Recomended pass through the study plan

Name of the pass: Master specialization System Programming, in Czech, 2023

Faculty/Institute/Others:

Department:

Pass through the study plan: Master specialization System Programming, in Czech, version from 2023

Branch of study guranteed by the department: Welcome page

Guarantor of the study branch: Program of study: Informatika

Type of study: Follow-up master full-time

Note on the pass: Jako volitelné p edm ty lze vedle ist volitelných p edm t zapisovat i povinné p edm ty

sousedních magisterských specializací

Coding of roles of courses and groups of courses:

P - compulsory courses of the program, PO - compulsory courses of the branch, Z - compulsory courses, S - compulsory elective courses, PV - compulsory elective courses, F - elective specialized courses, V - elective courses, T - physical training courses

Coding of ways of completion of courses (KZ/Z/ZK) and coding of semesters (Z/L):

KZ - graded assesment, Z - assesment, ZK - examination, L - summer semester, Z - winter semester

Number of semester: 1

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-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-EPC	Effective C++ programming Daniel Langr Daniel Langr Daniel Langr (Gar.)	Z,ZK	5	2P+1C	Z	PS
NI-OSY	Operating Systems and Systems Programming Petr Zemánek, Tomáš Martinec Petr Zemánek Petr Zemánek (Gar.)	Z,ZK	5	2P+1C	Z	PS
NI-SYP	Parsing and Compilers Jan Janoušek Jan Janoušek (Gar.)	Z,ZK	5	2P+1C	Z	PS
NI-V.2021	ist volitelné magisterské p edm ty NI-AOA,NI-ATH, (see the list of groups below)	Min. cours. 0 Max. cours. 79	Min/Max 0/366			V
NI-SP-VS.20	Volitelné odborné p edm ty p vodem z jiných specializací pro mag. specSystémové programování NI-ADM,NI-AIB, (see the list of groups below)	Min. cours.	Min/Max 0/			V

Number of semester: 2

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-PDP	Parallel and Distributed Programming Pavel Tvrdík Pavel Tvrdík Pavel Tvrdík (Gar.)	Z,ZK	6	2P+2C	L	PP
NI-VSM	Selected statistical Methods Daniel Vašata, Pavel Hrabák, Jana Vacková, Jitka Hrabáková, Ivo Petr, Petr Novák Pavel Hrabák Pavel Hrabák (Gar.)	Z,ZK	7	4P+2C	L	PP
NI-RUN	Runtime Systems Filip K ikava Filip K ikava Filip K ikava (Gar.)	Z,ZK	5	2P+1C	L	PS
NI-APR	Selected Methods for Program Analysis Filip K ikava Filip K ikava Filip K ikava (Gar.)	Z,ZK	5	2P+1C	Z	PS
NI-V.2021	ist volitelné magisterské p edm ty NI-AOA,NI-ATH, (see the list of groups below)	Min. cours. 0 Max. cours. 79	Min/Max 0/366			V
NI-SP-VS.20	Volitelné odborné p edm ty p vodem z jiných specializací pro mag. specSystémové programování NI-ADM,NI-AIB, (see the list of groups below)	Min. cours.	Min/Max 0/			V

Number of semester: 3

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-MPR	Master Project Zden k Muziká	Z	7		Z,L	PP
NI-GEN	Code Generators Petr Máj Petr Máj Jan Janoušek (Gar.)	Z,ZK	5	2P+1C	Z	PS
NI-APT	Advanced Program Testing Pierre Donat-Bouillud Pierre Donat-Bouillud Pierre Donat-Bouillud (Gar.)	Z,ZK	5	2P+1C	Z	PS
	ist volitelné magisterské p edm ty	Min. cours.				
NII V 0004		0	Min/Max			V
NI-V.2021	NI-AOA,NI-ATH, (see the list of groups below)	Max. cours.	0/366			
		79				
NI CD VC 20	Volitelné odborné p edm ty p vodem z jiných specializací	Min. cours.	Min/Max			.,,
NI-SP-VS.20	pro mag. specSystémové programování NI-ADM,NI-AIB, (see the list of groups below)	0	0/			V

Number of semester: 4

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-DIP	Diploma Thesis Zden k Muziká Zden k Muziká Zden k Muziká (Gar.)	Z	30	270ZP	L,Z	PP

List of groups of courses of this pass with the complete content of members of individual groups

Kód		Name of the group of group (for specification	f courses a on see here	nd codes of members of this or below the list of courses)	Comp	letion	Credits	Scope	Semester	Role
NI-SF	P-VS.20			vodem z jiných specializací nové programování			Min/Ma			٧
NI-ADM	Data Minir	ng Algorithms	NI-AIB	Algorithms of Information Securi	IN	II-ADP	<u> </u>	rchitecture a	l l nd Design patt	erns
NI-AM1		e Architectures 1	NI-AM2	Middleware Architectures 2		II-BML			nods for Machi	
NI-BVS	Embedded	d Security	NI-BKO	Error Control Codes	N	II-DSV	0	istributed Sy	stems and Co	mputin
NI-DDW	Web Data	Mining	NI-EVY	Efficient Text Pattern Matching	N	II-FME	F	ormal Metho	ds and Specifi	cation
NI-GAK	Graph the	ory and combinatorics	NI-HWB	Hardware Security	N	II-KOD	0	Data Compression		
NI-MKY	Mathemat	ics for Cryptology	NI-MVI	Computational Intelligence Metho .	N	II-MEP	N	lodelling of E	nterprise Proc	esse
NI-MTI	Modern In	ternet Technologies	NI-NUR	User Interface Design	N	II-NON	N	onlinear Cor	tinuous Optim	izatio
NI-NSS	Normalize	d Software Systems	NI-BUI	Business Informatics	N	II-PIS	E	nterprise Info	ormation Syste	ems
NI-KRY	Advanced	Cryptology	NI-PAS	Advanced Aspects of Business	N	II-PDB	Α	dvanced Da	abase System	S
NI-GPU	GPU Arch	itectures and Programmin	NI-PDD	Data Preprocessing	N	II-REV	R	everse Engi	neering	
NI-SWE	Semantic '	Web and Knowledge Graph	NI-SIM	Digital Circuit Simulation and V	N	II-SIB	N	etwork Secu	rity	
NI-SCR	Statistical	Analysis of Time Ser	NI-SYP	Parsing and Compilers	N	II-SBF	S	ystem Secur	ity and Forens	ics
NI-DSS	Decision S	Support Systems	NI-TES	Systems Theory	N	II-TSP	T	esting and R	eliability	
NI-TSW	Software F	Product Development	NI-UMI	Artificial intelligence	N	II-EHW	E	Embedded Hardware		
NI-ESW	Embedded	d Software	NI-VCC	Virtualization and Cloud Computi	N	II-PON	S	elected Topic	s in Optimizat	ion
NI-VMM	Retrieval f	rom Multimedia	NI-MCC	Multicore CPU Computing						
			•	•	Min. c	ours.				

NI-V.20)21	ist volit	elné magister	rské p edm ty	cours. 0 . cours. 79	Min/Ma	x		v
NI-AOA	Completing	g a professional event	NI-ATH	AlgorithmicTheories of Games	NI-AFP	. A	pplied Functi	onal Programi	ming
NI-APH	Architectur	e of computer games	NI-VGA	Video Games Architecture	NI-BPS	١	Wireless Computer Networks		
NI-BSO	Biosignals	and Biomedical Image	NIE-BLO	Blockchain	NI-CTF	(Capture The Flag		
NI-CAP	Cultural an	d Social Anthropology	NI-DPH	Game Design	NI-DSW	[esign Sprint		
NI-PSD	Public Ser	vices Design	NI-DID	Digital drawing	NI-DZO	[Digital Image I	Processing	
NI-DDM	Distributed	Data Mining	NI-PAM	Efficient Preprocessing and Para	NI-ESC	E	xperimental I	Project Course)
NI-GLR	Games an	d reinforcement learning	NI-GNN	Graph Neural Networks	NI-GRI	(Grid Computin	g	
NI-HCM	Mind Hack	ing	NI-HSC	Side-Channel Analysis in Hardwar	 NI-HMI2	ŀ	listory of Mat	nematics and	nfor
NI-IBE	Information	Security	NI-IVS	Intelligent embedded systems	NI-IKM	I	Internet and Classification Meth		eth
NI-IAM	Internet an	d Multimedia	NI-IOT	Internet of Things	FITE-EH	D I	Introduction to European Ecor		onomi
NI-KTH	Combinato	rial Theories of Games	NI-FMT	Finite model theory	NI-CCC	(reative Codir	ng and Compu	tationa

