# Study plan

## Name of study plan: Master specialization Computer Security, in Czech, 2020

Faculty/Institute/Others:

Department:

Branch of study guaranteed by the department: Welcome page

Garantor of the study branch: Program of study: Informatika

Type of study: Follow-up master full-time

Required credits: 98

Elective courses credits: 22 Sum of credits in the plan: 120

Note on the plan: Tato verze studijního plánu je ur ena pro ro níky, které byly p ijaty ke studiu od akademického roku 2020/2021 do prezen ní formy studia magisterského programu. . Garant: prof. lng.

Róbert Lorencz, CSc., email: robert.lorencz@fit.cvut.cz

Name of the block: Compulsory courses in the program

Minimal number of credits of the block: 63

Master Project

The role of the block: PP

Code of the group: NI-PP.2020

Name of the group: Compulsory Courses of Master Study Program, Version 2020, in Czech

Requirement credits in the group: In this group you have to gain 63 credits

Requirement courses in the group: In this group you have to complete 6 courses

Credits in the group: 63 Note on the group:

NI-MPR

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

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

NI-KOP	Combinatorial Optimization	Z,ZK	6				
The students will gain knowledge and understanding necessary deployment of combinatorial heuristics at a professional level. They will be able not only to select and implement but							
also to apply and evalu	also to apply and evaluate heuristics for practical problems.						
NI-DIP	Diploma Project	Z	30				

1. At the beginning of the semester, a student reserves her/his final thesis topic and gets together with its supervisor. Together they decide on partial tasks that should be carried out during the semester. If the requirements they agreed upon are met, the supervisor awards the student an assessment for the course MI-MPR at the end of the semester. 2. External Master these (MT) supervisor fills his/her assessment into the paper "Form to award assessment by an external Final theses (FT) supervisor" (for the courses BIE-BAP, MIE-MPR, MIE-DIP). Students, then, ensure that the assessment is registered into the information system (IS) by asking their internal FT opponent to award the assessment to the 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 head of the department responsible for the topic of the MT. 3. If the FT topic that the student has reserved is rather general, the immediate tasks the supervisor assigns to the student for the upcoming semester should aim at fine-tuning the FT topic so that the FTT will be complete and approvable at the end of the semester.

NI-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.

#### NI-PDP Parallel and Distributed Programming

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

#### NI-VSM Selected statistical Methods

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

Name of the block: Povinné p edm ty specializace

Minimal number of credits of the block: 35

The role of the block: PS

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

Name of the group: Compulsory Courses of Master Specialization Computer Security, Version 2020, in Czech

Requirement credits in the group: In this group you have to gain 35 credits

Requirement courses in the group: In this group you have to complete 7 courses

Credits in the group: 35 Note on the group.

NOTE OIL THE	<u> </u>					
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-AIB	Algorithms of Information Security  Martin Jure ek, Róbert Lórencz, Olha Jure ková Róbert Lórencz Róbert Lórencz (Gar.)	Z,ZK	5	2P+1C	Z	PS
NI-HWB	Hardware Security Ji í Bu ek, Róbert Lórencz <b>Ji í Bu ek</b> Ji í Bu ek (Gar.)	Z,ZK	5	2P+2C	L	PS
NI-MKY	Mathematics for Cryptology Martin Jure ek, Róbert Lórencz Róbert Lórencz Róbert Lórencz (Gar.)	Z,ZK	5	3P+1C	L	PS
NI-KRY	Advanced Cryptology  Ji í Bu ek, Róbert Lórencz, Simona Forn sek <b>Ji í Bu ek</b> Róbert Lórencz  (Gar.)	Z,ZK	5	2P+2C	Z	PS
NI-REV	Reverse Engineering Jií Dostál, Josef Kokeš, Róbert Lórencz <b>Jií Dostál</b> Jií Dostál (Gar.)	Z,ZK	5	1P+2C	Z	PS
NI-SIB	Network Security Ji í Dostál, Simona Forn sek, Martin Šutovský Simona Forn sek Ji í Dostál (Gar.)	Z,ZK	5	2P+1C	L	PS
NI-SBF	System Security and Forensics Simona Forn sek, Marián Svetlík Simona Forn sek	Z,ZK	5	2P+1C	Z	PS

## Characteristics of the courses of this group of Study Plan: Code=NI-PS-PB.20 Name=Compulsory Courses of Master Specialization Computer Security, Version 2020, in Czech

NI-AIB Algorithms of Information Security

Z.ZK

Students will get acquainted with the algorithms of secure key generation and cryptographic error (not only biometric) data processing. Furthermore, students will learn the mathematical principles of cryptographic protocols (identification, authentication, and signature schemes). Another part of the course is dedicated to malware detection and the use of machine learning in detection systems. The last topic includes practical steganographic methods and attacks on steganographic systems.

#### NI-HWB Hardware Security

Z.ZK

5

The course provides the knowledge needed for the analysis and design of computer systems security solutions. Students get an overview of safeguards against abuse of the system using hardware means. They will be able to safely use and integrate hardware components into systems and test them for resistance to attacks. Students will gain knowledge about the cryptographic accelerators, PUF, random number generators, smart cards, biometric devices, and devices for internal security functions of the computer.

#### NI-MKY Mathematics for Cryptology

Z,ZK

Students will gain deeper knowledge of algebraic procedures solving the most important mathematical problems concerning the security of ciphers. In particular, the course focuses on the problem of solving a system of polynomial equations over a finite field, the problem of factorization of large numbers and the problem of discrete logarithm. The problem of factorization will also be solved on elliptic curves. Students will further become familiar with modern encryption systems based on lattices.

