-PDB Advanced Database Systems	Z,ZK	5
Students orient themselves in problems of evaluation and optimization of SQL queries. The next part of the course deals with new concepts of database	1 1	
databases), with the related new data models (XML, graph databases, column databases) and languages for working with them (XQuery, XPath, CYPI		
the course deals with performance evaluation of databases machines.	iert, oremin). me	last part of
NI-PDD Data Preprocessing	Z,ZK	5
Students learn to prepare raw data for further processing and analysis. They learn what algorithms can be used to extract information from various data a	1	
time series, etc., and learn the skills to apply these theoretical concepts to solve specific problems in individual projects - e.g., extraction of characteris		
pages.	sics nom inages of	
NI-PDP Parallel and Distributed Programming	Z,ZK	6
21st century in computer architectures is primarily influenced by the shift of the Moore's law into parallelization of CPUs at the level of computing core	1 1	
are becoming a ubiquitous commodity and parallel programming becomes the basic paradigm of development of efficient applications for these platfo		
with architectures of parallel and distributed computing systems, their models, theory of interconnection networks and collective communication ope	-	-
environments for parallel programming of shared and distributed memory computers. They get acquianted with fundamental parallel algorithms and o		•
learn the techniques of design of efficient and scalable parallel algorithms and methods of performance evaluation of their implementations. The course	-	-
practical programming in OpenMP and MPI for solving a particular nontrivial problem.		
NI-PG1 Computer Grafics 1	ZK	4
The course builds on graphic courses (mainly BI-PGA and BI-PGR) and the knowledge from these courses is deepened by state-of-the-art knowledge. T	1	
interested in advanced computer graphics. Students will gain practical knowledge with realistic texturing and raytracing methods. An integral part of the	-	
articles and their subsequent implementation. The course will be followed by a course PG2 supplementing the knowledge of PG1 on other areas and		
NI-PIS Enterprise Information Systems	Z,ZK	5
The course is focused on the current IT requirements of large companies in the Czech Republic (Top 100). The basis is Data management, storage of b	1 ' 1	-
in BI (Business Intelligence). The principles of solving the overall architecture of information systems in the basis is bata management, storage of companies in the basis is bata management, storage of companies in the basis is bata management.		
real examples. Furthermore, students will get acquainted with the life cycle of information systems in the company / organization and its impact on the bus		
	57	

Students will be acquainted with technologies that have proven themselves in the elimination of basic risks in the planning, implementation and operation of information systems in the

	company / organization.		
NI-PIV	Computer Vision	Z,ZK	5
	on course focuses on the theoretical and practical mastery of modern methods and algorithms in the field of image data processing. St		
	les of computer vision, gradually move to advanced computer vision techniques using deep learning. Emphasis is placed on theoreti- ns and implementation of learned methods during exercises. Topics covered include morphological operations, image filtering, color re	-	
	and implementation of real net index during exercises, represerve a module morphological operations, image intering, even re and segmentation through classical and recent approaches based on deep learning, deep neural networks for computer vision (includ	-	
Ū	motion detection, visual expressiveness (saliency).	0, , ,	, ,,
NI-PLS1	Programming Language Seminar	Z	2
	Language Seminar aims to introduce students to research in programming languages. It has the format of a reading group in which		
about programming	g languages and related fields. Participating students are expected to present a paper of their interest and actively participate in the c		ading group
NI-PLS2	is a joint venue between FIT and MFF CUNI. It is open to all students and researchers interested in programming language Programming Language Seminar	Z	2
	g Language Seminar aims to introduce students to research in programming languages. It has the format of a reading group in which		
	g languages and related fields. Participating students are expected to present a paper of their interest and actively participate in the c		
	is a joint venue between FIT and MFF CUNI. It is open to all students and researchers interested in programming language	S.	