NI-KYB	Cybernality	NI-LSM2	Statistical Modelling Lab	NI-LOM	Linear Optimization and Methods
NI-MPL	Managerial Psychology	NI-MSI	Mathematical Structures in Compu	NI-MZI	Mathematics for data science
FIT-ITI	Modern IT infrastructure	NI-MOP	Modern Object-Oriented Programmi	NI-MMA	Multiplatform development of mob
NI-NLM	Neural Language Models	NI-NMS	Neural Networks, Machine Learnin	NI-NMU	New media in art and design
NI-OLI	Linux Drivers	NIE-PML	Personalized Machine Learning	NI-ARI	Computer arithmetic
NI-PG1	Computer Grafics 1	NI-PIV	Computer Vision	NI-EDW	Enterprise Data Warehouse System
NI-PVR	Advanced Virtual Reality	NI-AML	Advanced machine learning	NI-IOS	Advanced techniques in iOS appli
NI-APT	Advanced Program Testing	NI-PVS	Advanced embedded systems	NI-DNP	Advanced .NET
NI-PYT	Advanced Python	NIE-PDL	Practical Deep Learning	FIT-ACM1	Programming Practices 1
FIT-ACM2	Programming Practices 2	FIT-ACM3	Programming Practices 3	FIT-ACM4	Programming Practices 4
FIT-ACM5	Programming Practices 5	FIT-ACM6	Programming Practices 6	NI-GOL	Programming of distributed syste
NI-PSL	Programming in Scala	NI-RUB	Programming in Ruby	NI-ROZ	Pattern Recognition
NI-PLS4	Programming Language Seminar	NI-PLS3	Programming Language Seminar	NI-PLS2	Programming Language Seminar
NI-PLS1	Programming Language Seminar	NI-SCE1	Computer Engineering Seminar Mas	NI-SCE2	Computer Engineering Seminar Mas
FIT-SM1	Machine Learning Seminar 1	FIT-SM2	Machine Learning Seminar 2	FIT-SM3	Machine Learning Seminar 3
FIT-SM4	Machine Learning Seminar 4	FIT-SM5	Machine Learning Seminar 5	FIT-SM6	Machine Learning Seminar 6
FIT-SM7	Machine Learning Seminar 7	FIT-SM8	Machine Learning Seminar 8	NI-SZ1	Knowledge Engineering Seminar Ma
NI-SZ2	Knowledge Engineering Seminar Ma	PI-SCN	Seminars on Digital Design	NI-MLP	Machine Learning in Practice
FIT-SEP	World Economy and Business	NI-SEP	World Economy and Business	NI-TVR	Virtual Reality Technology
NI-TS1	Theoretical Seminar Master I	NI-TS2	Theoretical Seminar Master II	NI-TS3	Theoretical Seminar Master III
NI-TS4	Theoretical Seminar Master IV	NI-TKA	Category Theory	NI-TNN.25	Theory of Neural Networks
NI-TNN	Theory of Neural Networks	NI-CPX	Complexity Theory	FIT-TOP	Academic writing
NI-DVG	Introduction to Discrete and Com	NI-LNG	Introduction to Linguistics for	NI-VEM	Scientific thinking
NI-VOL	Elections	NI-VYC	Computability	NI-VPR	Research Project
NI-ZS10	Master internship abroad for 10	NI-ZS20	Master internship abroad for 20	NI-ZS30	Master internship abroad for 30

List of courses of this pass:

Code	Name of the course	Completion	Credits
FIT-ACM1	Programming Practices 1	KZ	5
'	This is a selective course for preparing talented student for representation in international programming contests.		'
FIT-ACM2	Programming Practices 2	KZ	5
	This is a selective course for preparing talented student for representation in international programming contests.	,	'
FIT-ACM3	Programming Practices 3	KZ	5
'	This is a selective course for preparing talented student for representation in international programming contests.	'	'
FIT-ACM4	Programming Practices 4	KZ	5
'	This is a selective course for preparing talented student for representation in international programming contests.	1	
FIT-ACM5	Programming Practices 5	KZ	5
'	This is a selective course for preparing talented student for representation in international programming contests.	1	'
FIT-ACM6	Programming Practices 6	KZ	5
'	This is a selective course for preparing talented student for representation in international programming contests.	1	1
FIT-ITI	Modern IT infrastructure	Z,ZK	5
with a very limited and tin	ne-invariable range of software or hardware, this subject tries to explain the issue as a whole and in the context of the time. A m	odern data or comp	uting center

with a very limited and time-invariable range of software or hardware, this subject tries to explain the issue as a whole and in the context of the time. A modern data or computing center is understood here as a complex whole, the individual parts of which must be reconciled from different aspects of the view using current technologies. The proposed solution should thus be capable of continuous and economically optimal operation.

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 by comparing individual countries and key regions of world economy. Students get to know about different religions and cultures, necessary for doing business in diverse societies as well as indexes of economic freedom, corruption and economic development, which are needed for the right investment decision. 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 course BIE-SEP as a prerequisite.

FIT-SM1 Machine Learning Seminar 1 Z 4

This seminar is led by experienced researchers and focuses on reviewing and understanding State-of-the-Art (SOTA) research papers in Machine Learning and AI. You will learn to:
- Critically analyze research papers from top institutes and groups worldwide. - Understand the latest breakthroughswhat is being developed in leading research labs. - Master the methodology for properly reading and presenting scientific literature. The work in this seminar will prepare you to attend (and profit from) top international ML/AI conferences and summer schools, as well as FIT's own Summer Research Program (VyLet).

FIT-SM2 Machine Learning Seminar 2 Z 4

This seminar is led by experienced researchers and focuses on reviewing and understanding State-of-the-Art (SOTA) research papers in Machine Learning and AI. You will learn to:
- Critically analyze research papers from top institutes and groups worldwide. - Understand the latest breakthroughswhat is being developed in leading research labs. - Master the methodology for properly reading and presenting scientific literature. The work in this seminar will prepare you to attend (and profit from) top international ML/AI conferences and summer schools, as well as FIT's own Summer Research Program (VyLet).

FIT-SM3 Machine Learning Seminar 3 Z 4

This seminar is led by experienced researchers and focuses on reviewing and understanding State-of-the-Art (SOTA) research papers in Machine Learning and AI. You will learn to:
- Critically analyze research papers from top institutes and groups worldwide. - Understand the latest breakthroughswhat is being developed in leading research labs. - Master the methodology for properly reading and presenting scientific literature. The work in this seminar will prepare you to attend (and profit from) top international ML/AI conferences and summer schools, as well as FIT's own Summer Research Program (VyLet).

