### Study plan

# Name of study plan: Master branch System Programming, spec. Computer Science, in Czech, 2016-2017

Faculty/Institute/Others: Department: Branch of study guaranteed by the department: Welcome page Garantor of the study branch: Program of study: Informatics, valid until 2024 Type of study: Follow-up master full-time Required credits: 89 Elective courses credits: 31 Sum of credits in the plan: 120 Note on the plan: Tato verze studijního plánu je ur ena pro ro ník, který byl p ijat ke studiu v akademickém roce 2016/2017 do prezen ní formy studia magisterského programu.

Name of the block: Compulsory courses in the program Minimal number of credits of the block: 54 The role of the block: PP

Code of the group: MI-PP.2016

Name of the group: Compulsory Courses of Master Study Program, Version 2016, in Czech Requirement credits in the group: In this group you have to gain 54 credits

Requirement courses in the group: In this group you have to complete at least 6 courses Credits in the group: 54

Note on the group: Opakovaně do studia zapsaní studenti s uznatelnou zkouškou z PAR mohou požádat o uznání zkoušky z předmětu PDP.# Opozdilcům: Student, kteremu chybí PPR, si zapíše PDP a získá z něj zápočet.# Do studia opakovaně zapsaným studentů: student se zkouškou z PPR má právou na uznání zápočtu z PDP.

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
MI-DIP	Diploma Project	Z	23		L,Z	PP
MI-MPR	Master Project	Z	7		Z,L	PP
MI-MPI	Mathematics for Informatics Št pán Starosta	Z,ZK	7	3P+2C	Z	PP
MI-PDP.16	Parallel and Distributed Programming	Z,ZK	5	2P+2C	L	PP
MI-PAA	Problems and Algorithms Petr Fišer	Z,ZK	5	2P+1R+1C	Z	PP
MI-SPI.16	Statistics for Informatics	Z,ZK	7	4P+2C	L	PP

### Characteristics of the courses of this group of Study Plan: Code=MI-PP.2016 Name=Compulsory Courses of Master Study Program, Version 2016, in Czech

MI-DIP	Diploma Project	Z	23					
MI-MPR	Master Project	Z	7					
1. At the beginning of th	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 t	he requirements they agreed upon are met, the supervisor awards the student an assessment for the course MI-MPR at the	end of the semes	ter. 2. External					
Master these (MT) supe	ervisor fills his/her assessment into the paper "Form to award assessment by an external Final theses (FT) supervisor" (for th	e courses BIE-BA	AP, MIE-MPR,					
MIE-DIP). Students, the	n, ensure that the assessment is registered into the information system (IS) by asking their internal FT opponent to award th	e assessment to t	he IS based on					
the confirmation of the	external MT supervisor. In the case the FT opponent is external as well, the assessment will be registered to the IS by the he	ad of the departm	nent responsible					
for the topic of the MT. 3	B. If the FT topic that the student has reserved is rather general, the immediate tasks the supervisor assigns to the student fo	r the upcoming se	mester should					
aim at fine-tuning the F	T topic so that the FTT will be complete and approvable at the end of the semester.							
MI-MPI	Mathematics for Informatics	Z,ZK	7					
	· · · · · · · · · · · · · · · · · · ·							

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.

MI-PDP.16	Parallel and Distributed Programming	Z,ZK	5
Due to the development	of cloud, web, and communication technologies and due to the shift of the Moore law into multicore and manycore CPUs, pa	arallel and distribu	uted applications
are becoming ubiquitou	s. Students get acquainted with architectures of parallel and distributed computing systems, their models, theory of interconr	nection networks,	and languages
and environments for pa	arallel programming of shared and distributed memory computers. On selected problems, they will learn the techniques of desig	gn of efficient and	scalable parallel
algorithms and methods	s of performance evaluation of their implementations.		
MI-PAA	Problems and Algorithms	Z,ZK	5
Students are able to eva	aluate discrete problems by complexity and by the purpose of optimisation (on-line tasks, multicriterial optimisation). They und	derstand principle	s and properties
of heuristics and exact a	algorithms and, therefore, are able to select, apply, and experimentally evaluate a suitable heuristics for a practical problem.		
MI-SPI.16	Statistics for Informatics	Z,ZK	7
Summary of probability	heory; Multivariate normal distribution; Entropy and its application to coding; Statistical tests: T-tests, goodness of fit tests, indep	pendence test; Ra	indom processes
- stacionarity; Markov cl	hains and limiting properties; Queuing theory		
Name of the h	lock: Compulsory courses of the specialization		
Name of the b			

Minimal number of credits of the block: 8

The role of the block: PO

#### Code of the group: MI-PO-SP.2016

Name of the group: Compulsory Courses of Master Branch System Programming, in Czech, Version 2016 Requirement credits in the group: In this group you have to gain 8 credits

Requirement courses in the group: In this group you have to complete at least 2 courses Credits in the group: 8

#### Note on the group:

Code	Name of the course / Name of the group of courses (in case of groups of courses the list of codes of their members) Tutors, authors and guarantors (gar.)	Completion	Credits	Scope	Semester	Role
MI-FLP	Functional and Logical Programming	Z,ZK	4	2P+1C	L	PO
MI-SYP.16	Parsing and Compilers	Z,ZK	5	2P+1C	Z	PO

## Characteristics of the courses of this group of Study Plan: Code=MI-PO-SP.2016 Name=Compulsory Courses of Master Branch System Programming, in Czech, Version 2016

MI-FLP	Functional and Logical Programming	Z,ZK	4		
Students will be acquainted with principles of functional and logic programming. They will be able to write their programs in Lisp and Prolog programming languages.					
MI-SYP.16	Parsing and Compilers	Z,ZK	5		
The module builds upon the knowledge of fundamentals of automata theory, formal language and formal translation theories. Students gain knowledge of various variants and applications					
of LR parsing and are introduced to special applications of parsers, such as incremental and parallel parsing.					

Name of the block: Povinné p edm ty zam ení Minimal number of credits of the block: 22 The role of the block: PZ

#### Code of the group: MI-PZ-SP-TI.2016

Name of the group: Compulsory Courses of Master Specialization Computer Science, Presented in Czech, Version 2016

Requirement credits in the group: In this group you have to gain 22 credits

Requirement courses in the group: In this group you have to complete at least 5 courses

Credits in the group: 22

Note on the group:

Code	Name of the course / Name of the group of courses (in case of groups of courses the list of codes of their members) Tutors, authors and guarantors (gar.)	Completion	Credits	Scope	Semester	Role
MI-AVY	Automata in Text Pattern Matching Ond ej Guth, Tomáš Pecka, Št pán Plachý, Jan Trávní ek, Jan Ž árek Ond ej Guth Ond ej Guth (Gar.)	Z,ZK	4	2P+1C	L	PZ
MI-MVI.16	Computational Intelligence Methods	Z,ZK	5	2P+1C	Z	ΡZ
MI-NON.16	Nonlinear Continuous Optimization and Numerical Methods	Z,ZK	5	2P+1C	Z	PZ
MI-PAL	Advanced Algorithms	Z,ZK	4	2P+1C	L	PZ
MI-CPX	Complexity Theory	Z,ZK	5	3P+1C	Z	PZ

Characteristics of the courses of this group of Study Plan: Code=MI-PZ-SP-TI.2016 Name=Compulsory Courses of Master Specialization Computer Science, Presented in Czech, Version 2016

MI-AVY	Automato in Tayt Dattorn Metabing	7.71	4					
	Automata in Text Pattern Matching	Z,ZK	4					
	tern matching) and generally in data is an area of problems and exciting solutions from theoretical and practical perspectives							
	al (text) or multi-dimensional (tree, picture). We may search for something known (a pattern: a string or a set specified by regi	· ,	•					
example, a regularity).	Matching can be either exact or approximate. This course presents a taxonomy of searching problems. It focuses on algorithr	ns based on some	e automaton					
(finite, pushdown, linear-bounded, or tree).								
MI-MVI.16	Computational Intelligence Methods	Z,ZK	5					
Students will understan	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 wor	k and how to apply them to problems related to data mining, control, intelligen games, optimizations, etc.							
MI-NON.16	Nonlinear Continuous Optimization and Numerical Methods	Z,ZK	5					
Students will be introdu	ed to nonlinear continuous optimization, principles of the most popular methods of optimization and applications of such met	, thods to real-world	d problems. They					
will also learn the finite	element method and the finite difference method used for solving ordinary and partial differential equations in engineering. T	hey will learn to s	olve systems of					
linear algebraic equatio	ns that arise from discretization of the continuous problems by direct and iterative algorithms. They will also learn to impleme	nt these algorithn	ns sequentially					
as well as in parallel.								
MI-PAL	Advanced Algorithms	Z,ZK	4					
The students will learn t	he most important advanced algorithms in different domains of the computer science that are not covered by modules of the	Bachelor program	1 Informatics and					
other modules of the Ma	aster program. They will also learn how to cope with problems that, according to the present knowledge, are not solvable opt	imally in polynom	ally bounded					
time.								
MI-CPX	Complexity Theory	Z,ZK	5					
Students will learn about	t the fundamental classes of problems in the complexity theory and different models of algoritms and about implications of the	he theory concerr	ing practical					
(un)solvability of difficul	t problems.		-					
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#### Name of the block: Compulsory elective economic-management courses Minimal number of credits of the block: 2 The role of the block: VE

#### Code of the group: MI-PV-EM.2016

Name of the group: Compulsory Elective Master Economics and Management Courses, in Czech, Ver. 2016 Requirement credits in the group: In this group you have to gain at least 2 credits (at most 6) Requirement courses in the group: In this group you have to complete at least 1 course (at most 2) Credits in the group: 2

Note on the group:

Opakovaně do studia zapsaným studentům: Má-li student uznaný předmět PRM, nelze ho uznat jako náhradu za nový předmět PCM (student musí vypracovat projekt).

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
FI-VEZ	economic-managerial course from a study abroad	Z	4	0+0	Z,L	VE
MI-IBE	Information Security	ZK	2	2P	Z	VE
MI-MPX	Management practice	Z	4	5XD	Z,L	VE
MI-PCM.16	Project And Change Management	KZ	3	1P+2C	Z,L	VE
MI-SEP	World Economy and Business	Z,ZK	4	2P+1C	Z	VE

### Characteristics of the courses of this group of Study Plan: Code=MI-PV-EM.2016 Name=Compulsory Elective Master Economics and Management Courses , in Czech, Ver. 2016

FI-VEZ	economic-managerial course from a study abroad	Z	4				
A "Humanities subject t	nat has been studied abroad" is covered by the Humanities subject from a study abroad in Compulsory Humanities Module t	hat is required in	the curriculum.				
The substitution is approved by the Vice-Dean for study affairs on behalf of the Dean at the request of the student.							
MI-IBE	Information Security	ZK	2				
Students learn informat	on and IS/ICT security management systems (ISMS), methods for information access control, and basic norms and internat	ional standards ir	this area. They				
understand methods for	management of internal and external security threats, for IS/IT security audits, and for application security testing (e.g., pen-	etration testing).					
MI-MPX	Management practice	Z	4				
The Student can once, v	vithin its master's degree graduate (to apply) management practices in the selected subject of practice (business subject) on ti	he operational, ta	ctical or strategic				
level of management (ty	rpically at the position of project manager, middle or top manager). The selected subject of practice and professional filling is	assessed well in	advance the				
course guarantor. In the	selected subject of practice may not have a substantial ownership interest or substantial decision-making influence of the re	latives of the stud	dent (e.g. as a				
member of the top man	agement).						
MI-PCM.16	Project And Change Management	KZ	3				
This course is presente	d in Czech.						
MI-SEP	World Economy and Business	Z,ZK	4				
This course is presente	d in Czech. However, there is an English variant in the program Informatics (N1801 / 4793). The course introduces students of	, of technical unive	rsity to the				
international business. I	t does that predominantly by comparing individual countries and key regions of world economy. Students get to know about o	different religions	and cultures,				
necessary for doing bus	iness in diverse societies as well as indexes of economic freedom, corruption and economic development, which are needed	d for the right inve	stment decision.				
Seminars help to improv	ve on the knowledge in the form of discussions based on individual readings. It is advised to take bachelor level of this course	e BIE-SEP as a p	rerequisite.				