NI-PLS3	Programming Language Seminar	Z	2
	g Language Seminar aims to introduce students to research in programming languages. It has the format of a reading group in which		
about programming	g languages and related fields. Participating students are expected to present a paper of their interest and actively participate in the c is a joint venue between FIT and MFF CUNI. It is open to all students and researchers interested in programming language		ading group
NI-PLS4	Programming Language Seminar	Z	2
-	g Language Seminar aims to introduce students to research in programming languages. It has the format of a reading group in which	-	1
about programming	g languages and related fields. Participating students are expected to present a paper of their interest and actively participate in the c	liscussions. The re	ading group
	is a joint venue between FIT and MFF CUNI. It is open to all students and researchers interested in programming language	1	
NI-PON	Selected Topics in Optimization and Numerical mathematics	Z,ZK	5
	s on optimization problems that appear in the field of machine learning and artificial intelligence. Students broaden their knowledge of co		
in the course Math	ematics for informatics. The methods are explained and described along with the details on how they are implemented on computers of numerical matematics, mainly numerical linear algebra, are explained too.	. Hence, the releva	ini concepts
NI-PSD	Public Services Design	КZ	4
	oduce students to specifics of UX, Service design and development for public sector. We will look into the design and development p	1	erspective of
suppliers (devs a	nd designesr) as well as clients. In small teams students will work on projects from partner organizations and will try out collaboration	n with client repres	entatives.
	Course is aimed at students-designers as well as clients.		
NI-PSL	Programming in Scala	Z,ZK	4
	uces the modern programming language Scala which exploits object-functional paradigm. Scala comprises advance language featur ibrary. Scala enables to use of applications functional patterns e.g. H-List, Monads, etc. Scala is used by many powerful frameworks and		-
	Scalaz, etc.	a libraries e.g. r lay,	oussundia,
NI-PVR	Advanced Virtual Reality	KZ	4
	Advanced Virtual Reality ces advanced parts of the virtual reality. It is a continuation of the already running graphic objects, especially the creation of 3D mode	1	4 among other
The course introdu things, it introduces	ces advanced parts of the virtual reality. It is a continuation of the already running graphic objects, especially the creation of 3D mode students to their application in virtual reality. Lectures will focus on virtual reality technology, its use in various applications and will also	ls in Blender, and a deal with creating	applications
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articles and other professional literature and/or work in K N laboratories. The capacity of the subject is limited by the possibilities of the seminar teachers. The topics are new for each

	semester.		
NI-SCE2	Computer Engineering Seminar Master II	Z	4
	mputer Engineering is a (s)elective course for students who want to deal with deeper topics of digital design, reliability and resistance to		
	dividually within the subject. Each student or group of students solves some interesting topic with the selected supervisor. Part of the		
articles and other p	rofessional literature and/or work in K N laboratories. The capacity of the subject is limited by the possibilities of the seminar teacher semester.	s. The topics are n	ew for each
NI-SCR	Statistical Analysis of Time Series	Z,ZK	5
	with the practical use of the basic time series modelling theory in engineering tasks, ranging from economics (stock exchange prices		
	g of signals and processes) to computer networks (network components load, attacks detection). The students learn to select a conve		
its parameters, ana	lyze its properties and use it for forecasting of future or intermediate values. The stress is put on understanding and adoption of the mai	n principles based	on practical
real-world example	s. Both the lab classes and the lectures exploit freely available software packages in order to provide easy and straightforward transfe	er of students' know	vledge from
	the academic to the real world.		
NI-SEP	World Economy and Business	Z,ZK	4
	resented in Czech. However, there is an English variant in the program Informatics (N1801 / 4793). The course introduces students o ness. It does that predominantly by comparing individual countries and key regions of world economy. Students get to know about dif		
	g business in diverse societies as well as indexes of economic freedom, corruption and economic development, which are needed for	-	
	p improve on the knowledge in the form of discussions based on individual readings. It is advised to take bachelor level of this course	-	
NI-SIB	Network Security	Z,ZK	5
NI-SIM	Digital Circuit Simulation and Verification	Z,ZK	5
The aim of the cou	rse is to acquaint the students with principles of digital circuit simulation at RTL (Register Transfer Level) and TLM (Transaction Level	Modeling) levels a	nd with the
	properties of proper tools. The course covers recent verification methods, too.		