FIT-SM4 This seminar is led			
nis seminar is led	Machine Learning Seminar 4	Z	4
- Critically analyz	l by experienced researchers and focuses on reviewing and understanding State-of-the-Art (SOTA) research papers in Machine Lear e research papers from top institutes and groups worldwide Understand the latest breakthroughswhat is being developed in leading	_	
	properly reading and presenting scientific literature. The work in this seminar will prepare you to attend (and profit from) top internation		
0,	summer schools, as well as FIT's own Summer Research Program (VyLet).		
FIT-SM5	Machine Learning Seminar 5	Z	4
	by experienced researchers and focuses on reviewing and understanding State-of-the-Art (SOTA) research papers in Machine Learn	-	
	e research papers from top institutes and groups worldwide Understand the latest breakthroughswhat is being developed in leading		
methodology for	properly reading and presenting scientific literature. The work in this seminar will prepare you to attend (and profit from) top internation summer schools, as well as FIT's own Summer Research Program (VyLet).	onal ML/Al confer	ences and
FIT-SM6	Machine Learning Seminar 6	Z	4
	by experienced researchers and focuses on reviewing and understanding State-of-the-Art (SOTA) research papers in Machine Lear		1
	e research papers from top institutes and groups worldwide Understand the latest breakthroughswhat is being developed in leading	-	
methodology for	properly reading and presenting scientific literature. The work in this seminar will prepare you to attend (and profit from) top internation	onal ML/AI confer	ences and
	summer schools, as well as FIT's own Summer Research Program (VyLet).		
FIT-SM7	Machine Learning Seminar 7	Z	4
	by experienced researchers and focuses on reviewing and understanding State-of-the-Art (SOTA) research papers in Machine Lear	_	
, ,	e research papers from top institutes and groups worldwide Understand the latest breakthroughswhat is being developed in leading properly reading and presenting scientific literature. The work in this seminar will prepare you to attend (and profit from) top internation	•	
methodology for	summer schools, as well as FIT's own Summer Research Program (VyLet).	mai wil/Ai comei	ences and
FIT-SM8	Machine Learning Seminar 8	Z	4
	by experienced researchers and focuses on reviewing and understanding State-of-the-Art (SOTA) research papers in Machine Lear		1
	e research papers from top institutes and groups worldwide Understand the latest breakthroughswhat is being developed in leading	•	
methodology for	properly reading and presenting scientific literature. The work in this seminar will prepare you to attend (and profit from) top internation	nal ML/AI confer	ences and
	summer schools, as well as FIT's own Summer Research Program (VyLet).		
FIT-TOP	Academic writing	Z	2
	portant and required part of research activity. It is not only about obtaining research results but also about applying them in the form of	=	-
	euseful 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		
	cle, what parts such an article should have, and how the peer review process works. Students will also try their hand at presenting an a ourse will be taught in blocks, with theoretical part at the beginning of the semester and one practical at the end of the semester/begin		-
se's article. The co	will be determined based on the availability of enrolled students.	iiig or the exam	periou. Date
FITE-EHD	Introduction to European Economic History	Z.ZK	3
	ces a selection of themes from the European economic history. It gives the student basic knowledge about forming of the global eco	,	-
f the key periods	in history. As European countries have been dominant actors in this process it focuses predominantly on their roles in the economic	history. From larg	e economic
ea of Roman Em	pire to fragmentation of the Middle Ages, from destruction of WWII to the current affairs, the development of modern financial instituti	ons is deciphered	d. The cours
loes not cover de	tailed economic history of particular European countries but rather the impact of trade and role of particular events, institutions and o	rganizations in h	story. Class
	meetings will consist of a mixture of lecture and discussion.	7 71	
NI-ADM	Data Mining Algorithms	Z,ZK	5 bina laarnin
	on algorithms used in the fields of machine learning and data mining. However, this is not an introductory course, and the students sis is put on advanced algorithms (e.g., gradient boosting) and non-basic kinds of machine learning tasks (e.g., recommendation syst		
ongo, ma	methods).	ome, and medel	, (0.9., 1.0
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		
e challenges issu	ies, and tradeoffs of advanced software design. In the first part of the course, the students will refresh and deepen their knowledge o	Well as Willi ullu	erstanding o
•		object-oriented	programmin
d get familiar with	the commonly used object-oriented design patterns that represent the best practices for solving common software design problems. I	object-oriented the second part	programmin the student
d get familiar with	the principles of software architecture design and analysis. This includes the classical architectural styles, component based systems	object-oriented the second part	programmin the student
d get familiar with	the principles of software architecture design and analysis. This includes the classical architectural styles, component based systems architectures used in large-scale distributed systems.	object-oriented on the second part and some advar	programmin the student aced softwar
d get familiar with	the principles of software architecture design and analysis. This includes the classical architectural styles, component based systems architectures used in large-scale distributed systems. Applied Functional Programming	object-oriented in the second part and some advar	programmin the student iced softwar
d get familiar with Il be introduced to NI-AFP ils course is pres	the principles of software architecture design and analysis. This includes the classical architectural styles, component based systems architectures used in large-scale distributed systems. Applied Functional Programming ented in Czech. Functional programming represents one of the traditional programming paradigms. Traditional and novel functional programming paradigms.	f object-oriented in the second part and some advar	programmin the student aced softwar 5 uages are o
d get familiar with Il be introduced to NI-AFP ils course is pres	the principles of software architecture design and analysis. This includes the classical architectural styles, component based systems architectures used in large-scale distributed systems. Applied Functional Programming	f object-oriented in the second part and some advar	programmin the student aced softwar 5 uages are o
d get familiar with Il be introduced to NI-AFP nis course is pres	the principles of software architecture design and analysis. This includes the classical architectural styles, component based systems, architectures used in large-scale distributed systems. Applied Functional Programming ented in Czech. Functional programming represents one of the traditional programming paradigms. Traditional and novel functional program the functional paradigm becomes an important construct of traditionally imperative languages (C++, C#, Java). As such, master necessary competence of a software engineer: the theory and especially the practice.	object-oriented in the second part and some advarused KZ orgramming langing this paradigm	programmin the student aced softwar 5 uages are o
d get familiar with a libe introduced to NI-AFP his course is preside rise nowadays	the principles of software architecture design and analysis. This includes the classical architectural styles, component based systems architectures used in large-scale distributed systems. Applied Functional Programming ented in Czech. Functional programming represents one of the traditional programming paradigms. Traditional and novel functional program the functional paradigm becomes an important construct of traditionally imperative languages (C++, C#, Java). As such, master	object-oriented in the second part and some advar KZ ogramming langing this paradigm Z,ZK	the student acced softwar 5 uages are or becomes a
d get familiar with II be introduced to NI-AFP his course is preshe rise nowadays NI-AIB udents will get ac	the principles of software architecture design and analysis. This includes the classical architectural styles, component based systems, architectures used in large-scale distributed systems. Applied Functional Programming ented in Czech. Functional programming represents one of the traditional programming paradigms. Traditional and novel functional program the functional paradigm becomes an important construct of traditionally imperative languages (C++, C#, Java). As such, master necessary competence of a software engineer: the theory and especially the practice. Algorithms of Information Security quainted with the algorithms of secure key generation and cryptographic error (not only biometric) data processing. Furthermore, stude tographic protocols (identification, authentication, and signature schemes). Another part of the course is dedicated to malware detectors.	tobject-oriented in the second part and some advaruant KZ orgamming langing this paradigm Z,ZK onts will learn the lition and the use	the student aced softwar 5 uages are or becomes a 5 mathematical
NI-AFP his course is preside nowadays NI-AIB Udents will get ac principles of cryp	the principles of software architecture design and analysis. This includes the classical architectural styles, component based systems, architectures used in large-scale distributed systems. Applied Functional Programming ented in Czech. Functional programming represents one of the traditional programming paradigms. Traditional and novel functional program the functional paradigm becomes an important construct of traditionally imperative languages (C++, C#, Java). As such, master necessary competence of a software engineer: the theory and especially the practice. Algorithms of Information Security quainted with the algorithms of secure key generation and cryptographic error (not only biometric) data processing. Furthermore, stude tographic protocols (identification, authentication, and signature schemes). Another part of the course is dedicated to malware detection in detection systems. The last topic includes practical steganographic methods and attacks on steganographic systems.	tobject-oriented in the second part and some advaruant KZ orgamming langing this paradigm Z,ZK orts will learn the use one.	the student iced softwar 5 uages are or becomes a 5 mathematica of machine
MI-AFP his course is president in the introduced to the introduced	the principles of software architecture design and analysis. This includes the classical architectural styles, component based systems, architectures used in large-scale distributed systems. Applied Functional Programming ented in Czech. Functional programming represents one of the traditional programming paradigms. Traditional and novel functional program the functional paradigm becomes an important construct of traditionally imperative languages (C++, C#, Java). As such, master necessary competence of a software engineer: the theory and especially the practice. Algorithms of Information Security quainted with the algorithms of secure key generation and cryptographic error (not only biometric) data processing. Furthermore, stude tographic protocols (identification, authentication, and signature schemes). Another part of the course is dedicated to malware detect learning in detection systems. The last topic includes practical steganographic methods and attacks on steganographic system. Middleware Architectures 1	tobject-oriented in the second part and some advaruand some advaru	the student idea software soft
d get familiar with a libe introduced to NI-AFP his course is preside rise nowadays NI-AIB high get ac principles of cryp NI-AM1 Students will students w	Applied Functional Programming ented in Czech. Functional programming represents one of the traditionally imperative languages (C++, C#, Java). As such, master necessary competence of a software engineer: the theory and especially the practice. Algorithms of Information Security quainted with the algorithms of secure key generation and cryptographic error (not only biometric) data processing. Furthermore, stude tographic protocols (identification, authentication, and signature schemes). Another part of the course is dedicated to malware detect learning in detection systems. The last topic includes practical steganographic methods and attacks on steganographic system Middleware Architectures 1 y new trends, concepts, and technologies in the area of service-oriented architectures. The will gain an overview of information system.	tobject-oriented in the second part and some advaruand some advaru	the student aced softwar 5 uages are o becomes a 5 mathematica of machine 5 web service
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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 implementation of a simple game, with a strong focus on nontrivial game mechanics.	ortant part of the co	urse is an
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 dynam		
we will look at the a	art of reasoning about computer programs without running them. We will look at the analyses for program understanding, optimizatior Analysis, we will look at the analyses considering individual program runs using a concrete environment and inputs.	is, error detection.	in Dynamic
NI-APT	Advanced Program Testing	Z,ZK	5
Testing 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
NI-ARI	advanced program testing techniques, beyond writing unit tests, especially fuzzing and symbolic execution. Computer arithmetic	Z,ZK	4
1417414	Students will learn various data representations used in digital devices and will be able to design arithmetic operations implementa		·
NI-ATH	AlgorithmicTheories of Games	Z,ZK	4
_	theory is a branch of mathematics, which has broad applications in economy, biology, politics and computer science. This theory studies are competitive process by designing a mathematical model and investigating the strategies. The traditional task of classical game to		- 1
	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	-	
	concepts. In this course we introduce the basics of game theory of many players, solution concept (usually equilibria) and methods of		
NI-BKO The goa	Error Control Codes If of the course is to present various ways to detect or correct individual errors and burst errors in data stored into memories or transr	Z,ZK nitted via channels	5
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		
	description of real phenomena, as well as their subsequent use, e.g., for forecasting of future evolution or learning about the hidden v 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
	n about the modern technologies, protocols, and standards for wireless networks. They will understand the routing mechanisms in ad nisms, and data flow control mechanisms. They will also learn about principles of communication in sensor networks. They get knowle		
	for wireless networks and get skills of configuration of wireless network elements and simulation of wireless networks using suitable	ole tools.	
NI-BSO	Biosignals and Biomedical Image Processing	Z,ZK	5
	ırse is to provide students with theoretical principles, techniques, and applications related to the processing and analysis of biologica , students will work on examples of processing various biosignals in the MATLAB environment. After completing the course, students	-	
=	ement solutions to complex tasks for biosignals and biomedical images, interpret results, and apply their knowledge to real-world med		accigit and
NI-BUI	Business Informatics	Z,ZK	5
	se is to focus on operational, tactical and strategic management of business informatics. Students will gain knowledge in the areas of b 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	nt, revenue and inv	estment
NI-BVS	management, IT investment evaluation and human resources management in IT (roles CIO, CEO, CFO). Embedded Security	Z.ZK	5
_	Embedded Security knowledge in selected topics of cryptography and cryptanalysis. The course focuses particularly on efficient implementations of crypto	, ,	-
and software (in em	bedded systems). Students gain a good overview of functionality of (hardware) cryptographic accelerators, smart cards, and resources of computer systems.	s for securing intern	al functions
NI-CAP	Cultural and Social Anthropology	ZK	2
	course aims to acquaint students with the basics of social and cultural anthropology as a scientific discipline dealing with the diversit search from our "exotic" cultures (topics: kinship, religion, social exclusion, migration, globalization, , material culture, language, healtl	=	
ununopological rec	shown. The course is presented in Czech.	i, motory, dodan, or	o, w bo
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 Ides 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 N (Institute of Intermedia FEL).		٠ ا
NI-CPX	Complexity Theory	Z,ZK	5
Students will lear	n about the fundamental classes of problems in the complexity theory and different models of algoritms and about implications of the	theory concerning	practical
NI-CTF	(in)tractability of difficult problems. Capture The Flag	KZ	4
NI-C II	The course is designed to introduce students to CTF competitions and let them gain practical experience in the field of cyber se		7
NI-DDM	Distributed Data Mining	KZ	4
	state-of-the-art approaches for distributed data mining and parallelization of machine learning algorithms. Students will gain hands of	-	-
data processing tra	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.	ind will be capable	to propose
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		
techniques for Web	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.	w of most recent de	velopments
NI-DID	Digital drawing	Z	2
The course will intr	oduce students to the basic principals of digital drawing and graphical design. Students will gain understanding of composition, persp	pective and color th	eory, which
	apply in their own design works. Students will also gain experience in drawing and painting with digital and analog tools. The course	=	
NI-DIP	r learn drawing and painting. The course is organized as a thematic practices covering parts of theory and practical exercise to practic Diploma Thesis	ce gained knowled	ge. 30
=			