Name of the block: Compulsory elective humanities courses Minimal number of credits of the block: 3 The role of the block: VH

#### Code of the group: MI-PV-HU.2016

Name of the group: Compulsory Elective Master Humanity Courses, Inclusive of Non-garanted Courses, Ver. 2016, in Czech

Requirement credits in the group: In this group you have to gain at least 3 credits (at most 6) Requirement courses in the group: In this group you have to complete at least 1 course ( at most 2) Credits in the group: 3

Note on the group:

If a student has attended one of the hum. courses offered here in bc. study, he must choose another

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-CAP	Cultural and Social Anthropology Alena Libánská, Tomáš Houdek, Jakub Senovský Jakub Šenovský Alena Libánská (Gar.)	ZK	2	2P	Z	VH
FI-FIL	Philosophy Peter Zamarovský Peter Zamarovský Peter Zamarovský (Gar.)	ZK	2	2P	Z,L	VH
MI-HMI2	History of Mathematics and Informatics	ZK	3	2P+1C	Z	VH
FI-HTE	History of Technology and Economics Jan Mikeš, Marcela Efmertová Jan Mikeš Jan Mikeš (Gar.)	ZK	2	2+0	Z,L	VH
FI-HPZ	Humanities subject from a study abroad	Z	3	0+0	Z,L	VH
MI-KYB.16	Cybernality	ZK	5	2P	Z	VH
FI-MPL	Managerial Psychology	ZK	2	2+0	Z,L	VH
FI-KSA	Cultural and Social Anthropology Jakub Šenovský	ZK	2	2P	L,Z	VH
FI-ULI	Introduction to Linguistics for Computer	ZK	2	2P	L	VH

### Characteristics of the courses of this group of Study Plan: Code=MI-PV-HU.2016 Name=Compulsory Elective Master Humanity Courses, Inclusive of Non-garanted Courses, Ver. 2016, in Czech

NI-CAP	Cultural and Social Anthropology	ZK	2
The one-semester cour	se aims to acquaint students with the basics of social and cultural anthropology as a scientific discipline dealing with the dive	rsity of the world	- examples from
anthropological researc	h from our "exotio" cultures (topics: kinship, religion, social exclusion, migration, globalization, , material culture, language, he	alth, history, deat	th, etc) will be
shown. The course is p	resented in Czech.		
FI-FIL	Philosophy	ZK	2
see A0B16			
MI-HMI2	History of Mathematics and Informatics	ZK	3
Selected topics {Infinite	simal calculus, probability, number theory, general algebra, different examples of algorithms, transformations, recursive functi	ons, eliptic curves	s, etc.) note on
possibilities of application	ons of some mathematical methods in informatics and its development.		
FI-HTE	History of Technology and Economics	ZK	2
The course introduces t	he scientific disciplines of history and technology, economic and social history of the Czech lands and Czechoslovakia in co	mparison with the	e development of
the European region 19	to 21 century.		
FI-HPZ	Humanities subject from a study abroad	Z	3
A "Humanities subject t	hat has been studied abroad" is covered by the Humanities subject from a study abroad in Compulsory Humanities Module t	hat is required in f	the curriculum.
The substitution is appr	oved by the Vice-Dean for study affairs on behalf of the Dean at the request of the student.		
MI-KYB.16	Cybernality	ZK	5
Students get acquainte	d with the fundamentals of legislation and international activities in the area of fighting cybercrime. Students will understand t	he classification c	of attacks and
have an overview of sys	tems for computer surveillance and traffic monitoring in the cyberspace. Students will also familiarize themselves with hacker a	activities and beha	avior. The course
will also discuss the coo	operation of the state agencies and subjects dealing with defence of the cyberspace (especially CSIRT and CERT teams).		
FI-MPL	Managerial Psychology	ZK	2
FI-KSA	Cultural and Social Anthropology	ZK	2
The one-semester cour	se aims to acquaint students with the basics of social and cultural anthropology as a scientific discipline dealing with the dive	rsity of the world	- examples from
anthropological researc	h from our "exotio" cultures (topics: kinship, religion, social exclusion, migration, globalization, , material culture, language, he	alth, history, deat	th, etc) will be
shown. The course is a	n interesting alternative to other humanities, taught at FIT.		
FI-ULI	Introduction to Linguistics for Computer	ZK	2
This course is presente	d in Czech.	·	

Name of the block: Elective courses Minimal number of credits of the block: 0 The role of the block: V

Code of the group: MI-V.2017 Name of the group: Purely Elective Master Courses, Version 2017 Requirement credits in the group: Requirement courses in the group:

# Credits in the group: 0

Note on the group:

In addition to the courses listed here, you can enroll as an elective any course that is offered within your study program and form of study that you did not enroll as a compulsory subject in the program/branch/specialization or a compulsory elective course. Courses of this group that a student has completed in the bachelor study at CTU cannot be re-completed.

	Name of the course / Name of the group of courses				1	
Code	(in case of groups of courses the list of codes of their members)	Completion	Credits	Scope	Semester	Role
MI-IKM	Tutors, authors and guarantors (gar.)	Z,ZK	4	1P+1C	L	V
	Applied Functional Programming					-
MI-AFP	Robert Pergl	KZ	5	2P+1C	L	V
MI-APH	Architecture of computer games	Z,ZK	4	2P+1C	Z	V
MI-BML	Bayesian Methods for Machine Learning	KZ	5	2P+1C	L	V
MI-BPS	Wireless Computer Networks	Z,ZK	4	2P+1C	L	V
MI-DSP	Database Systems in Practes	Z,ZK	4	2P+1C	L	V
MI-DZO	Digital Image Processing	Z,ZK	4	2P+1C	L	V
MI-DDM	Distributed Data Mining	KZ	4	3C	L	V
MI-PAM	Efficient Preprocessing and Parameterized Algorithms	Z,ZK	4	2P+1C	L	V
MI-GLR	Games and reinforcement learning	Z,ZK	4	2P+2C	L	V
NI-HSC	Side-Channel Analysis in Hardware Vojt ch Miškovský, Petr Socha Petr Socha Vojt ch Miškovský (Gar.)	Z,ZK	4	2P+2C	Z	V
MI-HMI2	History of Mathematics and Informatics	ZK	3	2P+1C	Z	V
MI-IVS	Intelligent embedded systems	KZ	4	1P+3C	L	V
NI-IAM	Internet and Multimedia	Z,ZK	4	2P+1C	L	V
MI-IOT	Internet of Things	Z,ZK	4	2P+1C	L	V
MI-ATH	Combinatorial Theories of Games	Z,ZK	4	2P+2C	L	V
NI-CCC	Creative Coding and Computational Art Josef Kortán, Radek Richtr Radek Richtr Radek Richtr (Gar.)	KZ	4	1P+2C	Z,L	V
NI-LSM	Statistical Modelling Lab Kamil Dedecius Kamil Dedecius (Gar.)	KZ	5	3C	L	V
MI-LOM.16	Linear Optimization and Methods	Z,ZK	5	2P+1C	Z	V
MI-MSI	Mathematical Structures in Computer Science	Z,ZK	4	2P+1C	L	V
MI-MZI	Mathematics for data science	Z,ZK	4	2P+1C	L	V
NI-MOP	Modern Object-Oriented Programming in Pharo Marek Skotnica, Jan Blizni enko Robert Pergl Robert Pergl (Gar.)	KZ	4	3C	Z	V
MI-MPC	Modern programming in C ++	Z,ZK	5	2P+1C	Z	V
MI-MAI	Multimedia and Internet	Z,ZK	3	2P+1C	L	V
MI-OLI	Linux Drivers	Z,ZK	4	2P+2C	L	V
MI-ARI	Computer arithmetic	Z,ZK	4	2P+1C	Z,L	V
NI-PG1	Computer Grafics 1 Radek Richtr Radek Richtr Radek Richtr (Gar.)	ZK	4	2P+1C	L	V
MI-PVR	Advanced Virtual Reality	KZ	4	2P+1C	Z	V
NI-AML	Advanced machine learning Miroslav epek, Petr Šimánek, Vojt ch Rybá, Rodrigo Augusto Da Silva Alves, Zden k Buk Miroslav epek Miroslav epek (Gar.)	Z,ZK	5	2P + 1C	L	V
MI-IOS	Advanced techniques in iOS applications	KZ	4	2P+2C	L	V
MI-PVS	Advanced embedded systems	Z,ZK	4	2P+2C	Z	V
MI-DNP	Advanced .NET	Z,ZK	4	2P+1C	Z	V
MI-PYT	Advanced Python	KZ	4	3C	Z	V
MI-PRC	Programming in CUDA	Z,ZK	4	2P+1C	L	V
MI-PSL	Programming in Scala	Z,ZK	4	2P+1C	L	V
MI-RUB	Programming in Ruby	KZ	4	3C	Z	V
MI-ROZ.16	Pattern Recognition	Z,ZK	5	2P+1C	Z	V
MI-RRI	Risk Management in Informatics	ZK	3	2P	L	V
MI-SCE1	Computer Engineering Seminar Master I	Z	4	2C	L,Z	V
MI-SCE2	Computer Engineering Seminar Master II	Z	4	2C	L,Z	V
MI-SZ1	Knowledge Engineering Seminar Master I	Z	4	2C	L,Z	V

PI-SCN	Seminars on Digital Design Petr Fišer Petr Fišer Petr Fišer (Gar.)	ZK	4	2P+1C	Z,L	V					
MI-SCR	Statistical Analysis of Time Series	Z,ZK	4	2P+1C	Z	V					
BI-SOJ	Machine Oriented Languages	Z,ZK	4	2P+2C	L	V					
MI-TS1	Theoretical Seminar Master I	Z	4	2C	Z	V					
MI-TS2	Theoretical Seminar Master II	Z	4	2C	L	V					
MI-TS3	Theoretical Seminar Master III	Z	4	2C	Z	V					
MI-TS4	Theoretical Seminar Master IV	Z	4	2C	L	v					
MI-TNN	Theory of Neural Networks	Z,ZK	4	1P+1C	L	V					
MI-VEM		KZ	2	1P+1C	L	V					
MI-MCS	Scientific thinking	KZ		1P+1C	Z						
	Multicore Systems	1	4			V					
MI-VYC	Computability	Z,ZK	4	2P+2C	L	V					
NI-VPR	Research Project Št pán Starosta Št pán Starosta Št pán Starosta (Gar.)	Z	5		Z,L	V					
MI-ZS10	Master internship abroad for 10 credits	Z	10		Z,L	V					
MI-ZS20	Master internship abroad for 20 credits	Z	20		Z,L	V					
MI-ZS30	Master internship abroad for 30 credits	Z	30		Z,L	V					
			1								
	e courses of this group of Study Plan: Code=MI-V.2017 Name=F	Purely Electiv	e Maste								
	story of Mathematics and Informatics	a transformations		1	ZK	3					
	I calculus, probability, number theory, general algebra, different examples of algorithm of some mathematical methods in informatics and its development.	s, transformations	, recursive	unctions, ell	plic curves,	etc.) hote on					
	ernet and Classification Methods			7	,ZK	4					
	get acquainted with classification methods used in four important internet, or generally	network application	ons: in span		·	-					
in malware detection system	as and in intrusion detection systems. However, they will learn more than only how class	sification is perfo	rmed when	solving these	e four kinds	of problems.					
-	applications, they get an overview of the fundamentals of classification methods. The	-		-		es and 2-hour					
	ses, the students on the one hand implement simple examples to topics from the lectu plied Functional Programming	res, on the other r	nand consu		KZ	5					
	Czech. Functional programming represents one of the traditional programming paradic	ms. Traditional an	d novel fun	1	1	-					
	unctional paradigm becomes an important construct of traditionally imperative language										
necessary competence of a	software engineer: the theory and especially the practice.										
	chitecture of computer games				,ZK	4					
	nderstanding of the various issues in the field of computer game development, from bo cture, game mechanics, and game AI that form an integral part of most games. They wil										
and apply them in practical				a patining	, networking	, and scripting					
	yesian Methods for Machine Learning				KZ	5					
, , ,	actical use of basic Bayesian modeling methods in the dynamically evolving machine le	• • •									
	n of real phenomena, as well as their subsequent use, e.g., for forecasting of future evo	-				-					
-	). The emphasis is put on understanding of explained principles and methods and their period tented to students, for instance, 2D/3D object tracking, radiation source term estimation		-	-							
some of them.		,									
MI-BPS Wi	reless Computer Networks			Z	,ZK	4					
	e modern technologies, protocols, and standards for wireless networks. They will under	-									
	I data flow control mechanisms. They will also learn about principles of communication at skills of configuration of wireless network elements and simulation of wireless netwo			knowledge	of security n	nechanisms					
	tabase Systems in Practes		10010.	7	,ZK	4					
This course is presented in	•				,	•					
	gital Image Processing				,ZK	4					
	prehensive overview of modern methods for interactive editing of digital images and vi	-	-	-		-					
· ·	esting theoretical basis. Visually attractive applications provide better understanding of This course will introduce algorithms solving the following practical applications: edge-		•								
	on, hybrid images, gradient domain editing, seamless image stitching and cloning, dig	-		-		-					
interactive as-rigid-as-possil	ole image deformation, free-form image registration, texture synthesis, interactive segr	nentation, coloriza	ation, paintii	ng, adding de	epth, alpha r	natting.					
	stributed Data Mining			1	KZ	4					
	the-art approaches for distributed data mining and parallelization of machine learning in Apache Spark and with existing distributed DM / ML algorithms. They will learn princip	-	-		-	-					
	Apache Spark and with existing distributed DM / ML algorithms. They will learn princip her algorithms. The course is prezented in czech language.	ico or trien paralle	, implettiefti		m ne cahan	ie io hiohose					
	ficient Preprocessing and Parameterized Algorithms			Z	,ZK	4					
	n problems for which no polynomial time algorithms are known (e.g. NP-complete prob	lems). Despite that	at it is often	1	·	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,											
	t size (which can be huge). Parameterized algorithms also represent a way to formaliz	e the notion of effe	ective polyn	omial time p	reprocessing	g of the input,					
which is not possible in the		e the notion of eff whatever is the s	ective polyn ubsequent	omial time p solution meth	reprocessing nod. We will	g of the input, present a					
which is not possible in the or plethora of parameterized al will also not miss out the relation	t size (which can be huge). Parameterized algorithms also represent a way to formaliz classical complexity. Such a polynomial time preprocessing is then a suitable first step,	e the notion of effort whatever is the s nd parameter) suc	ective polyn ubsequent ch an algorit	omial time p solution meth hm (presum	reprocessing nod. We will ably) does n	g of the input, present a					
which is not possible in the or plethora of parameterized al will also not miss out the relation MI-GLR Ga	t size (which can be huge). Parameterized algorithms also represent a way to formaliz classical complexity. Such a polynomial time preprocessing is then a suitable first step, gorithm design methods and we will also show how to prove that for some problem (ar	e the notion of eff whatever is the s nd parameter) suc ns or approximation	ective polyn ubsequent ch an algorit on schemes	omial time p solution meth hm (presum	reprocessing nod. We will ably) does n	g of the input, present a ot exist. We 4					