NI-SWE	Semantic Web and Knowledge Graphs	Z,ZK	5
	learn the most recent concepts and technologies of the Semantic Web. The course will provide an overview of the Semantic Web tech	-	
practices for mod	lelling, integration, publishing, querying and consumption of semantic data. The students will also gain skills in creation of knowledge	graphs and their s	ystematic
	quality assurance.	7 71/	F
NI-SYP	Parsing and Compilers upon the knowledge of fundamentals of automata theory, formal language and formal translation theories. Students gain knowledge of va	Z,ZK	5
	of LR parsing and are introduced to special applications of parsers, such as incremental and parallel parsing.		applications
NI-SZ1	Knowledge Engineering Seminar Master I	Z	4
	you will present a research paper from a top institute / research group to your peers. You will learn what is being cooked in top research		
Additionally, you wil	I learn how to properly present and read scientific papers. The work in the seminar will prepare you to attend (and profit from) top machin	ne learning and AI o	conferences
	and summer schools, as well as FIT's own Summer Research Program (VyLet).		
NI-SZ2	Knowledge Engineering Seminar Master II	Z	4
	you will present a research paper from a top institute / research group to your peers. You will learn what is being cooked in top research		
Additionally, you wil	I learn how to properly present and read scientific papers. The work in the seminar will prepare you to attend (and profit from) top machin	ne learning and AI o	conferences
	and summer schools, as well as FIT's own Summer Research Program (\/vl et)		
NILTES	and summer schools, as well as FIT's own Summer Research Program (VyLet).	7 7K	
NI-TES Today, humankin	Systems Theory	Z,ZK	5
Today, humankin		, the costs of man	5 aging this
Today, humankin complexity and of e	Systems Theory d has the ability to develop systems of incredible complexity (e.g., trains, microprocessors, airplanes, nuclear power plants). However	r, the costs of man odels that describe	5 aging this only those
Today, humankin complexity and of e aspects of the syst	Systems Theory d has the ability to develop systems of incredible complexity (e.g., trains, microprocessors, airplanes, nuclear power plants). However ensuring the correct behavior of a given system have become critical. A key technique for mastering this complexity is the usage of m ems that are important for the task at hand, and automated tools for analyzing those models. This subject will present theory and algorithe modeling and analysis of complex systems.	r, the costs of man odels that describe orithms that form th	5 aging this only those
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NI-TS4	Theoretical Seminar Master IV	Z	4
	r is intended for students which want to come in deeper contact with contemporary theoretical computer science. It is mostly a classic		
are treated individu	ally and concern themselves with interesting topics from the latest research in the area. Therefore, an integral part of the course is a	work with scientific	papers and
	other scholarly literature. The capacity is limited by the the potentials of the teachers of the seminar.		
NI-TSP	Testing and Reliability	Z,ZK	5
-	knowledge about circuit testing and about methods for increasing reliability and security. They will get practical skills to be able to pre		
the intuitive path se	ensitization and to use an ATPG for automatic test generation. They will be able to design easily testable circuits and systems with bu	lit-in-seif-test equip	oment. They
	will be able to compute, analyze, and control the reliability and availability of the designed circuits.	1/7	4
NI-TSW	Software Product Development	KZ	4
	The course is presented in Czech.	7 71/	0
NI-TVR	Virtual Reality Technology roduced to the basic concepts of virtual reality. Techniques for displaying virtual worlds (CAVE, HMD,) and the possibilities of cont	Z,ZK	3
	cking, eye tracking) will be discussed. Furthermore, the concepts of mixed and augmented reality will be introduced. Finally, ways of	•	
tracking, nana tra	reality will be presented.	using virtual and a	agmentea
NI-UMI	Artificial intelligence	Z,ZK	5
	search and inference algorithms in major formal paradigms used in artificial intelligence such as logic theories, constraint programn		-
	The main principles and practical applications of discussed techniques will be illustrated.	ing and automator	a pianing.
NI-VCC	Virtualization and Cloud Computing	Z,ZK	5
	n knowledge of architectures of large computer systems that are used in data centers and computer infrastructure of companies and		
-	tualization principles, tools and technologies that serve to facilitate and automate configuration, testing and monitoring, and to efficie	-	
	rameters of modern computer systems. Theoretically and practically, they will get acquainted with containerization as the most effect		
	nplex computer systems and with specific technologies of cloud systems. Finally, they will learn the principles and gain practical skills in		
	and development tools (Continuous integration and development).		