NI-DNP Advanced .NET Z,ZK Students will acquire an overview of platform .NET and will gain knowledge about technologies ASP.NET Core, Entity Framework Core, .NET MAUI (WPF, UWP), Blazor and also will get notions of Azure 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 7 7K 5 The course complements the NI-APH (Architecture of Computer Games) and BI-VHS (Virtual gaming worlds) course, while focusing primarily on game design. It is intended for people interested in deeper knowledge of the principles used for games design, such as: level design, gameplay design, character design, game mechanics design, storytelling, and game development cycle. The students will get an overview of game development from the designer's perspective, from theoretical concepts to practical implementation applied to semestral projects. NI-DSS **Decision Support Systems** The aim of the course is to provide students with knowledge and skills in decision support systems, their classification (Powerova), selected principles of data-oriented, model-oriented and knowledge-oriented decision support systems. Students will also gain knowledge of multicriterial decision-making methods and game theory. They will also learn about the principles of conceptually and ontologically oriented decision support systems and the basics of distribution, optimization and evolution methods and algorithms. NI-DSV Distributed Systems and Computing 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-DSW **Design Sprint** 7 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 validated prototype in 5 days. During the course the students will get familiar with the method as participants. Through practical challenges they will try the whole 5 day process starting with research and finishing with testing the prototypes (plus final presentation). NI-DVG Z,ZK Introduction to Discrete and Computational Geometry 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 the most fundamental notions of this discipline, and to be able to solve simple algorithmic problems with a geometric component. Digital Image Processing This course presents a comprehensive overview of modern methods for interactive editing of digital images and video. It mainly deals with practical algorithms that are both easy to implement and have an interesting theoretical basis. Visually attractive applications provide better understanding of basic theoretical background that is also valuable outside the domain of digital image processing. This course will introduce algorithms solving the following practical applications: edge-aware editing, tone mapping, HDR compression, de-blurring in frequency domain, abstraction, hybrid images, gradient domain editing, seamless image stitching and cloning, digital photo-montage, color-to-gray conversion, context enhancement, interactive as-rigid-as-possible image deformation, free-form image registration, texture synthesis, interactive segmentation, colorization, painting, adding depth, alpha matting. NI-FDW Enterprise Data Warehouse Systems The Enterprise Data Warehouses course focuses on the area of business intelligence. Students will be introduced to business intelligence methods and will gain practical knowledge not only in designing warehouses and various architectures, but also their deployment and maintenance. This course also includes an introduction to the area of reporting and data visualization. NI-EHW **Embedded Hardware** Z,ZK 5 The course brings basic laws that govern digital design and basic techniques to use them. It deals with both large and small scale systems. This is the base of advanced embedded systems, that profit from their specialized structure for effective computation and acceleration. Design of fast custom computing machines is discussed, including standardized means of internal communication, parallelism extraction and utilization in special structures and system architectures. NI-EPC Students learn how to use the modern features of contemporary versions of the C++ programming language for software development. The course focuses on programming effectivity and efficiency in the form of writing maintainable and portable source code and creating correct programs with low memory and processor time requirements **Experimental Project Course** "The Design Project course offers a holistic exploration of the design process, providing students with a well-rounded understanding of the principles, methodologies, and tools used in designing technology-driven solutions that are user-centric and industry-relevant. Throughout the semester, students will work on real-world design projects, collaborate with industry experts, and learn to integrate theory with practical application. Through a hands-on, project-based learning approach, students will develop their skills in user-centered design and user experience evaluation, as well as gain experience working in a team to design and prototype a functional solution." NI-ESW Embedded Software 7.7K Embedded software course acquainted students with the specifics of software development for embedded systems. The course covers the areas from the basic techniques of programming in C language and code optimizations, through typical areas as the reliable software development, embedded operating systems, signal processing, up to sophisticated techniques combined with artificial intelligence. Z,ZK NI-FVY Efficient Text Pattern Matching 5 Students get knowledge of efficient algorithms for text pattern matching. They learn to use so called succinct data structures that are efficient in both access 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 5 Students are able to describe semantics of software formally and to use sound reasoning for construction of correct software. They learn to use some software tools that allow to prove basic properties of software. Finite model theory The aim of the course is to introduce students to the basics of finite model theory. The original motivation is the questions expressibility and verifiability of logical properties of database systems. Since its inception in the 1970s, the course has evolved rapidly and touched on many other areas of theoretical computer science, such as descriptive complexity theory, the Constraint Satisfaction Problem (CSP), the theory of algorithmic meta-theorems and combinatorics. NI-GAK Graph theory and combinatorics Z,ZK The goal of the class is to introduce the most important topics in graph theory, combinatorics, combinatorial structures, discrete models and algorithms. The emphasis will be not only on undestanding the basic principles but also on applications in problem solving and algorithm design. The topics include: generating functions, selected topics from graph and hypergraph coloring, Ramsey theory, introduction to probabilistic method, properties of various special classes of graphs and combinatorial structures. The theory will be also applied in the fields of combinatorics on words, formal languages and bioinformatics. NI-GEN **Code Generators** Advanced techniques of translating programs written in high-level programming languages are essential for understanding the field of systems programming. This primarily involves understanding the algorithms and techniques used to translate more complex programming constructs of modern languages employed in systems programming. Students will become familiar with both the theoretical and practical aspects of implementing the back-end of optimizing compilers for programming languages NI-GLR Games and reinforcement learning The field of reinforcement learning is very hot recently, because of advances in deep learning, recurrent neural networks and general artificial intelligence. This course is intended to give you both theoretical and practical background so you can participate in related research activities. Presented in English.