NI-HSC	Side-Channel Analysis in Hardware	Z,ZK	4
This course is dedicate	d to so-called side-channel information leakage in hardware devices. It focuses on both theoretical analysis and practical atta	icks. Students get	familiar with
	nannels and they get deeper insight in power attacks. Students learn to implement various profiled and non-profiled attacks ar	-	n higher-order
	practice in both designing the SCA countermeasures and analyzing the amount and characteristics of the side-channel inform	-	
MI-IVS	Intelligent embedded systems	KZ	4
-	ystems course for master's degree is focused on high-level technology embedded systems integrating artificial intelligence. The ded system fundamentals course for the bachelor degree. The aim of the course is to teach students humanoid robot programed and the source is to teach students humanoid robot programed and the source is the sou		
	provide basis of motion control, sensor reading, application interfaces, robot navigation and development tools. In labs, studer		
	of various courses like nature inspired algorithms, data mining algorithms, image recognition and web technologies		
NI-IAM	Internet and Multimedia	Z,ZK	4
The NI-IAM course is for	bcused on principles and modern technologies for network transmissions of audiovisual (AV) signals. The syllabus includes a	equisition of AV sig	gnals (input),
	als (output), network communication protocols, device interfaces, codecs, data formats and stereoscopy. We will look at practic		
	ns. Within the labs, students will practically assemble AV transmission chains using HW and SW technologies and verify the		· ·
for audience.	of AV transmissions. Students will learn how to build Internet infrastructure for end-to-end AV transmissions from the recording	g the scene up to	the presentation
MI-IOT	Internet of Things	Z,ZK	4
	on the area of hardware and software technologies for the strongly growing computer support of various devices. Its goal is fa	I ' I	-
-	(Raspberry Pi, Arduino Due) and with the language for efficient application development and modification (GNU Forth).		
MI-ATH	Combinatorial Theories of Games	Z,ZK	4
This course is presente		_,	
NI-CCC	Creative Coding and Computational Art	KZ	4
Students work on pract	ical tasks, get acquainted with creative and yet proven methods of visualizing various types of data. The course freely follows	the basic graphics	s courses (MGA,
BLE,) and introduces	students to suitable visualization methods for traditional as well as for open data. It combines well-known visualization techn	iques with artistic	methods using
-	The aim is to create an interesting visualization project. It is planned to work closely with IPR CAMP (Center of Architecture and	nd Metropolitan Pl	anning) and IIM
(Institute of Intermedia			
NI-LSM	Statistical Modelling Lab	KZ	5
-	on a single and multi-target tracking. The student both learns the existing methods and tries to implement them. The stress is nd its modeling using numpy and scipy. The second half of the semester is focused on the design of methods and algorithms,	-	
	t is on the border of own research and may result in the topic of final work (diploma or bachelor thesis).	and analyses of t	nen properties.
MI-LOM.16	Linear Optimization and Methods	Z,ZK	5
	ications of optimization methods in computer science, economics, and industry. They are aware of practical importance of line		-
	otimization software and are familiar with languages used in programming of that software. They get skills in formalization of c		
science (such as sched	duling of tasks to processors, analysis of network flows), distribution and allocation of resources (transportation problems, trav	/elling salesman p	roblems, 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	on in algorithms
in linear programming.			
MI-MSI	Mathematical Structures in Computer Science	Z,ZK	4
	s of programming languages.	7 71/	4
MI-MZI	Mathematics for data science are introduced to those fields of mathematics that are necessary for understanding standard methods and algorithms used i	Z,ZK	4
	Igebra (matrix factorisations, eigenvalues, diagonalization), continuous optimisation (optimisation with constraints, duality prin		
-	probability theory and statistics.	ioipio, gradioni me	and and
NI-MOP	Modern Object-Oriented Programming in Pharo	KZ	4
-	mming is currently one of the most widespread paradigms of software creation, especially enterprise information systems, who		tural 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 s	kills of design and	Implementation
	odern pure object system Pharo (https://pharo.org). The course focuses on individual approach to students, their development		
	bject programming skills, which are generally applicable in other OO languages, students will also gain the opportunity to wo		-
-	f semestral work with the possibility of cooperation with practice and related bachelor, diploma, postgraduate our direct involv		
MI-MPC	Modern programming in C ++ use the modern features of contemporary versions of the C++ programming language for software development. The course fi	Z,ZK	5 mming offerstivity
	m of writing maintainable and portable source code and creating correct programs with low memory and processor time requ		mining enectivity
MI-MAI	Multimedia and Internet	Z,ZK	3
	rinciples and technologies for processing and network transmissions of multimedia signals, stereoscopy and visualizations in h	I ' I	-
	worked multimedia, transmission formats, interfaces, codecs, technologies for acquisition and reproduction of multimedia data	-	
and distributed collabor	ration using networking and immersive environments.		
MI-OLI	Linux Drivers	Z,ZK	4
	stem is an important operating system for personal computer and also for embedded systems. Systems on chip and combining		
-	of peripheral subsystems requiring specific software drivers. This course is an advanced course in the Linux driver development		udents. The
	edge of Linux operating system architecture, principles of development of various types drivers, including practical experience		
MI-ARI	Computer arithmetic	Z,ZK	4
	bus data representations used in digital devices and will be able to design arithmetic operations implementation units.	71/	4
NI-PG1	Computer Grafics 1		4
-	aphic courses (mainly BI-PGA and BI-PGR) and the knowledge from these courses is deepened by state-of-the-art knowledge computer graphics. Students will gain practical knowledge with realistic texturing and raytracing methods. An integral part of t		-
	equent implementation. The course will be followed by a course PG2 supplementing the knowledge of PG1 on other areas and		-
MI-PVR	Advanced Virtual Reality	KZ	4
	advanced parts of the virtual reality. It is a continuation of the already running graphic objects, especially the creation of 3D mo	I I	
	dents to their application in virtual reality. Lectures will focus on virtual reality technology, its use in various applications and will a		-
-	(mainly Unity3D). The course is freely connected with the subject VHS (virtual game worlds), students will be able to apply the	e knowledge gaine	ed in this subject
-	ctly create a complex game for VR.	·	
NI-AML	Advanced machine learning	Z,ZK	5
	students to selected advanced topics of machine learning and artificial intelligence. The topics present techniques in the field of		
processing, control and	I interconnection of physical laws with the field of machine learning. The aim of the exercise is to familiarize students with the	memoas aiscusse	eu.

	1	
MI-IOS Advanced techniques in iOS applications	KZ	4
Students will learn the latest trends in mobile development technologies for iOS platform. Class covers advanced topics, students need to know all	the basics from the	beginners class
BI-IOS.		
MI-PVS Advanced embedded systems	Z,ZK	4
The course is focused on ARM processors and microcontrollers and their usage in wide range of applications. The course includes a series of adv	anced topics like se	curity support,
working with mass storage devices, motor control, system control and industrial communication. The students obtain both theoretical and also pra	ctical experiences v	vith embedded
systems.		
MI-DNP Advanced_NET	Z,ZK	4
Students acquire a knowledge about advanced desgin of applicatios on a .NET platform. They gain skills of WPF (Windows Presentation Foundati		(Windows
Communication Foundation) and Entity Framework. They are able to apply these skills on a development and desgin of advanced .NET application		
MI-PYT Advanced Python	KZ	4
The goal of this course is to learn various advanced techniques and methods in Python. The course indirectly continues where Programming in Py		-
very hands-on and it has only tutorials, everything is demonstrated on examples. Classification is based on work in class as well as semestral course teachers from Red Hat.	work. The course is	leau by external
	7 71/	
MI-PRC Programming in CUDA	Z,ZK	4
The students gain a good overview of present parallel architectures in GPUs. Students also get hands-on experience with programming these sys		
MI-PSL Programming in Scala	Z,ZK	4
The course introduces the modern programming language Scala which exploits object-functional paradigm. Scala comprises advance language fe	atures - e.g.patterr	matching and
advance standard library. Scala enables to use of applications functional patterns e.g. H-List, Monads, etc. Scala is used by many powerful frameworl	ks and libraries e.g.	Play, Cassandra,
Scalaz, etc.		
MI-RUB Programming in Ruby	KZ	4
This course is presented in Czech.	1	1 -
MI-ROZ.16 Pattern Recognition	Z,ZK	5
	1 .	-
The aim of the module is to give a systematic account of the major topics in pattern recognition with emphasis on problems and applications of the		-
recognition. Students will learn the fundamental concepts and methods of pattern recognition, including probability models, parameter estimation,		
MI-RRI Risk Management in Informatics	ZK	3
Information security is very often considered as one of main objectives to secure targets of information processing. However, to focus on this info	-	
IT systems against viruses, malware etc. very often means misunderstanding and underestimating of real threats which are around us and which a	re more dangerous	then viruses and
other malware. The necessity to continue with business after disaster is also slightly ignored. International standards which are focused on informational standards which are focused on information and the stan	atics and information	n security just
during last years started to anticipate necessity of risk management. There is no commonly accepted methodology used for this task. Threats which	ch are currently pos	sible to see
worldwide, invoke pressures to prepare plans for business continuity management even in the case of dramatic political changes, natural disasters	s etc.	
MI-SCE1 Computer Engineering Seminar Master I	Z	4
The Seminar of Computer Engineering is a (s)elective course for students who want to deal with deeper topics of digital design, reliability and resista	nce to failures and a	attacks. Students
are approached individually within the subject. Each student or group of students solves some interesting topic with the selected supervisor. Part of		
articles and other professional literature and/or work in K N laboratories. The capacity of the subject is limited by the possibilities of the seminar te	-	
semester.		
MI-SCE2 Computer Engineering Seminar Master II	Z	4
The Seminar of Computer Engineering is a (s)elective course for students who want to deal with deeper topics of digital design, reliability and resista		
are approached individually within the subject. Each student or group of students solves some interesting topic with the selected supervisor. Part of	-	
articles and other professional literature and/or work in K N laboratories. The capacity of the subject is limited by the possibilities of the seminar te	achers. The topics	are new for each
semester.		
MI-SZ1 Knowledge Engineering Seminar Master I	Z	4
On this seminar you will present a research paper from a top institute / research group to your peers. You will learn what is being cooked in top res	earch labs around	the world.
Additionally, you will learn how to properly present and read scientific papers. The work in the seminar will prepare you to attend (and profit from) top r	nachine learning an	d AI conferences
and summer schools, as well as FIT's own Summer Research Program (VyLet).		
PI-SCN Seminars on Digital Design	ZK	4
This subject deals with problems of realization and implementation of digital circuits - both combinational and sequential. Basic means of descripti		and basic logic
synthesis and optimization algorithms are described. Basics of EDA (Electronic Design Automation) systems are given, together with combinatoria		
MI-SCR Statistical Analysis of Time Series		4
The course deals with the practical use of the basic time series modelling theory in engineering tasks, ranging from economics (stock exchange p		1
problems (modelling of signals and processes) to computer networks (network components load, attacks detection). The students learn to select a	•	
its parameters, analyze its properties and use it for forecasting of future or intermediate values. The stress is put on understanding and adoption of the		
real-world examples. Both the lab classes and the lectures exploit freely available software packages in order to provide easy and straightforward to	ransfer of students	knowledge from
the academic to the real world.		
BI-SOJ Machine Oriented Languages	Z,ZK	4
Students of the course will gain an ability to create their own programs in the assembly language of the most common PC platform focusing on optim	nal use of micropro	cessor's features
and efficient cooperation of software with hardware. Next, there will be discussed x86 specifics of the majority of OSes from the application point of v	iew linked to higher	level languages.
This knowledge will be used during reverse engineering, optimization, and evaluation of code security.		
MI-TS1 Theoretical Seminar Master I	Z	4
Theoretical seminar is intended for students which want to come in deeper contact with contemporary theoretical computer science. It is mostly a c	1	-
are treated individually and concern themselves with interesting topics from the latest research in the area. Therefore, an integral part of the course		-
other scholarly literature. The capacity is limited by the the potentials of the teachers of the seminar.		1
	Z	4
	1	-
Theoretical seminar is intended for students which want to come in deeper contact with contemporary theoretical computer science. It is mostly a constructed individually and concern the mean of the group of the gr		-
are treated individually and concern themselves with interesting topics from the latest research in the area. Therefore, an integral part of the course	IS A WORK WITH SCIE	nunc papers and
other scholarly literature. The capacity is limited by the the potentials of the teachers of the seminar.		I
MI-TS3 Theoretical Seminar Master III	Z	4
Theoretical seminar is intended for students which want to come in deeper contact with contemporary theoretical computer science. It is mostly a c		-
are treated individually and concern themselves with interesting topics from the latest research in the area. Therefore, an integral part of the course	e is a work with scie	ntific papers and
other scholarly literature. The capacity is limited by the the potentials of the teachers of the seminar.		