NI-VGA	Video Games Architecture	Z,ZK	5
The course covers	a wide range of topics, procedures and methodologies related to the development of computer games - from a technical point of vie	w, but also from a	design and
philosophical point	of view. In the lectures, students will be guided through the history of development, the structure of game engines, component and fu	unctional architectu	re typical of
game development	, physics, graphics, artificial intelligence and multiplayer. The exercises will then cover selected technological topics in greater detail, in	ncluding ways of im	plementing
	some game mechanics, in the form of practical demonstrations.		
NI-VMM	Retrieval from Multimedia	Z,ZK	5
The student obtains	general knowledge regarding interfaces of portals providing multimedia content, the principles of similarity search, the methods of fear	ture extraction from	multimedia
	objects, indexing, and structure of distributed search engines.		
NI-VOL	Elections	Z,ZK	5
	We will cover the basics of (committee) elections and, in general, opinion aggregation.	_	
NI-VPR	Research Project	Z	5
	Student obtains the credits for published scientific outputs. The details are at https://courses.fit.cvut.cz/NI-VPR/en.		
		7 71/	7
NI-VSM	Selected statistical Methods	Z,ZK	7
The course leads	Selected statistical Methods the student through advanced probabilistic and statistical methods used in information technology praxis. Particularly it deals with me	ultivariate normal d	istribution,
The course leads	Selected statistical Methods the student through advanced probabilistic and statistical methods used in information technology praxis. Particularly it deals with more opy in coding theory, hypothesis testing (T-tests, goodness of fit tests, independence test). Second part of the course deals with random	ultivariate normal d	istribution,
The course leads application of entr	Selected statistical Methods the student through advanced probabilistic and statistical methods used in information technology praxis. Particularly it deals with more opy in coding theory, hypothesis testing (T-tests, goodness of fit tests, independence test). Second part of the course deals with rank Markov chains. The high point of the course is the Queuing theory and its application in networks.	ultivariate normal d dom processes with	istribution, n focus on
The course leads	Selected statistical Methods the student through advanced probabilistic and statistical methods used in information technology praxis. Particularly it deals with me opy in coding theory, hypothesis testing (T-tests, goodness of fit tests, independence test). Second part of the course deals with rank Markov chains. The high point of the course is the Queuing theory and its application in networks. Computability	ultivariate normal d	istribution,
The course leads application of entr NI-VYC	Selected statistical Methods the student through advanced probabilistic and statistical methods used in information technology praxis. Particularly it deals with me opy in coding theory, hypothesis testing (T-tests, goodness of fit tests, independence test). Second part of the course deals with rank Markov chains. The high point of the course is the Queuing theory and its application in networks. Computability Classical theory of recursive functions and effective computability.	ultivariate normal d dom processes with	istribution, n focus on 4
The course leads application of entr NI-VYC NI-ZS10	Selected statistical Methods the student through advanced probabilistic and statistical methods used in information technology praxis. Particularly it deals with me opy in coding theory, hypothesis testing (T-tests, goodness of fit tests, independence test). Second part of the course deals with rank Markov chains. The high point of the course is the Queuing theory and its application in networks. Computability	ultivariate normal d dom processes with Z,ZK Z	istribution, n focus on 4 10
The course leads application of entr NI-VYC NI-ZS10 Each student can of	Selected statistical Methods the student through advanced probabilistic and statistical methods used in information technology praxis. Particularly it deals with me opy in coding theory, hypothesis testing (T-tests, goodness of fit tests, independence test). Second part of the course deals with rank Markov chains. The high point of the course is the Queuing theory and its application in networks. Computability Classical theory of recursive functions and effective computability. Master internship abroad for 10 credits	ultivariate normal d dom processes with Z,ZK Z tion. Before the inte	istribution, n focus on 4 10 ernship the
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to a wide range of other fields, including education, medicine, and chemical engineering. In this course, we will explore the latest PML methods from theoretical, algorithmic, and practical perspectives. Specifically, we will focus on cutting-edge models that are of interest to both the research and commercial communities.

 PI-SCN
 Seminars on Digital Design
 ZK
 4

 This subject deals with problems of realization and implementation of digital circuits - both combinational and sequential. Basic means of description of digital circuits and basic logic synthesis and optimization algorithms are described. Basics of EDA (Electronic Design Automation) systems are given, together with combinatorial problems emerging in EDA.

For updated information see <u>http://bilakniha.cvut.cz/en/FF.html</u> Generated: day 2025-07-04, time 01:25.