NI-GNN	Graph Neural Networks	Z,ZK	4
	oduces students to advanced artificial intelligence techniques for working with graphs. Lectures will focus on the latest graph neural n		•
representations of	of nodes, edges and entire graphs. The techniques discussed cover various types of graphs, including time-varying graphs. The last p		also covers
NII COI	graph generation and interpretability of graph neural networks. In the exercises, students will try out selected techniques and pro		
NI-GOL NI-GPU	Programming of distributed systems in GO GPU Architectures and Programming	KZ Z,ZK	5
	GPO Architectures and Programming chowledge of the internal architecture of modern massively parallel GPU processors. They will learn to program them mainly in the CUI		-
-	videspread programming technology of GPU processors. As an integral part of the effective computational use of these hierarchical computational use of these hierarchical computational uses of the end of the en		
,	will also learn optimization programming techniques and methods of programming multiprocessor GPU systems.	•	,
NI-GRI	Grid Computing	Z,ZK	5
	Grid computing and gain knowledge about the world-wide network and computing infrastructure.		<u>.</u>
NI-HCM	Mind Hacking	ZK	5
	is an emerging discipline that is closely related to cyber security. While the domain of cyber security is the protection of networks, info	-	
_	nitive security is the protection of the human mind from intentional and unintentional digital manipulation. The topic of cognitive secur mation warfare, increasing digital dependence and the development of artificial intelligence, where these phenomena from the Internet		-
TIC CONTEXT OF INION	impacts such as disruption of social cohesion, threats to democracy or war.	CHVITORITICHERIAVO	, rear societar
NI-HMI2	History of Mathematics and Informatics	ZK	3
	esented in Czech. Selected topics {Infinitesimal calculus, probability, number theory, general algebra, different examples of algorithm	। s, transformations	s, recursive
	functions, eliptic curves, etc.) note on possibilities of applications of some mathematical methods in informatics and its develop	ment.	
NI-HSC	Side-Channel Analysis in Hardware	Z,ZK	4
	dicated to so-called side-channel information leakage in hardware devices. It focuses on both theoretical analysis and practical attack	_	
	ide channels and they get deeper insight in power attacks. Students learn to implement various profiled and non-profiled attacks and They also get practice in both designing the SCA countermeasures and analyzing the amount and characteristics of the side-channel	•	•
NI-HWB	Hardware Security	Z,ZK	5
	es the knowledge needed for the analysis and design of computer systems security solutions. Students get an overview of safeguard	,	-
•	leans. They will be able to safely use and integrate hardware components into systems and test them for resistance to attacks. Studen	_	=
the cr	yptographic accelerators, PUF, random number generators, smart cards, biometric devices, and devices for internal security functions	of the computer.	
NI-IAM	Internet and Multimedia	Z,ZK	4
	se is focused on principles and modern technologies for network transmissions of audiovisual (AV) signals. The syllabus includes acq	_	
	signals (output), network communication protocols, device interfaces, codecs, data formats and stereoscopy. We will look at practical unissions. Within the labs, students will practically assemble AV transmission chains using HW and SW technologies and verify the effi		
	ncy of AV transmissions. Students will learn how to build Internet infrastructure for end-to-end AV transmissions from the recording the		-
. ,	for audience.	•	
NI-IBE	Information Security	ZK	2
	ormation and IS/ICT security management systems (ISMS), methods for information access control, and basic norms and internation		-
	d methods for management of internal and external security threats, for IS/IT security audits, and for application security testing (e.g.		
NI-IKM	Internet and Classification Methods students get acquainted with classification methods used in four important internet, or generally network applications: in spam filtering	Z,ZK	4
	ion systems and in intrusion detection systems. However, they will learn more than only how classification is performed when solving	**	
	d of these applications, they get an overview of the fundamentals of classification methods. The course is taught in a 2-weeks cycle w		-
	During the exercises, the students on the one hand implement simple examples to topics from the lectures, on the other hand consul	t their semester ta	asks.
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 b	asics from the be	ginners class
NI-IOT	BI-IOS. Internet of Things	Z,ZK	4
	coused on the area of hardware and software technologies for the strongly growing computer support of various devices. Its goal is fa		I
	development elements (Raspberry Pi, Arduino Due) and with the language for efficient application development and modification (G		
NI-IVS	Intelligent embedded systems	KZ	4
Intelligent embedo	ded systems course for master's degree is focused on high-level technology embedded systems integrating artificial intelligence. The	course is an adva	nce version
_	mbedded system fundamentals course for the bachelor degree. The aim of the course is to teach students humanoid robot programment of the course is to teach students humanoid robot programment.	-	
development. Lectu	ures provide basis of motion control, sensor reading, application interfaces, robot navigation and development tools. In labs, students of provided a control of the provided and the provided an		applications
NI-KOD	combining knowledge of various courses like nature inspired algorithms, data mining algorithms, image recognition and web technical compression	Z,ZK	5
	pata Compression bucked to the basic principles of data compression. They will learn the necessary theoretical background and get an overview of data	. ,	-
	ne overview covers principles of integer coding and of statistical, dictionary, and context data compression methods. In addition, stude	=	_
·	lossy data compression methods used in image, audio, and video compression.		
NI-KOP	Combinatorial Optimization	Z,ZK	6
The students will of	gain knowledge and understanding necessary deployment of combinatorial heuristics at a professional level. They will be able not only	y to select and im	plement but
NII I/D)/	also to apply and evaluate heuristics for practical problems.	7.71	
NI-KRY	Advanced Cryptology	Z,ZK	5
	n the essentials of cryptanalysis and the mathematical principles of constructing symmetric and asymmetric ciphers. They will know tl generators. They will have an overview of cryptanalysis methods, elliptic curve cryptography and quantum cryptography, which they c		•
	their own systems or to the creation of their own software solutions.		
NI-KTH	Combinatorial Theories of Games	Z,ZK	4
	theory is a branch of mathematics, which has broad applications in economy, biology, politics and computer science. This theory study		r of agents
	ain competitive process by designing a mathematical model and investigating the strategies. The traditional task of classical game to	-	-
	s of the game where no player wants to deviate from his strategy. Historically, the second big development in game theory of two-playe		
-	onway, Berlekamp and Guy. They developed a theory, originally used for solving end-games in Go, into a full fledged field. The idea is patible games can be added, that is, played simultaneously. This led to the algrebraic approach to study combinatorial games. The thi	_	
-	established the theory of positional games (like tic-tac-toe and hex). In analysis of these game, one cannot escape the brute-force tra	=	-
	k introduced the "false probabilistic method", which aims to tackhle this problem. In this course we build the foundation of the theory of	_	
games. We focus o	in theoretical analysis of games and building the theory, not on the programming aspects of game solving algorithms. The course req	uires independen	t work, ability