MI-TS4 Theoretical Seminar Master IV	Z	4
Theoretical seminar is intended for students which want to come in deeper contact with contemporary theoretical computer science. It is mostly a cla	ssical reading gro	up. The students
are treated individually and concern themselves with interesting topics from the latest research in the area. Therefore, an integral part of the course i	s a work with scie	ntific papers and
other scholarly literature. The capacity is limited by the the potentials of the teachers of the seminar.		
MI-TNN Theory of Neural Networks	Z,ZK	4
In this course, we study neural networks from the point of view of the theory of function approximation and from the point of view of probability theor	y. At first, we reca	Il basic concepts
pertaining to artificial neural Networks, such as neurons and connections between them, types of neurons from the point of view of signal transmission	on, network topolo	ogy, somatic and
synaptic mappings, network training, and the role of time in neural networks. In connection with network topology, we get acquainted with its transfo	rmation into a can	onical topology,
and in connection with somatic and synaptic mappings, with their composition into mappings computed by the Network, Finally in connection with tr	aining, we pay atte	ention to the
problem of overtraining and to the fact that training is actually a specific optimization task, recalling the most typical objective functions and the most	t important optimiz	zation methods
employed for neural network training. We will see the meaning of all these concepts in the context of common kinds of forward neural networks. Within	the topic approxir	mation approach
to neural networks, we first notice the connection of neural networks to expressing functions of many variables using functions of fewer variables (K	•	
theorem). Afterwards, we will see how the universal approximation capacity of neural networks can be mathematically formalized as the sets of mapp		
being dense in important Banach spaces of functions, in particular in the spaces of continuous functions, spaces of functions integrable with respectively and the spaces of continuous functions and the spaces of functions are spaced as the space of the		-
functions with continuous derivatives, and Sobolev spaces. Within the topic probabilistic approach, we first get acquainted with training based on ex	-	-
random sample, and with probabilistic assumptions about training data with which those two kinds of neural networks can be employed. We will see h	•	5
of the conditional expectancy of network outputs conditioned by its inputs using the expectancy based learning. We recall the strong and the weak learning the second strong and the weak learning the second strong and strong an	-	-
acquainted with an analogy of the strong law of large numbers for neural networks and with the assumptions for its validity. Finally, we recall the cen		
with its analogy for neural networks, with the assumptions for its validity and with the hypothesis tests based on it. We will see how those tests can be tracked as a structure of the network.	e employed to sea	arch for the
topology of the network.		
MI-VEM Scientific thinking	KZ	2
The objective of the course is to get acquainted with scientific methods and discovery of order and laws of the universe, including the aspects of hu		
scientific methods in natural sciences, mathematics, computer science and humanities. Another aim is to introduce rules and requirements of science	ific communication	n via research
papers and posters.		
MI-MCS Multicore Systems	KZ	4
Students understand architecture of systems based on multicore processors with multiple threads per core, structure and usage of cache hierarchy		-
parallel algorithm classification, parallel programming technics, simulation and monitoring tools for measurement and optimization of parallel algorith		
design MTMD programs (Multiple Threads Multiple Data), measure and analyze latency and throughput of parallel algorithms and optimize them for		-
MI-VYC Computability	Z,ZK	4
Classical theory of recursive functions and effective computability, with applications in provability theory.		
NI-VPR Research Project	Z	5
Student obtains the credits for published scientific outputs. The details are at https://courses.fit.cvut.cz/NI-VPR/en.		-
MI-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 ins	stitution. Before the	e internship the
Dean of the FIT, or the vice-dean for study affairs assesses the professional content. The student must provide evidence of the professional content ar	nd extent of the inte	ernship. Auxiliary
courses MI-ZS10, MI-ZS20, MI-ZS30 are used used for the evidence and evaluation of the internship in IS KOS. Every 10 credits correspond to 4 w	eeks of full-time e	mployment with
a foreign institution. The maximum number of credits a student can earn for one internship is 30 credits. This amount can be divided into two subjections and the student can be divided into two subjections and the student can be divided into two subjections and the student can be divided into two subjections and the student can be divided into two subjections and the student can be divided into two subjections are student can be dinto two subjections are stu	ts if the internship	exceeds the
academic year's dead-line.		
MI-ZS20 Master internship abroad for 20 credits	Z	20
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 ins	stitution. Before the	e internship the
Dean of the FIT, or the vice-dean for study affairs assesses the professional content. The student must provide evidence of the professional content ar	nd extent of the inte	ernship. Auxiliary
courses MI-ZS10, MI-ZS20, MI-ZS30 are used used for the evidence and evaluation of the internship in IS KOS. Every 10 credits correspond to 4 w	eeks of full-time e	mployment with
a foreign institution. The maximum number of credits a student can earn for one internship is 30 credits. This amount can be divided into two subjections and the student can be divided into two subjections and the student can be divided into two subjections and the student can be divided into two subjections and the student can be divided into two subjections and the student can be divided into two subjections are student can be dinto two subjections are stu	ts if the internship	exceeds the
academic year's dead-line.		
MI-ZS30 Master internship abroad for 30 credits	Z	30
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 ins	stitution. Before the	e internship the
Dean of the FIT, or the vice-dean for study affairs assesses the professional content. The student must provide evidence of the professional content ar	nd extent of the inte	ernship. Auxiliary
courses MI-ZS10, MI-ZS20, MI-ZS30 are used used for the evidence and evaluation of the internship in IS KOS. Every 10 credits correspond to 4 w	eeks of full-time e	mployment with
a foreign institution. The maximum number of credits a student can earn for one internship is 30 credits. This amount can be divided into two subjections of the student can be divided into two subjections of two subjections o	ts if the internship	exceeds the
academic year's dead-line.		
Code of the group: MI-SP-TI-VO.2017		

Name of the group: Elective Vocational Courses for Master Specialisation MI-SP-TI, version 2017 Requirement credits in the group: Requirement courses in the group:

Credits in the group: 0

Note on the group:

Compulsory courses of all branches and specializations with the exception of this branch.

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
MI-ADM.16	Data Mining Algorithms	Z,ZK	5	2P+1C	L	V
MI-ADP.16	Architecture and Design Patterns	Z,ZK	5	2P+1C	Z	V
MI-BPR	Security and Secure Programming	Z,ZK	4	2P+1C	Z	V
MI-BHW.16	Security and Hardware Martin Novotný	Z,ZK	5	2P+2C	L	V
MI-BKO.16	Error Control Codes	Z,ZK	5	2P+1C	L	V
MI-DSV.16	Distributed Systems and Computing	Z,ZK	5	2P+1C	Z	V

MI-DDW.16	Web Data Mining	Z,ZK	5	2P+1C	L	V
MI-FME.16	Formal Methods and Specifications	Z,ZK	5	2P+1C	L	V
MI-GEN	Code Generators	Z,ZK	4	2P+1C	L	V
MI-HWB.16	Hardware Security	Z,ZK	5	2P+2C	L	V
MI-KOD.16	Data Compression	Z,ZK	5	2P+1C	L	V
MI-MKY.16	Mathematics for Cryptology	Z,ZK	5	3P+1C	L	V
MI-MVI.16	Computational Intelligence Methods	Z,ZK	5	2P+1C	Z	V
MI-MEP.16	Modelling of Business Processes Robert Pergl	Z,ZK	5	2P+1C	Z	V
MI-MTI.16	Modern Internet Technologies	Z,ZK	5	2P+1C	Z	V
MI-NFA.16	Design for the FPGA and ASIC Technology	Z,ZK	5	2P+1C	Z	V
MI-NUR.16	User Interface Design	Z,ZK	5	2P+1C	Z	V
MI-NSS.16	Normalized Software Systems Robert Pergl	ZK	5	2P	L	V
MI-PAP.16	Parallel Computer Architectures	Z,ZK	5	2P+1C	L	V
MI-EDW.16	Enterprise Data Warehouse Systems	Z,ZK	5	2P+1C	L	V
MI-KRY.16	Advanced Cryptology	Z,ZK	5	2P+2C	Z	V
MI-POA.16	Advanced Computer System Architectures	Z,ZK	5	2P+1C	L	V
MI-PDB.16	Advanced Database Systems	Z,ZK	5	2P+1C	Z	V
MI-PIS.16	Advanced Information Systems	Z,ZK	5	2P+1C	L	V
MI-PCM.16	Project And Change Management	KZ	3	1P+2C	Z,L	V
MI-PDD.16	Data Preprocessing	Z,ZK	5	2P+1C	Z	V
MI-REV.16	Reverse Engineering	Z,ZK	5	1P+2C	Z	V
MI-MBI.16	Management of Business Informatics	Z,ZK	5	3P+1C	L	V
MI-SWE.16	Semantic Web	Z,ZK	5	2P+1C	Z	V
MI-SIB.16	Network Security	Z,ZK	5	2P+1C	L	V
MI-SMI.16	Strategic Management of Informatics	Z,ZK	5	3P+1C	Z	V
MI-SYB.16	System Security	Z,ZK	5	2P+2C	L	V
MI-SOC.16	Systems on Chip	Z,ZK	5	2P+1C	Z	V
MI-TES.16	Systems Theory	Z,ZK	5	2P+1C	Z	V
MI-TSP.16	Testing and Reliability Petr Fišer	Z,ZK	5	2P+2C	Z	V
MI-VMM.16	Retrieval from Multimedia	Z,ZK	5	2P+1C	Z	V
MI-W20.16	Web 2.0	Z,ZK	5	2P+1C	L	V
MI-MDW.16	Web Services and Middleware	Z,ZK	5	2P+1C	Z	V
	of the courses of this group of Study Plan: Code=MI-SP-TI-V I-SP-TI, version 2017	O.2017 Name=Electi	ve Voca	tional Cou	irses for	Master
MI-MVI.16	Computational Intelligence Methods			Z	,ZK	5
Students will understa	nd methods and techniques of computational intelligence that are mostly nature-ir		ind applica			y will learn
	ork and how to apply them to problems related to data mining, control, intelligen g	ames, optimizations, etc.			(7	3
MI-PCM.16	Project And Change Management			I	<z td=""  <=""><td></td></z>	

MI-PCM.16	Project And Change Management	KZ	3
This course is presented	d in Czech.		
MI-ADM.16	Data Mining Algorithms	Z,ZK	5
The course focuses on a	algorithms used in the fields of machine learning and data mining. However, this is not an introductory course, and the stude	nts should know r	nachine learning
basics. The emphasis is	put on advanced algorithms (e.g., gradient boosting) and non-basic kinds of machine learning tasks (e.g., recommendation	systems) and mo	dels (e.g., kernel
methods).			
MI-ADP.16	Architecture and Design Patterns	Z,ZK	5
The objective of this cou	irse is to provide students with both work knowledge about the underlying foundations of object-oriented design and analysis	s as well as with u	inderstanding of
the challenges, issues, a	and tradeoffs of advanced software design. In the first part of the course, the students will refresh and deepen their knowledg	je of object-orient	ed programming
and get familiar with the	commonly used object-oriented design patterns that represent the best practices for solving common software design probler	ns. In the second	part the students

 will be introduced to the principles of software architecture design and analysis. This includes the classical architectural styles, component based systems, and some advanced software architectures used in large-scale distributed systems.

 MI-BPR
 Security and Secure Programming
 Z,ZK
 4

 The students will learn how to assess security risks and how to take them into account in the design phase of their own code and solutions. After getting familiar with the threat modeling theory, students gain practical experience with running programs with reduced privileges and methods of specifying these privileges, since not every program needs to run with administrator privileges. Dangers inherent in buffer overflows will be practically demonstrated. Students will be introduced to the principles of securing data and the relationships of security and database systems, web, remote procedure calls, and sockets in general. The module concludes with Denial of Service attacks and the defense against them.

 MI-BHW.16
 Security and Hardware
 Z,ZK
 5

 Students gain appreciate a private and base of the private and base of the private and the private and any sockets in general. The module concludes with Denial of Service attacks and the defense against them.

Students gain a basic knowledge in selected topics of cryptography and cruptanalysis. The module focuses particularly on elliptic curve cryptography, and on contemporary attacks on cryptographic systems. Students gain a good overview of the functionality of (hardware) cryptographic accelerators, random number generators, smart cards, and resources for securing of internal functions of computer systems.

MI-BKO.16			
	Error Control Codes	Z,ZK	5
	s to present various ways to detect or correct individual errors and burst errors in data stored into memories or transmitted vi		
MI-DSV.16	Distributed Systems and Computing	Z,ZK	5
	to methods for coordination of processes in distributed environment characterised by nondeterministic time responses of compu sic algorithms that assure correctness of computations realized by a group of loosely coupled processes and mechanisms th		
-	safety in case of failures.	at support high a	valiability of both
MI-DDW.16	Web Data Mining	Z,ZK	5
	t methods and technologies for Web data acquisition, analysis and utilization of the discovered knowledge. Students will gair	· ·	-
techniques for Web crav	vling and search, Web structure analysis, Web usage analysis, Web content mining and information extraction. Students will	also gain an over	view of most
· · ·	the field of social web and recommendation systems.		
MI-FME.16	Formal Methods and Specifications	Z,ZK	5
	scribe semantics of software formally and to use sound reasoning for construction of correct software. They learn to use some	e software tools th	at allow to prove
basic properties of softwork		Z,ZK	4
	Code Generators equainted with both theoretical and practical aspects of back-end of an optimizing programming language compiler.	Z,ZR	4
MI-HWB.16	Hardware Security	Z,ZK	5
	e knowledge needed for the analysis and design of computer systems security solutions. Students get an overview of safegua	,	-
	They will be able to safely use and integrate hardware components into systems and test them for resistance to attacks. Stud	-	
the cryptographic accel	erators, PUF, random number generators, smart cards, biometric devices, and devices for internal security functions of the co	omputer.	
MI-KOD.16	Data Compression	Z,ZK	5
	to the basic principles of data compression. They will learn the necessary theoretical background and get an overview of data	•	•
	erview covers principles of integer coding and of statistical, dictionary, and context data compression methods. In addition, si	tudents learn the	fundamentals of
MI-MKY.16	methods used in image, audio, and video compression.	Z,ZK	5
	Mathematics for Cryptology ar with parts of mathematics necessary for deeper understanding of the methods used in symmetric and asymmetric cryptogr	· ·	-
	rity of encryption systems, cryptanalysis methods, cryptography over elliptic curves, and quantum cryptography are based.		io mainomatical
MI-MEP.16	Modelling of Business Processes	Z,ZK	5
	on introduction to the discipline of Enterprise Engineering. Students learn the importance of a proper methodological approact	· ·	-
implementation of proce	esses, organisation structures and information support in big enterprises and institutions.		
MI-MTI.16	Modern Internet Technologies	Z,ZK	5
	gies of the modern Internet. links of the IP technology to the modern communication networks, mechanisms for multicasting a		
	virtual channels, and the new IPv6 architecture. They will understand the issues of monitoring and management of large complete reconnection naturates for HPC and the sectors.	uter networks. The	y are introduced
MI-NFA.16	terconnection networks for HPC systems.	Z,ZK	5
	Design for the FPGA and ASIC Technology knowledge needed to start a career in a design house. They will understand the FPGA and ASIC implementation technologi	· ·	-
-	the design. They are able to perform and to manage typical workflows, their analytic and synthetic steps, with an emphasis of		
the structure and dema	nds of software tools, as well as what to expect from them.		
MI-NUR.16	User Interface Design	Z,ZK	5
Students will understand	the theorized heaters and of human computer interaction and uppr interface (UI) design, will leave formal description of UIs, for		5
	the theorical background of human-computer interaction and user interface (UI) design, will learn formal description of UIs, for	mal user models,	the fundamental
	They get acquainted with graphical, speech, and multimodal UIs. Thanks to the gained knowledge, the students will be able	mal user models, to design advanc	the fundamental ed UIs.
MI-NSS.16	They get acquainted with graphical, speech, and multimodal UIs. Thanks to the gained knowledge, the students will be able Normalized Software Systems	mal user models, to design advanc ZK	the fundamental ed UIs. 5
MI-NSS.16 Students will learn the f	They get acquainted with graphical, speech, and multimodal UIs. Thanks to the gained knowledge, the students will be able Normalized Software Systems pundations of Normalized Systems theory, which studies the evolvability of modular structures based on concepts from engine	mal user models, to design advanc ZK neering such as si	the fundamental ed UIs. 5 ability from
MI-NSS.16 Students will learn the f systems theory and entr	They get acquainted with graphical, speech, and multimodal UIs. Thanks to the gained knowledge, the students will be able Normalized Software Systems	mal user models, to design advanc ZK neering such as st ty was translated i	the fundamental ed UIs. 5 rability from nto the definition
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MI-PIS.16 Advanced Information Systems	Z,ZK	5
Students learn the notion of business process logic and its formalization, with business process roles, business rules, and data processing, with the n		iented company,
enterprise services and service solution of business logic. They get acquainted with these notions also for the other types of ISs. They learn about a	gility and adaptivi	ty and using of
artificial intelligence methods for implementation of these ideas in ISs. They understand modern object-oriented methodologies for modelling of busi	ness processes, b	ousiness rules,
processed data, and enterprise ISs. They will get the rules and technologies for successful implementation of IS.		
MI-PDD.16 Data Preprocessing	Z,ZK	5
Students learn to prepare raw data for further processing and analysis. They learn what algorithms can be used to extract parameters from various da		as images, texts,
time series, etc., and learn the skills to apply these theoretical concepts to solve a specific problem in individual projects - e.g., parameter extraction	from image data	or from Internet.
MI-REV.16 Reverse Engineering	Z,ZK	5
Students will get acquainted with the essentials of reverse engineering of computer software. They will learn how processes start and what happens	before and after t	he main 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 de	dicated to reverse	engineering of
applications written in C++. Students will also understand principles of disassemblers and obfuscation techniques. A part of the course will also be o	dedicated to debug	ggers: how
debuggers and debugging work and which methods can be used to detect it. One of the lectures will be dedicated to the latest trends on the compu	ter malware scene	e. The focus of
the course is on the seminars, where students will solve practically oriented tasks from the real world.		
MI-MBI.16 Management of Business Informatics	Z,ZK	5
This course is presented in Czech.		
MI-SWE.16 Semantic Web	Z,ZK	5
Students learn standards used for processing and sharing knowledge mainly in the area of web. They get used to designing and using knowledge mainly in the area of web.	1 '	representation,
and practical aspects as publishing, sharing, exchange, and acquisition of knowledge on the web. The presentation is based on the idea of the semi	-	-
and technologies (RDF, RDFS, OWL) and formal models.		
MI-SIB.16 Network Security	Z,ZK	5
The students will gain theoretical and practical knowledge and experience in the area of current security threats in computer networks, specifically a	1 1	
course explains basic pricipals of security monitoring, packet-based and flow-based analysis, in order to detect anomalies and suspicious network t		
explanation and practical examples of various mechanisms of securing network infrastructure and detection in real time. The course covers general		
security events (i.e. incident handling and incident response).		9
MI-SMI.16 Strategic Management of Informatics	Z,ZK	5
The course focuses on the strategic management of information systems. Students will learn the process of creation and implementation of an infor	1 1	-
the importance of ICT for business and interrelations between information strategies and lobal business strategies. Furthermore, they gain the know		-
management of IS/IT, management of investments and ROI, assessment of IT investments and management of human resources in IT (the role of 0	-	
course is the role of project management, risk management and quality assessment of informatics.	,,,	
MI-SYB.16 System Security	Z,ZK	5
Students will familiarize themselves with the actual ICT security needs in all ICT disciplines. Students will gain knowledge of typical network attacks and		
with essential communication encryption techniques. They will learn how to work with certain aspects of encryption techniques - passwords and cer		-
learn the basics of anti-virus, anti-spam and heuristic analyses used in modern anti-virus solutions or Unified Threat Management (UTM) based sol		
principles of securing websites, web applications and databases. Upon completion of the module, students will have a broad overview of IT security		
integration of various software systems and applications.		
MI-SOC.16 Systems on Chip	Z,ZK	5
Students gain key knowledge and skills in the design of large-scale digital systems. They will be familiar with architectures of such systems and comr		their parts. They
will use an appropriate workflow to design these architectures, their hardware and software. They will also have knowledge of contemporary method	s of large system	s verification and
fault-tolerant systems design.		
MI-TES.16 Systems Theory	Z,ZK	5
Today, humankind has the ability to develop systems of incredible complexity (e.g., trains, microprocessors, airplanes, nuclear power plants). However	er, the costs of m	anaging this
complexity and of ensuring the correct behavior of a given system have become critical. A key technique for mastering this complexity is the usage of	of models that des	cribe only those
aspects of the systems that are important for the task at hand, and automated tools for analyzing those models. This subject will present theory and	algorithms that fo	rm the basis for
the modeling and analysis of complex systems.		
MI-TSP.16 Testing and Reliability	Z,ZK	5
Students gain knowledge about circuit testing and about methods for increasing reliability and security. They will get practical skills to be able to prej	pare a test set with	h the help of the
intuitive path sensitization and to use an ATPG for automatic test generation. They will be able to design easy testable circuits and systems with buil	t-in-self-test equip	ment. They will
be able to analyze and control reliability and availability of the designed circuits.		
MI-VMM.16 Retrieval from Multimedia	Z,ZK	5
The student obtains general knowledge regarding interfaces of portals providing multimedia content, the principles of similarity search, the methods of	feature extraction	from multimedia
objects, indexing, and structure of distributed search engines.		
MI-W20.16 Web 2.0	Z,ZK	5
Students will learn new trends and technologies on the Web including theoretical foundations. Students will gain an overview about Web application	s architectures, co	
technologies about programmable Web (REST Architectures, Mashups), basic mechanisms for knowledge representation on the Web (microformats,	meta-data, ontolo	gies, open linked
data, etc.), mechanisms about collective intelligence (collaborative filtering, predictions of users' behaviours), social networks, and security.		
MI-MDW.16 Web Services and Middleware	Z,ZK	5
Students learn new trends and technologies in the area of service-oriented architectures, web services, middleware, and cloud computing, including		background.

### List of courses of this pass:

Code	Name of the course	Completion	Credits		
BI-SOJ	Machine Oriented Languages	Z,ZK	4		
Students of the course will gain an ability to create their own programs in the assembly language of the most common PC platform focusing on optimal use of microprocessor's features					
and efficient cooperation of software with hardware. Next, there will be discussed x86 specifics of the majority of OSes from the application point of view linked to higher level languages.					
This knowledge will be used during reverse engineering, optimization, and evaluation of code security.					

FI-FIL	Philosophy	ZK	2
	see A0B16		
FI-HPZ A "Humanities sub	Humanities subject from a study abroad ject that has been studied abroad" is covered by the Humanities subject from a study abroad in Compulsory Humanities Module that	t is required in the	3 curriculum
	The substitution is approved by the Vice-Dean for study affairs on behalf of the Dean at the request of the student.		ounoulum
FI-HTE	History of Technology and Economics	ZK	2
The course introdu	ces the scientific disciplines of history and technology, economic and social history of the Czech lands and Czechoslovakia in compa the European region 19 to 21 century.	arison with the dev	elopment of
FI-KSA	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	1	1
anthropological res	search from our "exotic" cultures (topics: kinship, religion, social exclusion, migration, globalization, , material culture, language, healt	h, history, death, et	tc) will be
FI-MPL	shown. The course is an interesting alternative to other humanities, taught at FIT. Managerial Psychology	ZK	2
FI-ULI	Introduction to Linguistics for Computer	ZK	2
	This course is presented in Czech.		1
FI-VEZ	economic-managerial course from a study abroad	Z	4
A "Humanities suc	ject that has been studied abroad" is covered by the Humanities subject from a study abroad in Compulsory Humanities Module that The substitution is approved by the Vice-Dean for study affairs on behalf of the Dean at the request of the student.	t is required in the	curriculum.
MI-ADM.16	Data Mining Algorithms	Z,ZK	5
	s on algorithms used in the fields of machine learning and data mining. However, this is not an introductory course, and the students		-
basics. The empha	sis is put on advanced algorithms (e.g., gradient boosting) and non-basic kinds of machine learning tasks (e.g., recommendation sys methods).	tems) and models	(e.g., kernel
MI-ADP.16	Architecture and Design Patterns	Z,ZK	5
	is course is to provide students with both work knowledge about the underlying foundations of object-oriented design and analysis as		-
-	ues, and tradeoffs of advanced software design. In the first part of the course, the students will refresh and deepen their knowledge o		
0	n the commonly used object-oriented design patterns that represent the best practices for solving common software design problems. In the principles of software architecture design and analysis. This includes the classical architectural styles, component based systems	•	
	architectures used in large-scale distributed systems.	,	
MI-AFP	Applied Functional Programming	KZ	5
	ented in Czech. Functional programming represents one of the traditional programming paradigms. Traditional and novel functional p and the functional paradigm becomes an important construct of traditionally imperative languages (C++, C#, Java). As such, master		-
the fise flowadays	necessary competence of a software engineer: the theory and especially the practice.	ing this paradigin t	becomes a
MI-APH	Architecture of computer games	Z,ZK	4
-	a basic understanding of the various issues in the field of computer game development, from both the technical and creative points of		
component-oriente	d architecture, game mechanics, and game AI that form an integral part of most games. They will also understand the basics of pathfin and apply them in practical exercises (labs).	ding, networking, a	ind scripting
MI-ARI	Computer arithmetic	Z,ZK	4
	Students will learn various data representations used in digital devices and will be able to design arithmetic operations implementa		
MI-ATH	Combinatorial Theories of Games This course is presented in Czech.	Z,ZK	4
MI-AVY	Automata in Text Pattern Matching	Z,ZK	4
-	(pattern matching) and generally in data is an area of problems and exciting solutions from theoretical and practical perspectives. We nsional (text) or multi-dimensional (tree, picture). We may search for something known (a pattern: a string or a set specified by regula		
	arity). Matching can be either exact or approximate. This course presents a taxonomy of searching problems. It focuses on algorithms		-
	(finite, pushdown, linear-bounded, or tree).		
MI-BHW.16	Security and Hardware sic knowledge in selected topics of cryptography and cruptanalysis. The module focuses particularly on elliptic curve cryptography, ar	Z,ZK	5 v attacks on
-	ems. Students gain a good overview of the functionality of (hardware) cryptographic accelerators, random number generators, smart ca		-
	of internal functions of computer systems.		
MI-BKO.16	Error Control Codes	Z,ZK	5
MI-BML	I of the course is to present various ways to detect or correct individual errors and burst errors in data stored into memories or transr Bayesian Methods for Machine Learning	KZ	5
	sed on practical use of basic Bayesian modeling methods in the dynamically evolving machine learning theory. In particular, it studies	1	1
	description of real phenomena, as well as their subsequent use, e.g., for forecasting of future evolution or learning about the hidden		
-	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.		.,
MI-BPR	Security and Secure Programming	Z,ZK	4
	arn how to assess security risks and how to take them into account in the design phase of their own code and solutions. After getting fa		-
-	ileges. Dangers inherent in buffer overflows will be practically demonstrated. Students will be introduced to the principles of securing		
-	database systems, web, remote procedure calls, and sockets in general. The module concludes with Denial of Service attacks and the		
MI-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 suitat	ble tools.	
MI-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 (un)solvability of difficult problems.	stneory concerning	g practical
L			