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 7K 5 Students get acquainted with the fundamentals of legislation and international activities in the area of fighting cybercrime. Students will understand the classification of attacks and have an overview of systems for computer surveillance and traffic monitoring in the cyberspace. Students will also familiarize themselves with hacker activities and behavior. The course will also discuss the cooperation of the state agencies and subjects dealing with defence of the cyberspace (especially CSIRT and CERT teams). NI-LNG Introduction to Linguistics for IT Students This one-semester course should provide a gentle introduction to linguistics and language research for students majoring in IT and programming. Students get acquainted with basic concepts used in language descriptions as well as major theories influencing the current mainstream in linguistics. Specific attention will be paid to empirical and quantitative methods in linguistics, including the use of language corpora, and to specific issues of Czech. NI-LOM Linear Optimization and Methods Students learn the applications of optimization methods in computer science, economics, and industry. They are aware of practical importance of linear and integer programming. They are able to work with optimization software and are familiar with languages used in programming of that software. They get skills in formalization of optimization problems in computer science (such as scheduling of tasks to processors, analysis of network flows), distribution and allocation of resources (transportation problems, travelling salesman problems, etc.), issues from economics, and modelling of conflicts via the game theory. They get an overview of computational complexity of optimization problems. They get orientation in algorithms in linear programming. NI-LSM2 Statistical Modelling Lab ΚZ 5 The topic of LSM2 is advanced multiple target tracking (MTT). This domain covers simultaneous tracking of multiple targets using radar under the presence of clutter, or video tracking. 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 acquainted in detail with hardware support and programming technologies for the creation of parallel multithreaded computations on multicore processors with shared and virtually shared memories, which are today the most common computing nodes of powerful (super)computer systems. Students will gain knowledge of architecturally specific optimization techniques used to reduce the performance drop due to the widening gap between the computational requirements of multi-core CPUs and memory interface throughout. 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 5 The subject is focused on introduction to the discipline of Enterprise Engineering. Students learn the importance of a proper methodological approach for (re)engineering and implementation of processes, organisation structures and information support in big enterprises and institutions. NI-MKY Z,ZK Mathematics for Cryptology 5 Students will gain deeper knowledge of algebraic procedures solving the most important mathematical problems concerning the security of ciphers. In particular, the course focuses on the problem of solving a system of polynomial equations over a finite field, the problem of factorization of large numbers and the problem of discrete logarithm. The problem of factorization will also be solved on elliptic curves. Students will further become familiar with modern encryption systems based on lattices NI-MLP Machine Learning in Practice Applying machine learning methods to real projects in practice involves many other necessary tasks - from understanding the intentions of the client to, ideally, technical implementation The course guides students through all phases of a project according to the standard CRISP-DM methodology, not only theoretically but also practically. The aim is to experience real 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 understandable report. NI-MMA Multiplatform development of mobile applications 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 beginners class BI-IOS. NI-MOP Modern Object-Oriented Programming in Pharo ΚZ Object-oriented programming is currently one of the most widespread paradigms of software creation, especially enterprise information systems, where its ability to natural abstraction is used to build complex modern applications. In this course, we build on the knowledge acquired in the course BI-OOP and aim to further deepen the skills of design and implementation of object systems in modern pure object system Pharo (https://pharo.org). The course focuses on individual approach to students, their development needs and areas of interest. In addition to deepening object programming skills, which are generally applicable in other OO languages, students will also gain the opportunity to work on interesting projects and OO technologies in terms of semestral work with the possibility of cooperation with practice and related bachelor, diploma, postgraduate our direct involvement in the Pharo Consortium. NI-MPI Mathematics for Informatics The course comprises topics from general algebra with focus on finite structures used in computer science. It includes topics from multi-variate analysis, smooth optimization 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 selected numerical algorithm and their stability analysis. The topics are completed with demonstration of applications in computer science. The course focuses on clear presentation and argumentation. NI-MPL Managerial Psychology ZK 2 NI-MPR Master Project Ζ 1. At the beginning of the semester, a student reserves her/his final thesis topic and gets together with its supervisor. Together they decide on partial tasks that should be carried out during the semester. If the requirements they agreed upon are met, the supervisor awards the student an assessment for the course MI-MPR at the end of the semester. 2. The external supervisor enters the information on granting the credit using the form "Granting credit from the external supervisor of the final thesis" (http://fit.cvut.cz/student/studijni/formulare). The completed and signed form 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 topic that the student has reserved is rather general, the immediate tasks the supervisor assigns to the student for the upcoming semester should aim at fine-tuning the FT topic so that the FTT will be complete and approvable at the end of the semester. NI-MSI Mathematical Structures in Computer Science Z.ZK 4 Mathematical semantics of programming languages. Data types as continuous lattices, Scott topology. Procedures as continuous mappings. The Scott model of lambda calculus. Introduction to category theory. NI-MTI Modern Internet Technologies Z,ZK SYNOPSIS The subject "Modern Internet Technologies" is designed on four major pillars of networking: 1. Unified Communication and Collaboration - A single network, 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, video and data to achieve seamless integrated services. 2. Design of Extremely Scalable Networks - This provides the insights of network architectures which can accommodate hundreds of millions of users and billions of devices, Thus, there is a paradigm switch from LANs (Local Area Networks) to SPs (Service Providers), 3, Traffic Segregation, Traffic Matching and Traffic Prioritisation - These technologies allow service providers to create private channels of communication between customers, with guaranteed parameters (bandwidth, delay, jitter, type of protocol). 4. Acceleration Technologies - They allow traffic to be carried at the optimal speed and allow for graceful degradation of service parameters in case of failures. NI-MVI Computational Intelligence Methods Students will understand methods and techniques of computational intelligence that are mostly nature-inspired, parallel by nature, and applicable to many problems. They will learn how these methods work and how to apply them to problems related to data mining, control, intelligen games, optimizations, etc.

NI-MZI Mathematics for data science Z,ZK In this course, students are introduced to those fields of mathematics that are necessary for understanding standard methods and algorithms used in data science. The studied topics include mainly: linear algebra (matrix factorisations, eigenvalues, diagonalization), continuous optimisation (optimisation with constraints, duality principle, gradient methods) and selected notions from probability theory and statistics. NI-NLM Neural Language Models 7 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 goal of the course is to teach students how to use language models to solve problems, make informed risk assessments, and work critically with the scientific literature. NI-NMS Neural Networks, Machine Learning and Randomness Stochastic methods, i.e. methods based on randomness, are extremely important for the construction and training of neural networks as well as a number of other machine learning models. The course "Neural networks, machine learning and randomness" will discuss in sufficient depth a number of specific types of neural networks that rely substantially on 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 stochastic approach to training neural networks and shows that, in addition to the use of randomness in neural networks and machine learning, machine learning models, including neural networks, are used in one of the most important applications of randomness stochastic optimization methods, which include e.g. popular evolutionary algorithms. New media in art and design NI-NMU 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 and sound. The main goal is to familiarize the student with the largest possible range of creative approaches in new media. The subject emphasizes dialogue with students, especially in lectures devoted to specific art projects. NI-NON Nonlinear Continuous Optimization and Numerical Methods Z,ZK 5 Students will be introduced to nonlinear continuous optimization, principles of the most popular methods of optimization and applications of such methods to real-world problems. They will also learn the finite element method and the finite difference method used for solving ordinary and partial differential equations in engineering. They will learn to solve systems of linear algebraic equations that arise from discretization of the continuous problems by direct and iterative algorithms. They will also learn to implement these algorithms sequentially as well as in parallel. 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, such as stability from system theory and entropy from thermodynamics. Students will understand a set of principles that indicate where violations of stability and entropy-related issues occur in any given software architecture. In the second part of the course, students learn how to construct software architectures using a set of 5 design patterns called elements. These elements provide the core functionality of information systems in terms of storing data, executing actions, workflows, connectors, and triggers, while handling violations of the stability and entropy-related principles. This knowledge allows students to realize new levels of evolvability in software architectures. NI-NUR User Interface Design Z.ZK Students will understand the theorical background of human-computer interaction and user interface (UI) design, will learn formal description of UIs, formal user models, the fundamental notions and procesures. They get acquainted with graphical, speech, and multimodal Uls. Thanks to the gained knowledge, the students will be able to design advanced Uls. Linux Drivers The Linux operating system is an important operating system for personal computer and also for embedded systems. Systems on chip and combining powerful processors and FPGAs increase the variability of peripheral subsystems requiring specific software drivers. This course is an advanced course in the Linux driver development for master's students. The course provides knowledge of Linux operating system architecture, principles of development of various types drivers, including practical experience. Operating Systems and Systems Programming NI-OSY The course covers system programming in UNIX environment. Emphasis is given on kernel development with focus on kernel architecture and kernel data structures. Key topics are: process management, memory management, file operations and architecture of modern file systems, device drivers and network programming. The course also addresses kernel development process, upgrades of existing kernels, kernel booting, debugging using dynamic instrumentation, and techniques to guarantee portability. Specifics of kernel architecture in embedded and real-time operating systems are also discussed. Theoretical and general principles are demonstrated on the LINUX kernel. Within labs, students will work on projects focused on development of LINUX kernel modules. NI-PAM Efficient Preprocessing and Parameterized Algorithms Z.ZK There are many optimization problems for which no polynomial time algorithms are known (e.g. NP-complete problems). Despite that it is often necessary to solve these problems exactly in practice. We will demonstrate that many problems can be solved much more effectively than by naively trying all possible solutions. Often one can find a common property (parameter) of the inputs from practice-e.g., all solutions are relatively small. Parameterized algorithms exploit that by limiting the time complexity exponentially in this (small) parameter and polynomially in the input size (which can be huge). Parameterized algorithms also represent a way to formalize the notion of effective polynomial time preprocessing of the input, which is not possible in the classical complexity. Such a polynomial time preprocessing is then a suitable first step, whatever is the subsequent solution method. We will present a plethora of parameterized algorithm design methods and we will also show how to prove that for some problem (and parameter) such an algorithm (presumably) does not exist. We will also not miss out the relations to other approaches to hard problems such as moderately exponential algorithms or approximation schemes. NI-PAS Advanced Aspects of Business 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 their own business or business management, especially in law, administration (necessary steps and documents), business economics, foreign trade and related aspects Advanced Database Systems Students orient themselves in problems of evaluation and optimization of SQL queries. The next part of the course deals with new concepts of database machines (so called NoSQL databases), with the related new data models (XML, graph databases, column databases) and languages for working with them (XQuery, XPath, CYPHER, Gremlin). The last part of the course deals with performance evaluation of database machines. NI-PDD Data Preprocessing Z,ZK Students learn to prepare raw data for further processing and analysis. They learn what algorithms can be used to extract information from various data sources, such as images, texts, time series, etc., and learn the skills to apply these theoretical concepts to solve specific problems in individual projects - e.g., extraction of characteristics from images or from web pages. NI-PDP Parallel and Distributed Programming Z,ZK 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 acquianted 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-PG1 Computer Grafics 1 7K 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. The course is designed for those interested in advanced computer graphics. Students will gain practical knowledge with realistic texturing and raytracing methods. An integral part of the course is the study of scientific articles and their subsequent implementation. The course will be followed by a course PG2 supplementing the knowledge of PG1 on other areas and topics of computer graphics.