MI-DDM	Distributed Data Mining	KZ	4
Course focuses on	state-of-the-art approaches for distributed data mining and parallelization of machine learning algorithms. Students will gain hands of	on experience with	large scale
data processing fra	amework Apache Spark and with existing distributed DM / ML algorithms. They will learn principles of their parallel implementations a	nd will be capable	to propose
	approaches to parallelize other algorithms. The course is prezented in czech language.		
MI-DDW.16	Web Data Mining	Z,ZK	5
Students will lea	rn latest methods and technologies for Web data acquisition, analysis and utilization of the discovered knowledge. Students will gain	an overview of We	b mining
techniques for W	eb crawling and search, Web structure analysis, Web usage analysis, Web content mining and information extraction. Students will al	so gain an overvie	w of most
	recent developments in the field of social web and recommendation systems.		
MI-DIP	Diploma Project	Z	23
MI-DNP	Advanced .NET	Z,ZK	4
Students acquir	e a knowledge about advanced desgin of applicatios on a .NET platform. They gain skills of WPF (Windows Presentation Foundation	i), WCF/WebAPI (V	Vindows
Co	ommunication Foundation) and Entity Framework. They are able to apply these skills on a development and desgin of advanced .NET	applications.	
MI-DSP	Database Systems in Practes	Z,ZK	4
	This course is presented in Czech.		
MI-DSV.16	Distributed Systems and Computing	Z,ZK	5
Students are introdu	Jced to methods for coordination of processes in distributed environment characterised by nondeterministic time responses of computing	processes and con	nmunication
channels. They lear	rn basic algorithms that assure correctness of computations realized by a group of loosely coupled processes and mechanisms that s	support high availat	oility of both
	data and services, and safety in case of failures.		
MI-DZO	Digital Image Processing	Z,ZK	4
	nts a comprehensive overview of modern methods for interactive editing of digital images and video. It mainly deals with practical alg		-
implement and have	e an interesting theoretical basis. Visually attractive applications provide better understanding of basic theoretical background that is als	so valuable outside	the domain
	processing. This course will introduce algorithms solving the following practical applications: edge-aware editing, tone mapping, HDR	•	•
	abstraction, hybrid images, gradient domain editing, seamless image stitching and cloning, digital photo-montage, color-to-gray conv		
	gid-as-possible image deformation, free-form image registration, texture synthesis, interactive segmentation, colorization, painting, ac		· ·
MI-EDW.16	Enterprise Data Warehouse Systems	Z,ZK	5
	ta Warehouses course focuses on the area of business intelligence. Students will be introduced to business intelligence methods and		
not only in design	ing warehouses and various architectures, but also their deployment and maintenance. This course also includes an introduction to the	ne area of reporting	g and data
	visualization.		
MI-FLP	Functional and Logical Programming	Z,ZK	4
	vill be acquainted with principles of functional and logic programming. They will be able to write their programs in Lisp and Prolog programming.		
MI-FME.16	Formal Methods and Specifications	Z,ZK	5
Students are able to	o describe semantics of software formally and to use sound reasoning for construction of correct software. They learn to use some sol	ftware tools that all	ow to prove
	basic properties of software.		
MI-GEN	Code Generators	Z,ZK	4
	Students will become acquainted with both theoretical and practical aspects of back-end of an optimizing programming language of		
MI-GLR	Games and reinforcement learning	Z,ZK	4
The field of reinfor	cement learning is very hot recently, because of advances in deep learning, recurrent neural networks and general artificial intelligen		ntended to
	give you both theoretical and practical background so you can participate in related research activities. Presented in English		
MI-HMI2	History of Mathematics and Informatics	ZK	3
Selected topics (in	finitesimal calculus, probability, number theory, general algebra, different examples of algorithms, transformations, recursive function	s, eliptic curves, et	c.) note on
	possibilities of applications of some mathematical methods in informatics and its development.	771	-
MI-HWB.16	Hardware Security	Z,ZK	5
	es the knowledge needed for the analysis and design of computer systems security solutions. Students get an overview of safeguards	-	-
-	eans. They will be able to safely use and integrate hardware components into systems and test them for resistance to attacks. Studer	-	edge about
-	ptographic accelerators, PUF, random number generators, smart cards, biometric devices, and devices for internal security functions		0
MI-IBE	Information Security	ZK	2
	rmation and IS/ICT security management systems (ISMS), methods for information access control, and basic norms and international accession of the security theory for management of internal and external eccurity theory for IS/IT security audits, and for application security testing (or a		-
MI-IKM	d methods for management of internal and external security threats, for IS/IT security audits, and for application security testing (e.g. Internet and Classification Methods	Z,ZK	<u>g).</u> 4
		· · ·	
	students get acquainted with classification methods used in four important internet, or generally network applications: in spam filtering on systems and in intrusion detection systems. However, they will learn more than only how classification is performed when solving		-
	I 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 consult		
MI-IOS	Advanced techniques in iOS applications	KZ	4
	the latest trends in mobile development technologies for iOS platform. Class covers advanced topics, students need to know all the ba	1	
	BI-IOS.	xoloo nom alo bogi	
MI-IOT	Internet of Things	Z,ZK	4
	bcused on the area of hardware and software technologies for the strongly growing computer support of various devices. Its goal is fa		
	development elements (Raspberry Pi, Arduino Due) and with the language for efficient application development and modification (G		
MI-IVS	Intelligent embedded systems	KZ	4
	led systems course for master's degree is focused on high-level technology embedded systems integrating artificial intelligence. The		
-	mbedded system fundamentals course for the bachelor degree. The aim of the course is to teach students humanoid robot program		
e e	ires provide basis of motion control, sensor reading, application interfaces, robot navigation and development tools. In labs, students of	•	
-	combining knowledge of various courses like nature inspired algorithms, data mining algorithms, image recognition and web techn		
MI-KOD.16	Data Compression	Z,ZK	5
	duced to the basic principles of data compression. They will learn the necessary theoretical background and get an overview of data	I ' I	
used in practice. Th	ne overview covers principles of integer coding and of statistical, dictionary, and context data compression methods. In addition, stude	ents learn the funda	amentals of
	lossy data compression methods used in image, audio, and video compression.		

MI-KRY.16	Advanced Cryptology	Z,ZK	5
	n the essentials of cryptanalysis and the mathematical principles of constructing symmetric and asymmetric ciphers. They will know the		
random number g	generators. They will have an overview of cryptanalysis methods, elliptic curve cryptography and quantum cryptography, which they ca their own systems or to the creation of their own software solutions.	an apply to the inte	egration of
MI-KYB.16	Cybernality	ZK	5
	uainted with the fundamentals of legislation and international activities in the area of fighting cybercrime. Students will understand the		attacks and
	of systems for computer surveillance and traffic monitoring in the cyberspace. Students will also familiarize themselves with hacker activ		r. The course
	will also discuss the cooperation of the state agencies and subjects dealing with defence of the cyberspace (especially CSIRT and CE	Z.ZK	
MI-LOM.16	Linear Optimization and Methods applications of optimization methods in computer science, economics, and industry. They are aware of practical importance of linear a	I '	5 mming They
	ith optimization software and are familiar with languages used in programming of that software. They get skills in formalization of optim		
	scheduling of tasks to processors, analysis of network flows), distribution and allocation of resources (transportation problems, travelli		
issues from econo	mics, and modelling of conflicts via the game theory. They get an overview of computational complexity of optimization problems. The	ey get orientation in	n algorithms
	in linear programming.		
MI-MAI	Multimedia and Internet rer principles and technologies for processing and network transmissions of multimedia signals, stereoscopy and visualizations in high	Z,ZK	3
	f networked multimedia, transmission formats, interfaces, codecs, technologies for acquisition and reproduction of multimedia data and		
	and distributed collaboration using networking and immersive environments.	g	
MI-MBI.16	Management of Business Informatics	Z,ZK	5
	This course is presented in Czech.		1
MI-MCS	Multicore Systems	KZ	4
	and architecture of systems based on multicore processors with multiple threads per core, structure and usage of cache hierarchy with		-
•	classification, parallel programming technics, simulation and monitoring tools for measurement and optimization of parallel algorithms.		
MI-MDW.16	grams (Multiple Threads Multiple Data), measure and analyze latency and throughput of parallel algorithms and optimize them for con Web Services and Middleware	Z.ZK	5
-	ew trends and technologies in the area of service-oriented architectures, web services, middleware, and cloud computing, including t	I '	-
MI-MEP.16	Modelling of Business Processes	Z,ZK	5
The subject is f	focused on introduction to the discipline of Enterprise Engineering. Students learn the importance of a proper methodological approa	, ,	-
	implementation of processes, organisation structures and information support in big enterprises and institutions.		
MI-MKY.16	Mathematics for Cryptology	Z,ZK	5
	amiliar with parts of mathematics necessary for deeper understanding of the methods used in symmetric and asymmetric cryptograph		nathematical
DI	rinciples on which security of encryption systems, cryptanalysis methods, cryptography over elliptic curves, and quantum cryptograph	iy are based.	1
	Modern programming in C + +	774	
MI-MPC	Modern programming in C ++	Z,ZK	5 na effectivity
MI-MPC Students learn how	Modern programming in C ++ v to use the modern features of contemporary versions of the C++ programming language for software development. The course focus ficiency in the form of writing maintainable and portable source code and creating correct programs with low memory and processor t	ses on programmi	ng effectivity
MI-MPC Students learn how	v to use the modern features of contemporary versions of the C++ programming language for software development. The course focus	ses on programmi	ng effectivity
MI-MPC Students learn how and eff MI-MPI	v to use the modern features of contemporary versions of the C++ programming language for software development. The course focus ficiency in the form of writing maintainable and portable source code and creating correct programs with low memory and processor t	ses on programmi ime requirements.	ng effectivity
MI-MPC Students learn how and eff MI-MPI The course comp multi-variate integra	v to use the modern features of contemporary versions of the C++ programming language for software development. The course focus ficiency in the form of writing maintainable and portable source code and creating correct programs with low memory and processor t Mathematics for Informatics prises topics from general algebra with focus on finite structures used in computer science. It includes topics from multi-variate analys ation. The third large topic is computer arithmetics and number representation in a computer along with error manipulation. The last top	ime requirements. Z,ZK sis, smooth optimiz pic includes selecte	ng effectivity 7 zation and ed numerical
MI-MPC Students learn how and eff MI-MPI The course comp nulti-variate integra algorithm and their	v to use the modern features of contemporary versions of the C++ programming language for software development. The course focus ficiency in the form of writing maintainable and portable source code and creating correct programs with low memory and processor t Mathematics for Informatics prises topics from general algebra with focus on finite structures used in computer science. It includes topics from multi-variate analys ation. The third large topic is computer arithmetics and number representation in a computer along with error manipulation. The last top r stability analysis. The topics are completed with demonstration of applications in computer science. The course focuses on clear pre	ime requirements. Z,ZK sis, smooth optimiz pic includes selecte	ng effectivity 7 zation and ed numerica
MI-MPC Students learn how and eff MI-MPI The course comp multi-variate integra algorithm and their MI-MPR	v to use the modern features of contemporary versions of the C++ programming language for software development. The course focus ficiency in the form of writing maintainable and portable source code and creating correct programs with low memory and processor t Mathematics for Informatics prises topics from general algebra with focus on finite structures used in computer science. It includes topics from multi-variate analys ation. The third large topic is computer arithmetics and number representation in a computer along with error manipulation. The last top r stability analysis. The topics are completed with demonstration of applications in computer science. The course focuses on clear pre Master Project	ses on programmin ime requirements. Z,ZK sis, smooth optimiz bic includes selecte esentation and arg Z	rg effectivity 7 zation and ed numerical umentation. 7
MI-MPC Students learn how and eff MI-MPI The course comp nulti-variate integra algorithm and their MI-MPR 1. At the beginning	v to use the modern features of contemporary versions of the C++ programming language for software development. The course focus ficiency in the form of writing maintainable and portable source code and creating correct programs with low memory and processor t Mathematics for Informatics prises topics from general algebra with focus on finite structures used in computer science. It includes topics from multi-variate analys ation. The third large topic is computer arithmetics and number representation in a computer along with error manipulation. The last top r stability analysis. The topics are completed with demonstration of applications in computer science. The course focuses on clear pre Master Project g of the semester, a student reserves her/his final thesis topic and gets together with its supervisor. Together they decide on partial tas	ses on programmin ime requirements. Z,ZK sis, smooth optimiz bic includes selecte esentation and arg Z sks that should be	rg effectivity 7 zation and ed numerical umentation. 7 e carried out
MI-MPC Students learn how and eff MI-MPI The course comp multi-variate integra algorithm and their MI-MPR 1. At the beginning during the semest	v to use the modern features of contemporary versions of the C++ programming language for software development. The course focus ficiency in the form of writing maintainable and portable source code and creating correct programs with low memory and processor t Mathematics for Informatics prises topics from general algebra with focus on finite structures used in computer science. It includes topics from multi-variate analys ation. The third large topic is computer arithmetics and number representation in a computer along with error manipulation. The last top r stability analysis. The topics are completed with demonstration of applications in computer science. The course focuses on clear pre Master Project	ses on programmin ime requirements. Z,ZK sis, smooth optimiz- bic includes selecte esentation and arg Z sks that should be d of the semester.	7 zation and ed numerica umentation. 7 e carried out 2. External
MI-MPC Students learn how and eff MI-MPI The course comp multi-variate integra algorithm and their MI-MPR 1. At the beginning during the semest Master these (MT	v to use the modern features of contemporary versions of the C++ programming language for software development. The course focus ficiency in the form of writing maintainable and portable source code and creating correct programs with low memory and processor t Mathematics for Informatics prises topics from general algebra with focus on finite structures used in computer science. It includes topics from multi-variate analys ation. The third large topic is computer arithmetics and number representation in a computer along with error manipulation. The last top r stability analysis. The topics are completed with demonstration of applications in computer science. The course focuses on clear pre Master Project g of the semester, a student reserves her/his final thesis topic and gets together with its supervisor. Together they decide on partial tast ter. If the requirements they agreed upon are met, the supervisor awards the student an assessment for the course MI-MPR at the en	ses on programmin ime requirements. Z,ZK sis, smooth optimiz- bic includes selecte esentation and arg Z sks that should be d of the semester. courses BIE-BAP,	7 zation and ed numerica umentation. 7 e carried out 2. External MIE-MPR,
MI-MPC Students learn how and eff MI-MPI The course comp multi-variate integra algorithm and their MI-MPR 1. At the beginning during the semest Master these (MT MIE-DIP). Students the confirmation of	v to use the modern features of contemporary versions of the C++ programming language for software development. The course focus ficiency in the form of writing maintainable and portable source code and creating correct programs with low memory and processor t Mathematics for Informatics prises topics from general algebra with focus on finite structures used in computer science. It includes topics from multi-variate analys ation. The third large topic is computer arithmetics and number representation in a computer along with error manipulation. The last top r stability analysis. The topics are completed with demonstration of applications in computer science. The course focuses on clear pre Master Project g of the semester, a student reserves her/his final thesis topic and gets together with its supervisor. Together they decide on partial ta- ter. If the requirements they agreed upon are met, the supervisor awards the student an assessment for the course MI-MPR at the en C) supervisor fills his/her assessment into the paper "Form to award assessment by an external Final theses (FT) supervisor" (for the s, then, ensure that the assessment is registered into the information system (IS) by asking their internal FT opponent to award the as f the external MT supervisor. In the case the FT opponent is external as well, the assessment will be registered to the IS by the head	ses on programmini ime requirements. Z,ZK sis, smooth optimiz- oic includes selecte esentation and arg Z sks that should be d of the semester. courses BIE-BAP, ssessment to the of the department	7 zation and ed numerica umentation. 7 e carried out . 2. External MIE-MPR, IS based on responsible
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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.	<u>.</u>		
MI-NSS.16 Normalized Software Systems	ZK	5	
Students will learn the foundations of Normalized Systems theory, which studies the evolvability of modular structures based on concepts from engine	-	-	
systems theory and entropy from thermodynamics. Initially, the theory was developed at the level of software architectures, where the concept of stability was of so-called combinatorial effects. These effects occur when the impact of a change to the software architecture is dependent on the change itself, as well			
The latter is highly undesirable, as it will cause even a simple change to incur an ever-increasing impact as the size of the system grows over time. As su		-	
be considered as a main cause of Lehman's Law of Increasing Complexity (see, e.g., http://en.wikipedia.org/wiki/Lehman's_laws_of_software_evolution	,		
entropy was used in the study of which micro-states in a modular structure correspond with a given macro-state. This is related mainly to issues such as tes	-		
Normalized Systems theory consists first of a set of principles which indicate where violations of stability and entropy-related issues occur in any given principles indicate that very fine-grained modular structures are required in order to control them. In the second part of the theoretical framework, it is shown			
can be constructed based on a set of 5 design patterns called elements. These elements provide the core functionality of information systems in terms of s			
workflows, connectors and triggers, while controlling for violations of the stability and entropy-related principles, allowing them to realize new levels of evolva			
Recently, Normalized Systems theory was also applied to the modular structures in business processes and enterprise architectures, with the goal of cons for Enterprise Engineering.	structing a foundation	onal theory	
MI-NUR.16 User Interface Design	Z.ZK	5	
Students will understand the theorical background of human-computer interaction and user interface (UI) design, will learn formal description of UIs, formal	· · ·	-	
notions and procesures. They get acquainted with graphical, speech, and multimodal UIs. Thanks to the gained knowledge, the students will be able	to design advance	ed Uls.	
MI-OLI Linux Drivers	Z,ZK	4	
The Linux operating system is an important operating system for personal computer and also for embedded systems. Systems on chip and combining por increase the variability of peripheral subsystems requiring specific software drivers. This course is an advanced course in the Linux driver development			
course provides knowledge of Linux operating system architecture, principles of development of various types drivers, including practica		sino. The	
MI-PAA Problems and Algorithms	Z,ZK	5	
Students are able to evaluate discrete problems by complexity and by the purpose of optimisation (on-line tasks, multicriterial optimisation). They unders		properties	
of heuristics and exact algorithms and, therefore, are able to select, apply, and experimentally evaluate a suitable heuristics for a practi	-		
MI-PAL Advanced Algorithms The students will learn the most important advanced algorithms in different domains of the computer science that are not covered by modules of the Bac	Z,ZK	4	
other modules of the Master program. They will also learn how to cope with problems that, according to the present knowledge, are not solvable optimate			
time.	, , , ,		
MI-PAM Efficient Preprocessing and Parameterized Algorithms	Z,ZK	4	
There are many optimization problems for which no polynomial time algorithms are known (e.g. NP-complete problems). Despite that it is often necess exactly in practice. We will demonstrate that many problems can be solved much more effectively than by naively trying all possible solutions. Often one	-		
(parameter) of the inputs from practice-e.g., all solutions are relatively small. Parameterized algorithms exploit that by limiting the time complexity exponer			
and polynomially in the input size (which can be huge). Parameterized algorithms also represent a way to formalize the notion of effective polynomial tim			
which is not possible in the classical complexity. Such a polynomial time preprocessing is then a suitable first step, whatever is the subsequent solution	-		
plethora of parameterized algorithm design methods and we will also show how to prove that for some problem (and parameter) such an algorithm (pre will also not miss out the relations to other approaches to hard problems such as moderately exponential algorithms or approximation		exist. We	
MI-PAP.16 Parallel Computer Architectures	Z,ZK	5	
The students gain a good overview of present parallel architectures and processors:parallel (ILP) microarchitectures, multithreaded and multicore proc	essors, SoCs and	MPSoCs,	
GPUs, and neural processors. Students also get hands-on experience with programming these systems.	1/7		
MI-PCM.16 Project And Change Management This course is presented in Czech.	KZ	3	
MI-PDB.16 Advanced Database Systems	Z,ZK	5	
Students orient themselves in problems of evaluation and optimization of SQL queries. The next part of the course deals with new concepts of database databases), with the related new data models (XML, graph databases, column databases) and languages for working with them (XQuery, XPath, CYPH			
the course deals with performance evaluation of database machines.	,,		
MI-PDD.16 Data Preprocessing	Z,ZK	5	
Students learn to prepare raw data for further processing and analysis. They learn what algorithms can be used to extract parameters from various data so		-	
time series, etc., and learn the skills to apply these theoretical concepts to solve a specific problem in individual projects - e.g., parameter extraction from         MI-PDP.16       Parallel and Distributed Programming	Z,ZK	5	
Due to the development of cloud, web, and communication technologies and due to the shift of the Moore law into multicore and manycore CPUs, paralle	,	-	
are becoming ubiquitous. Students get acquainted with architectures of parallel and distributed computing systems, their models, theory of interconnect	ion networks, and	languages	
and environments for parallel programming of shared and distributed memory computers. On selected problems, they will learn the techniques of design of algorithms and methods of performance evaluation of their implementations.	f efficient and scala	ble parallel	
MI-PIS.16 Advanced Information Systems	Z,ZK	5	
Students learn the notion of business process logic and its formalization, with business process roles, business rules, and data processing, with the notion			
enterprise services and service solution of business logic. They get acquainted with these notions also for the other types of ISs. They learn about agilit		-	
artificial intelligence methods for implementation of these ideas in ISs. They understand modern object-oriented methodologies for modelling of busines processed data, and enterprise ISs. They will get the rules and technologies for successful implementation of IS.	s processes, busin	less rules,	
MI-POA.16 Advanced Computer System Architectures	Z,ZK	5	
The student will learn the current trends in infrastructure architecture of complex business computer systems. After completion of the module, the student will learn the current trends in infrastructure architecture of complex business computer systems.			
complex system infrastructure that meets availability and scalability requirements given by the business environment.			
MI-PRC Programming in CUDA The students gain a good overview of present parallel architectures in GPUs. Students also get hands-on experience with programming t	Z,ZK hese systems.	4	
MI-PSL Programming in Scala	Z,ZK	4	
The course introduces the modern programming language Scala which exploits object-functional paradigm. Scala comprises advance language features advance standard library. Scala comprises advance language features and the list Manada ate. Scala is used by many powerful frameworks and		-	
advance standard library. Scala enables to use of applications functional patterns e.g. H-List, Monads, etc. Scala is used by many powerful frameworks and libraries e.g. Play, Cassandra, Scalaz, etc.			
MI-PVR Advanced Virtual Reality	KZ	4	
The course introduces advanced parts of the virtual reality. It is a continuation of the already running graphic objects, especially the creation of 3D models things, it introduces students to their application in virtual reality. Lectures will focus on virtual reality technology, its use in various applications and will also	s in Blender, and a	-	

in available 3D engines (mainly Unity3D). The course is freely connected with the subject VHS (virtual game worlds), students will be able to apply the knowledge gained in this subject