NI-PIS	Enterprise Information Systems	Z,ZK	5
	ed on the current IT requirements of large companies in the Czech Republic (Top 100). The basis is Data management, storage of bi elligence). The principles of solving the overall architecture of information systems in the banking, insurance and telecommunication:	, , ,	
	properties). The principles of contring the ordinal architecture of information systems in the company / organization and its impact on the bus	-	
Students will be acq	uainted with technologies that have proven themselves in the elimination of basic risks in the planning, implementation and operation	n of information syst	tems in the
NII DIV	company / organization.	7 71/	-
NI-PIV The Computer Vision	Computer Vision n course focuses on the theoretical and practical mastery of modern methods and algorithms in the field of image data processing.St	Z,ZK udents will get acgu	5 ainted with
·	es of computer vision, gradually move to advanced computer vision techniques using deep learning. Emphasis is placed on theoretic		
	s and implementation of learned methods during exercises. Topics covered include morphological operations, image filtering, color re		
and recognition and	d segmentation through classical and recent approaches based on deep learning, deep neural networks for computer vision (includi motion detection, visual expressiveness (saliency).	ing CNN, RCNN, YC	DLO, ViT),
NI-PLS1	Programming Language Seminar	Z	2
The Programming	Language Seminar aims to introduce students to research in programming languages. It has the format of a reading group in which	we discuss scientif	
about programming	languages and related fields. Participating students are expected to present a paper of their interest and actively participate in the d		ding 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	s. Z	2
- 1	Language Seminar aims to introduce students to research in programming languages. It has the format of a reading group in which	_	
about programming	languages and related fields. Participating students are expected to present a paper of their interest and actively participate in the d		ding group
NII DI OO	is a joint venue between FIT and MFF CUNI. It is open to all students and researchers interested in programming language		
NI-PLS3	Programming Language Seminar Language Seminar aims to introduce students to research in programming languages. It has the format of a reading group in which	we discuss scientif	2 ic naners
	languages and related fields. Participating students are expected to present a paper of their interest and actively participate in the d		
	is a joint venue between FIT and MFF CUNI. It is open to all students and researchers interested in programming language	S.	
NI-PLS4	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 languages and related fields. Participating students are expected to present a paper of their interest and actively participate in the d		
about programming	is a joint venue between FIT and MFF CUNI. It is open to all students and researchers interested in programming language		anig group
NI-PON	Selected Topics in Optimization and Numerical mathematics	Z,ZK	5
	on optimization problems that appear in the field of machine learning and artificial intelligence. Students broaden their knowledge of co	•	
in the course Mathe	matics 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 relevan	t concepts
NI-PSD	Public Services Design	KZ	4
	duce students to specifics of UX, Service design and development for public sector. We will look into the design and development p		•
suppliers (devs ar	d designesr) as well as clients. In small teams students will work on projects from partner organizations and will try out collaboration Course is aimed at students-designers as well as clients.	n with client represe	ntatives.
NI-PSL	Programming in Scala	Z,ZK	4
The course introdu	ces the modern programming language Scala which exploits object-functional paradigm. Scala comprises advance language feature	es - e.g.pattern mat	٠ ١
advance standard lib	orary. Scala enables to use of applications functional patterns e.g. H-List, Monads, etc. Scala is used by many powerful frameworks and	l libraries e.g. Play, C	Cassandra,
NI-PVR	Scalaz, etc. Advanced Virtual Reality	KZ	4
	es advanced parts of the virtual reality. It is a continuation of the already running graphic objects, especially the creation of 3D model		
•	students to their application in virtual reality. Lectures will focus on virtual reality technology, its use in various applications and will also	•	
in available 3D engir	nes (mainly Unity3D). The course is freely connected with the subject VHS (virtual game worlds), students will be able to apply the kn in virtual reality, or directly create a complex game for VR.	lowledge gained in t	his subject
NI-PVS	Advanced embedded systems	Z,ZK	4
	sed on ARM processors and microcontrollers and their usage in wide range of applications. The course includes a series of advance		
working with mass	storage devices, motor control, system control and industrial communication. The students obtain both theoretical and also practica	I experiences with e	mbedded
NI-PYT	systems. Advanced Python	KZ	4
	rse is to learn various advanced techniques and methods in Python. The course indirectly continues where Programming in Python		
very hands-on and it	has only tutorials, everything is demonstrated on examples. Classification is based on work in class as well as semestral coursework	The course is lead	by external
NII DEV	teachers from Red Hat.	7 71/	
NI-REV Students will get acc	Reverse Engineering quainted with the essentials of reverse engineering of computer software. They will learn how processes start and what happens before	Z,ZK ore and after the ma	5 ain function
is called. Students	will understand how executable files are organized and how they interact with 3rd party libraries. Another part of the course is dedicated	ated to reverse engi	neering of
	en in C++. Students will also understand principles of disassemblers and obfuscation techniques. A part of the course will also be do		
debuggers and der	bugging work and which methods can be used to detect it. One of the lectures will be dedicated to the latest trends on the computer the course is on the seminars, where students will solve practically oriented tasks from the real world.	maiware scene. In	e focus of
NI-ROZ	Pattern Recognition	Z,ZK	5
The aim of the mo	odule is to give a systematic account of the major topics in pattern recognition with emphasis on problems and applications of the st	atistical approach to	pattern
	dents will learn the fundamental concepts and methods of pattern recognition, including probability models, parameter estimation, at		
NI-RUB	Programming in Ruby This course is presented in Czech.	KZ	4
NI-RUN	Runtime Systems	Z,ZK	5
	oduction to the world of virtual machines (VM) for high-level programming languages. There are two goals: Give you hands-on experienc		
-	a VM from scratch, including Abstract Syntax Tree (AST) interpretation Byte code (BC) design and interpretation AST to BC compil	=	- 1
Just-ın-time compila	tion and some optimization techniques Through a series of guest lectures, introduce you to various advanced topics and implementatio Dynamic optimizations, speculations, and deoptimizations Language implementation frameworks Read-world VMs	ris of real-world VM:	s, including
	,		

NI-SBF	System Security and Forensics	Z,ZK	5				
Students will get familiar with aspects of system security (principles of end station security, principles of security policies, security models, authentication concepts). Furthermore, students will get familiar with forensic analysis as a tool for investigating security incidents (techniques used by malicious software/attackers and forensic analysis techniques and the							
students will get lai	importance of operating system/operating system artifacts or file system for attack analysis and detection).	c analysis techniqu	ies and the				
NI-SCE1	Computer Engineering Seminar Master I	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 professional literature and/or work in K N laboratories. The capacity of the subject is limited by the possibilities of the seminar teacher	· ·					
articles and other p	semester.	s. The topics are in	ew ioi eacii				
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 professional literature and/or work in K N laboratories. The capacity of the subject is limited by the possibilities of the seminar teacher	•					
articles and other p	semester.	s. The topics are in	ew ioi eacii				
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						
problems (modelling of signals and processes) to computer networks (network components load, attacks detection). The students learn to select a convenient process model, estimate ts parameters, analyze its properties and use it for forecasting of future or intermediate values. The stress is put on understanding and adoption of the main principles based on practical							
•	s. Both the lab classes and the lectures exploit freely available software packages in order to provide easy and straightforward transfe						
	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	-					
	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 properties of proper tools. The course covers recent verification methods, too.	Modeling) levels a	na with the				
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		s and best				
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				
NI-SYP	quality assurance. Parsing and Compilers	Z,ZK	5				
	ا upon the knowledge of fundamentals of automata theory, formal language and formal translation theories. Students gain knowledge of va		-				
	of LR parsing and are introduced to special applications of parsers, such as incremental and parallel parsing.						
NI-SZ1	Knowledge Engineering Seminar Master I	Z	4				
	ryou will present a research paper from a top institute / research group to your peers. You will learn what is being cooked in top resea 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						
radiionany, you wii	and summer schools, as well as FIT's own Summer Research Program (VyLet).	io iodiriirig dila 7 ii c	0011101011000				
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 resear						
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 machir and summer schools, as well as FIT's own Summer Research Program (VyLet).	ie iearning and Ai d	conferences				
NI-TES	Systems Theory	Z,ZK	5				
-	d has the ability to develop systems of incredible complexity (e.g., trains, microprocessors, airplanes, nuclear power plants). However	, the costs of man					
	ensuring the correct behavior of a given system have become critical. A key technique for mastering this complexity is the usage of means that are important for the took at head, and submated took for applying those models. This publicat will present the arry and slow		· ·				
aspects of the syst	ems that are important for the task at hand, and automated tools for analyzing those models. This subject will present theory and algo- the modeling and analysis of complex systems.	טוונווווז נוומנ וטוווו נו	ie dasis idi				
NI-TKA	Category Theory	Z,ZK	4				
NI-TNN	Theory of Neural Networks	Z,ZK	5				
	works are now the foundation of artificial intelligence and the fastest-growing area of machine learning. This course introduces their the		- 1				
-	eptsstructure, active dynamics, and adaptive dynamics (i.e., learning). Then it covers the theoretical basis of the most common types ron of the 1950s to the transformer of 2017. Finally, using function approximation theory, it rigorously explains the most important the						
	approximation capability of neural networks.						
NI-TNN.25	Theory of Neural Networks	Z,ZK	4				
	works are now the foundation of artificial intelligence and the fastest-growing area of machine learning. This course introduces their the eptsstructure, active dynamics, and adaptive dynamics (i.e., learning). Then it covers the theoretical basis of the most common types		- 1				
ŭ	ron of the 1950s to the transformer of 2017. Finally, using function approximation theory, it rigorously explains the most important the						
	approximation capability of neural networks.						
NI-TS1	Theoretical Seminar Master I	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 vector other scholarly literature. The capacity is limited by the the potentials of the teachers of the seminar.	VOLK WITH SCIENTIFIC	papers and				
NI-TS2	Theoretical Seminar Master II	Z	4				
	r is intended for students which want to come in deeper contact with contemporary theoretical computer science. It is mostly a classical						
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 vector other scholarly literature. The capacity is limited by the the potentials of the teachers of the seminar.	vork with scientific	papers and				
NI-TS3	Theoretical Seminar Master III	Z	4				
	r is intended for students which want to come in deeper contact with contemporary theoretical computer science. It is mostly a classical		-				
	ally and concern themselves with interesting topics from the latest research in the area. Therefore, an integral part of the course is a v						
	other scholarly literature. The capacity is limited by the potentials of the teachers of the seminar.						

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 other scholarly literature. The capacity is limited by the the potentials of the teachers of the seminar.	work with scientific	papers and
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	,	
•	ensitization and to use an ATPG for automatic test generation. They will be able to design easily testable circuits and systems with bu		
	will be able to compute, analyze, and control the reliability and availability of the designed circuits.		
NI-TSW	Software Product Development	KZ	4
	The course is presented in Czech.		
NI-TVR	Virtual Reality Technology	Z,ZK	3
	troduced to the basic concepts of virtual reality. Techniques for displaying virtual worlds (CAVE, HMD,) and the possibilities of cont	•	"
tracking, hand tra	cking, eye tracking) will be discussed. Furthermore, the concepts of mixed and augmented reality will be introduced. Finally, ways of	using virtual and a	lugmented
NI-UMI	reality will be presented.	Z,ZK	5
	Artificial intelligence s search and inference algorithms in major formal paradigms used in artificial intelligence such as logic theories, constraint programn	,	_
1110 000100 001010	The main principles and practical applications of discussed techniques will be illustrated.	mig and adtornate	a plaining.
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		ey will get
acquainted with vir	rtualization principles, tools and technologies that serve to facilitate and automate configuration, testing and monitoring, and to efficie	ently operate and o	ptimize the
	rameters of modern computer systems. Theoretically and practically, they will get acquainted with containerization as the most effect	• • • • • • • • • • • • • • • • • • • •	
management of cor	nplex computer systems and with specific technologies of cloud systems. Finally, they will learn the principles and gain practical skills in	n the use of moder	n integration
NII V/ENA	and development tools (Continuous integration and development).	KZ	2
NI-VEM	Scientific thinking he course is to get acquainted with scientific methods and discovery of order and laws of the universe, including the aspects of huma		1
-	in natural sciences, mathematics, computer science and humanities. Another aim is to introduce rules and requirements of scientific	-	
	papers and posters.		a roodaron
NI-VGA	Video Games Architecture	Z,ZK	5
	a wide range of topics, procedures and methodologies related to the development of computer games - from a technical point of vie		
philosophical point	of view. In the lectures, students will be guided through the history of development, the structure of game engines, component and fu	ınctional 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 ir	nplementing
	some game mechanics, in the form of practical demonstrations.	7 71/	
NI-VMM	Retrieval from Multimedia speneral knowledge regarding interfaces of portals providing multimedia content, the principles of similarity search, the methods of fear	Z,ZK	5 multimodia
The student obtains	objects, indexing, and structure of distributed search engines.	lure extraction from	Tillulullileula
NI-VOL	Elections	Z,ZK	5
	We will cover the basics of (committee) elections and, in general, opinion aggregation.	_,	1 -
NI-VPR	Research Project	Z	5
NII VOM	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 the student through advanced probabilistic and statistical methods used in information technology praxis. Particularly it deals with m	Z,ZK	7
	ropy in coding theory, hypothesis testing (T-tests, goodness of fit tests, independence test). Second part of the course deals with random technology praxis. Fall total random technology praxis. F		
	Markov chains. The high point of the course is the Queuing theory and its application in networks.		
NI-VYC	Computability	Z,ZK	4
'	Classical theory of recursive functions and effective computability.	,	'
NI-ZS10	Master internship abroad for 10 credits	Z	10
Each student can	once within his / her master's degree have a foreign internship at a foreign university or other foreign scientific and/or research institu	tion. Before the int	ernship the
	the vice-dean for study affairs assesses the professional content. The student must provide evidence of the professional content and ex		
	MI-ZS20, MI-ZS30 are used used for the evidence and evaluation of the internship in IS KOS. Every 10 credits correspond to 4 week on. The maximum number of credits a student can earn for one internship is 30 credits. This amount can be divided into two subjects	-	- 1
a loreign mondic	academic year's dead-line.	ii tile iiiteriisiiip ez	iceeus ine
NI-ZS20	Master internship abroad for 20 credits	Z	20
	once within his / her master's degree have a foreign internship at a foreign university or other foreign scientific and/or research institu		
Dean of the FIT, or t	the vice-dean for study affairs assesses the professional content. The student must provide evidence of the professional content and ex	tent of the internsl	hip. Auxiliary
	MI-ZS20, MI-ZS30 are used used for the evidence and evaluation of the internship in IS KOS. Every 10 credits correspond to 4 week	•	
a foreign institution	on. 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 ex	ceeds the
NII 7000	academic year's dead-line.		- 00
NI-ZS30	Master internship abroad for 30 credits	Z	30
	ented in chzech language. Each student can once within his / her master's degree have a foreign internship at a foreign university or Before the internship the Dean of the FIT, or the vice-dean for study affairs assesses the professional content. The student must provice	-	
	of the internship. Auxiliary courses MI-ZS10, MI-ZS20, MI-ZS30 are used used for the evidence and evaluation of the internship in IS KO		·
	ime employment with a foreign institution. The maximum number of credits a student can earn for one internship is 30 credits. This are	•	
	subjects if the internship exceeds the academic year's dead-line.		
NIE-BLO	Blockchain	Z,ZK	5
	stand the foundations of blockchain technology, smart contract programming, and gain an overview of most notable blockchain platform		- 1
	secure decentralized application, and assess whether integration of a blockchain is suitable for a given problem. The course places are blocked and in the course places are blocked and in the course places are blocked and in the course places.		
relationship between	en blockchains and information security. It is concluded with a defense of a research or applied semester project, which prepares the supervising implementation of blockchain-based solutions in both academia and business.	students for imple	ernenting or
NIE-PDL		KZ	5
	Practical Deep Learning igned to provide students with a comprehensive understanding of Deep Learning using PyTorch, a popular open-source machine lea		1 1
	s will develop practical skills in building and training deep neural networks, using PyTorch to solve real-world problems in fields such a	-	- 1
,	language processing.		

١	Personalized machine learning (PML) is a sub-field of machine learning that aims to create models and predictions based on the unique characteristics and behaviors of individual						
l	entities. While PML is commonly used in applications such as recommender systems, which recommend items to users based on their personal interests, its principles can be applied						
l	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.						
Γ	PI-SCN	0		4			
п	FI-3CIN	Seminars on Digital Design	ZK	4			
		Seminars on Digital Design vith problems of realization and implementation of digital circuits - both combinational and sequential. Basic means of description of	ZK digital circuits and	4 basic logic			

Z,ZK

Personalized Machine Learning

For updated information see http://bilakniha.cvut.cz/en/FF.html Generated: day 2025-11-27, time 18:32.

NIE-PML