5	in virtual reality, or directly create a complex game for VR.		,
MI-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 practical systems.	r experiences with	embedded
MI-PYT	Advanced Python	KZ	4
The goal of this cou	rse is to learn various advanced techniques and methods in Python. The course indirectly continues where Programming in Python	(BI-PYT) left of. Th	ne course is
very hands-on and it	t has only tutorials, everything is demonstrated on examples. Classification is based on work in class as well as semestral coursework. teachers from Red Hat.	The course is lead	by external
MI-REV.16	Reverse Engineering	Z,ZK	5
-	quainted with the essentials of reverse engineering of computer software. They will learn how processes start and what happens before with and next how processes start and what happens before with and next how processes start and what happens before with and next how processes start and what happens before with an analysis of the course is dediced by the course of the		
	will understand how executable files are organized and how they interact with 3rd party libraries. Another part of the course is dedica en in C++. Students will also understand principles of disassemblers and obfuscation techniques. A part of the course will also be de	-	-
	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	00	
	the course is on the seminars, where students will solve practically oriented tasks from the real world.		
MI-ROZ.16	Pattern Recognition	Z,ZK	5
	odule is to give a systematic account of the major topics in pattern recognition with emphasis on problems and applications of the st dents will learn the fundamental concepts and methods of pattern recognition, including probability models, parameter estimation, ar		-
MI-RRI	Risk Management in Informatics	ZK	3
	is very often considered as one of main objectives to secure targets of information processing. However, to focus on this info securi	I I	-
	viruses, malware etc. very often means misunderstanding and underestimating of real threats which are around us and which are mo	-	
	e necessity to continue with business after disaster is also slightly ignored. International standards which are focused on informatics started to anticipate necessity of risk management. There is no commonly accepted methodology used for this task. Threats which a		
	dwide, invoke pressures to prepare plans for business continuity management even in the case of dramatic political changes, natura		0 366
MI-RUB	Programming in Ruby	KZ	4
	This course is presented in Czech.	Z	4
MI-SCE1	Computer Engineering Seminar Master I nputer Engineering is a (s)elective course for students who want to deal with deeper topics of digital design, reliability and resistance to	- 1	
	lividually within the subject. Each student or group of students solves some interesting topic with the selected supervisor. Part of the		
articles and other pr	ofessional literature and/or work in K N laboratories. The capacity of the subject is limited by the possibilities of the seminar teacher	rs. The topics are n	ew for each
	semester.	7	4
MI-SCE2	Computer Engineering Seminar Master II nputer Engineering is a (s)elective course for students who want to deal with deeper topics of digital design, reliability and resistance to	S and attack	4 s Students
	lividually within the subject. Each student or group of students solves some interesting topic with the selected supervisor. Part of the		
articles and other pr	ofessional literature and/or work in K N laboratories. The capacity of the subject is limited by the possibilities of the seminar teacher	rs. The topics are n	ew for each
	semester.		
		771	4
MI-SCR	Statistical Analysis of Time Series	Z,ZK	4 Lindustrial
The course deals		s, employment) and	d industrial
The course deals we problems (modelling its parameters, analy	Statistical Analysis of Time Series with the practical use of the basic time series modelling theory in engineering tasks, ranging from economics (stock exchange prices g of signals and processes) to computer networks (network components load, attacks detection). The students learn to select a conver- yze its properties and use it for forecasting of future or intermediate values. The stress is put on understanding and adoption of the main	s, employment) and enient process mod in principles based	d industrial lel, estimate on practical
The course deals we problems (modelling its parameters, analy	Statistical Analysis of Time Series with the practical use of the basic time series modelling theory in engineering tasks, ranging from economics (stock exchange prices g of signals and processes) to computer networks (network components load, attacks detection). The students learn to select a conver- yze its properties and use it for forecasting of future or intermediate values. The stress is put on understanding and adoption of the main s. Both the lab classes and the lectures exploit freely available software packages in order to provide easy and straightforward transfer	s, employment) and enient process mod in principles based	d industrial lel, estimate on practical
The course deals of problems (modelling its parameters, analy real-world examples	Statistical Analysis of Time Series with the practical use of the basic time series modelling theory in engineering tasks, ranging from economics (stock exchange prices g of signals and processes) to computer networks (network components load, attacks detection). The students learn to select a conver- yze its properties and use it for forecasting of future or intermediate values. The stress is put on understanding and adoption of the mai s. Both the lab classes and the lectures exploit freely available software packages in order to provide easy and straightforward transfer the academic to the real world.	s, employment) and inient process mod in principles based er of students' know	d industrial lel, estimate on practical wledge from
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principles of securing websites, web applications and databases. Upon completion of the module, students will have a broad overview of IT security and	-	
integration of various software systems and applications.		1
MI-SYP.16 Parsing and Compilers	Z,ZK	5
The module builds upon the knowledge of fundamentals of automata theory, formal language and formal translation theories. Students gain knowledge of vaious of LR parsing and are introduced to special applications of parsers, such as incremental and parallel parsing.	rious variants and	applications
MI-SZ1 Knowledge Engineering Seminar Master I	Z	4
On this seminar you will present a research paper from a top institute / research group to your peers. You will learn what is being cooked in top resea		
Additionally, you will learn how to properly present and read scientific papers. The work in the seminar will prepare you to attend (and profit from) top machin and summer schools, as well as FIT's own Summer Research Program (VyLet).	e learning and Al	conferences
MI-TES.16 Systems Theory	Z,ZK	5
Today, humankind has the ability to develop systems of incredible complexity (e.g., trains, microprocessors, airplanes, nuclear power plants). However,	•	1
complexity and of ensuring the correct behavior of a given system have become critical. A key technique for mastering this complexity is the usage of mo		-
aspects of the systems 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.	orithms that form t	the basis for
MI-TNN Theory of Neural Networks	Z,ZK	4
In this course, we study neural networks from the point of view of the theory of function approximation and from the point of view of probability theory. At		
pertaining to artificial neural Networks, such as neurons and connections between them, types of neurons from the point of view of signal transmission, r		
synaptic mappings, network training, and the role of time in neural networks. In connection with network topology, we get acquainted with its transformat and in connection with somatic and synaptic mappings, with their composition into mappings computed by the Network, Finally in connection with train		
problem of overtraining and to the fact that training is actually a specific optimization task, recalling the most typical objective functions and the most imposition into mappings.		
employed for neural network training. We will see the meaninig of all these concepts in the context of common kinds of forward neural networks. Within the	topic approximation	on approach
to neural networks, we first notice the connection of neural networks to expressing functions of many variables using functions of fewer variables (Kol	-	
theorem). Afterwards, we will see how the universal approximation capacity of neural networks can be mathematically formalized as the sets of mappings being dense in important Banach spaces of functions, in particular in the spaces of continuous functions, spaces of functions integrable with respect to		
functions with continuous derivatives, and Sobolev spaces. Within the topic probabilistic approach, we first get acquainted with training based on expect		•
random sample, and with probabilistic assumptions about training data with which those two kinds of neural networks can be employed. We will see how it		
of the conditional expectancy of network outputs conditioned by its inputs using the expectancy based learning. We recall the strong and the weak law acquainted with an analogy of the strong law of large numbers for neural networks and with the assumptions for its validity. Finally, we recall the central	-	-
with its analogy for neural networks, with the assumptions for its validity and with the hypothesis tests based on it. We will see how those tests can be		·
topology of the network.		
MI-TS1 Theoretical Seminar Master I	Z	4
Theoretical seminar is intended for students which want to come in deeper contact with contemporary theoretical computer science. It is mostly a classical are treated individually and concern themselves with interesting topics from the latest research in the area. Therefore, an integral part of the course is a w		
other scholarly literature. The capacity is limited by the the potentials of the teachers of the seminar.		papers and
MI-TS2 Theoretical Seminar Master II	Z	4
Theoretical seminar is intended for students which want to come in deeper contact with contemporary theoretical computer science. It is mostly a classical	al reading group. T	he students
Theoretical seminar is intended for students which want to come in deeper contact with contemporary theoretical computer science. It is mostly a classical are treated individually and concern themselves with interesting topics from the latest research in the area. Therefore, an integral part of the course is a w	al reading group. T	he students
Theoretical seminar is intended for students which want to come in deeper contact with contemporary theoretical computer science. It is mostly a classical are treated individually and concern themselves with interesting topics from the latest research in the area. Therefore, an integral part of the course is a worker scholarly literature. The capacity is limited by the the potentials of the teachers of the seminar.	al reading group. T vork with scientific	he students papers and
Theoretical seminar is intended for students which want to come in deeper contact with contemporary theoretical computer science. It is mostly a classical are treated individually and concern themselves with interesting topics from the latest research in the area. Therefore, an integral part of the course is a w	al reading group. T vork with scientific Z	he students papers and
Theoretical seminar is intended for students which want to come in deeper contact with contemporary theoretical computer science. It is mostly a classical are treated individually and concern themselves with interesting topics from the latest research in the area. Therefore, an integral part of the course is a worker scholarly literature. The capacity is limited by the the potentials of the teachers of the seminar.           MI-TS3         Theoretical Seminar Master III           Theoretical seminar is intended for students which want to come in deeper contact with contemporary theoretical computer science. It is mostly a classical are treated individually and concern themselves with interesting topics from the latest research in the area. Therefore, an integral part of the course is a worker treated individually and concern themselves with interesting topics from the latest research in the area. Therefore, an integral part of the course is a worker treated individually and concern themselves with interesting topics from the latest research in the area. Therefore, an integral part of the course is a worker treated individually and concern themselves with interesting topics from the latest research in the area. Therefore, an integral part of the course is a worker treated individually and concern themselves with interesting topics from the latest research in the area. Therefore, an integral part of the course is a worker to come in deeper contact with contemporary theoretical computer science. It is mostly a classical are treated individually and concern themselves with interesting topics from the latest research in the area. Therefore, an integral part of the course is a worker to computer science is a worker to	al reading group. T vork with scientific Z al reading group. T	The students papers and 4 The students
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Theoretical seminar is intended for students which want to come in deeper contact with contemporary theoretical computer science. It is mostly a classical are treated individually and concern themselves with interesting topics from the latest research in the area. Therefore, an integral part of the course is a worker scholarly literature. The capacity is limited by the the potentials of the teachers of the seminar.         MI-TS3       Theoretical Seminar Master III         Theoretical seminar is intended for students which want to come in deeper contact with contemporary theoretical computer science. It is mostly a classical are treated individually and concern themselves with interesting topics from the latest research in the area. Therefore, an integral part of the course is a worker scholarly literature. The capacity is limited by the the potentials of the teachers of the seminar.         MI-TS4       Theoretical Seminar Master IV         Theoretical seminar is intended for students which want to come in deeper contact with contemporary theoretical computer science. It is mostly a classical are treated individually and concern themselves with interesting topics from the latest research in the area. Therefore, an integral part of the course is a worker scholarly literature. The capacity is limited by the the potentials of the teachers of the seminar.         MI-TS16       Testing and Reliability         Students gain knowledge about circuit testing and about methods for increasing reliability and availability of the designed circuits.       MI-VEM         MI-VEM       Scientific thinking       The student obtains gain anatural sciences, mathematics, computer science and humanities. Another aim is to introduce rules and requirements of scientific	al reading group. T vork with scientific Z al reading group. T vork with scientific Z al reading group. T vork with scientific Z,ZK a test set with the self-test equipmen KZ n life. The subject communication vi Z,ZK ure extraction from Z,ZK architectures, con- a-data, ontologies, security. Z tion. Before the internst s of full-time emplo	he students papers and 4 he students papers and 4 he students papers and 5 he help of the nt. They will 2 combines ia research 5 n multimedia 4 5 cepts and open linked 10 ternship the hip. Auxiliary oyment with

MI-ZS20	Master internship abroad for 20 credits	Z	20		
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 institut	tion. Before the inte	ernship the		
Dean of the FIT, or the vice-dean for study affairs assesses the professional content. The student must provide evidence of the professional content and extent of the internship. Auxiliary					
courses MI-ZS10, MI-ZS20, MI-ZS30 are used used for the evidence and evaluation of the internship in IS KOS. Every 10 credits correspond to 4 weeks of full-time employment with					
a foreign institutio	n. The maximum number of credits a student can earn for one internship is 30 credits. This amount can be divided into two subjects i	f the internship exc	ceeds the		
	academic year's dead-line.				
MI-ZS30	Master internship abroad for 30 credits	Z	30		
Each student can o	once within his / her master's degree have a foreign internship at a foreign university or other foreign scientific and/or research institut	tion. Before the inte	ernship the		
	he vice-dean for study affairs assesses the professional content. The student must provide evidence of the professional content and ex				
	VII-ZS20, MI-ZS30 are used used for the evidence and evaluation of the internship in IS KOS. Every 10 credits correspond to 4 weeks		-		
a foreign institutio	n. The maximum number of credits a student can earn for one internship is 30 credits. This amount can be divided into two subjects i	f the internship exe	ceeds the		
	academic year's dead-line.	r			
NI-AML	Advanced machine learning	Z,ZK	5		
	es students to selected advanced topics of machine learning and artificial intelligence. The topics present techniques in the field of rec	-	-		
	control and interconnection of physical laws with the field of machine learning. The aim of the exercise is to familiarize students with the				
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 diversity				
anthropological res	earch from our "exotic" cultures (topics: kinship, religion, social exclusion, migration, globalization, , material culture, language, health	1, history, death, et	c) will be		
	shown. The course is presented in Czech.				
NI-CCC	Creative Coding and Computational Art	KZ	4		
	ractical tasks, get acquainted with creative and yet proven methods of visualizing various types of data. The course freely follows the l				
	uces students to suitable visualization methods for traditional as well as for open data. It combines well-known visualization technique				
modern technologie	es. The aim is to create an interesting visualization project. It is planned to work closely with IPR CAMP (Center of Architecture and M	letropolitan Plannir	ng) and IIM		
	(Institute of Intermedia FEL).				
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	•			
	de channels and they get deeper insight in power attacks. Students learn to implement various profiled and non-profiled attacks and		-		
	hey also get practice in both designing the SCA countermeasures and analyzing the amount and characteristics of the side-channel in the second se	-			
NI-IAM	Internet and Multimedia		4		
	e is focused on principles and modern technologies for network transmissions of audiovisual (AV) signals. The syllabus includes acqu signals (output), network communication protocols, device interfaces, codecs, data formats and stereoscopy. We will look at practical u	-			
•	issions. Within the labs, students will practically assemble AV transmission chains using HW and SW technologies and verify the effe				
	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-LSM	Statistical Modelling Lab	KZ	5		
-	ented on a single and multi-target tracking. The student both learns the existing methods and tries to implement them. The stress is p	1	-		
	on and its modeling using numpy and scipy. The second half of the semester is focused on the design of methods and algorithms, and				
	At this point, the subject is on the border of own research and may result in the topic of final work (diploma or bachelor thesis	s).			
NI-MOP	Modern Object-Oriented Programming in Pharo	KZ	4		
Object-oriented pro	gramming is currently one of the most widespread paradigms of software creation, especially enterprise information systems, where i	ts ability to natural	abstraction		
is used to build com	plex 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 impl	ementation		
of object systems	in modern pure object system Pharo (https://pharo.org). The course focuses on individual approach to students, their development ne	eds and areas of i	interest. In		
addition to deepeni	ng object programming skills, which are generally applicable in other OO languages, students will also gain the opportunity to work o	n interesting project	cts and OO		
technologies in ter	ms of semestral work with the possibility of cooperation with practice and related bachelor, diploma, postgraduate our direct involvem	ent in the Pharo C	onsortium.		
NI-PG1	Computer Grafics 1	ZK	4		
The course builds o	n graphic courses (mainly BI-PGA and BI-PGR) and the knowledge from these courses is deepened by state-of-the-art knowledge. Th	e course is designe	ed 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-VPR	Research Project	Z	5		
	Student obtains the credits for published scientific outputs. The details are at https://courses.fit.cvut.cz/NI-VPR/en.	,			
PI-SCN	Seminars on Digital Design	ZK	4		
	with problems of realization and implementation of digital circuits - both combinational and sequential. Basic means of description of				
synthesis and optimization algorithms are described. Basics of EDA (Electronic Design Automation) systems are given, together with combinatorial problems emerging in EDA.					

For updated information see <u>http://bilakniha.cvut.cz/en/FF.html</u> Generated: day 2024-05-19, time 02:37.