### Advanced Cryptology

Students will learn the essentials of cryptanalysis and the mathematical principles of constructing symmetric and asymmetric ciphers. They will know the mathematical principles of random number generators. They will have an overview of cryptanalysis methods, elliptic curve cryptography and quantum cryptography, which they can apply to the integration of their own systems or to the creation of their own software solutions.

#### NI-REV Reverse Engineering

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 the 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 dedicated 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 dedicated to debuggers: 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 computer malware scene. The focus of the course is on the seminars, where students will solve practically oriented tasks from the real world.

NI-SIB	Network Security

Z.ZK

5

NI-SBF System Security and Forensics

Students will get familiar with aspects of system security (principles of end station security, principles of security policies, security models, authentication concepts). Furthermore,

students will get familiar with forensic analysis as a tool for investigating security incidents (techniques used by malicious software/attackers and forensic analysis techniques and the importance of operating system/operating system artifacts or file system for attack analysis and detection).

Name of the block: Elective courses Minimal number of credits of the block: 0

The role of the block: V

Code of the group: NI-V.2021

Name of the group: Purely Elective Master Courses, Version 2021

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	e re-comple	ted.	J	·	otaaont
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-ATH	AlgorithmicTheories of Games Dušan Knop, Tomáš Valla Tomáš Valla (Gar.)	Z,ZK	4	2P+2C	L	V
BI-AG2.21	Algorithms and Graphs 2 Ond ej Suchý, Radek Hušek, Michal Opler Ond ej Suchý Ond ej Suchý (Gar.)	Z,ZK	5	2P+2C	L	٧
NI-AFP	Applied Functional Programming Robert Pergl, Marek Suchánek, Daniel N mec Robert Pergl Robert Pergl (Gar.)	KZ	5	2P+1C	L	٧
NI-APH	Architecture of computer games  Adam Vesecký Adam Vesecký Adam Vesecký (Gar.)	Z,ZK	4	2P+1C	Z	V
BI-APS.21	Architectures of Computer Systems Pavel Tvrdík, Michal Štepanovský Michal Štepanovský Pavel Tvrdík (Gar.)	Z,ZK	5	2P+2C	Z	V
NI-BPS	Wireless Computer Networks Alexandru Moucha Alexandru Moucha (Gar.)	Z,ZK	4	2P+1C	L	V
BI-BEK.21	Secure Code Josef Kokeš, Viktor Fischer Róbert Lórencz Josef Kokeš (Gar.)	Z,ZK	5	2P+2C	L	V
BI-BLE	Blender Lukáš Ba inka <b>Lukáš Ba inka</b> Lukáš Ba inka (Gar.)	Z,ZK	4	2P+2C	L	V
NIE-BLO	Blockchain Róbert Lórencz, Jakub R ži ka, Josef Gattermayer, Marek Bielik Josef Gattermayer Róbert Lórencz (Gar.)	Z,ZK	5	1P+2C	Z	٧
NI-CTF	Capture The Flag Ji i Dostál	KZ	4	3C	Z	V
NI-DPH	Game Design Adam Vesecký Adam Vesecký (Gar.)	Z,ZK	5	2P+1C	L	V
NI-DSW	Design Sprint Ond ej Brém, Michal Manda Michal Manda David Pešek (Gar.)	Z	2	30B	Z	V
NI-PSD	Public Services Design Ond ej Brém, David Pešek David Pešek (Gar.)	KZ	4	1P+2C		V
NI-DID	Digital drawing Denisa S vová, Eliška Novotná Denisa S vová Denisa S vová (Gar.)	Z	2	4C	Z,L	V
NI-DZO	Digital Image Processing	Z,ZK	4	2P+1C	L	V
NI-DDM	Distributed Data Mining Tomáš Borovi ka	KZ	4	3C	L	V
NI-PAM	Efficient Preprocessing and Parameterized Algorithms Ond ej Suchý Ond ej Suchý (Gar.)	Z,ZK	4	2P+1C	L	V
BI-EHA.21	Ethical Hacking Ji í Dostál, Martin Šutovský, Tomáš Kiezler, Martin Kolárik <b>Ji í Dostál</b> Ji í Dostál (Gar.)	Z,ZK	5	2P+2C	L	٧
NI-ESC	Experimental Project Course  Jan Matoušek, Ond ej Brém, Jitka Aslan Ond ej Brém Ond ej Brém (Gar.)	KZ	8	OP430R452C	L	V
BI-FMU	Financial and Management Accounting David Buchtela David Buchtela David Buchtela (Gar.)	Z,ZK	5	2P+2C	Z	V
BI-FTR.1	Financial Markets Pavla Vozárová	Z,ZK	5	2P+2C	L	V
NI-GLR	Games and reinforcement learning  Juan Pablo Maldonado Lopez	Z,ZK	4	2P+2C	L	V
NI-GNN	Graph Neural Networks Miroslav epek Miroslav epek (Gar.)	Z,ZK	4	1P+1C	L	V

NI-GRI	Grid Computing  André Sopczak, Petr Fiedler Pavel Tvrdík André Sopczak (Gar.)	Z,ZK	5	2P+1C	Z	V
NI-HCM	Mind Hacking  Marcel Ji ina, Josef Holý Marcel Ji ina Marcel Ji ina (Gar.)	ZK	5	2P+1C	Z	V
NI-HSC	Side-Channel Analysis in Hardware Vojt ch Miškovský, Petr Socha Petr Socha Vojt ch Miškovský (Gar.)	Z,ZK	4	2P+2C	Z	V
NI-HMI2	History of Mathematics and Informatics  Alena Šolcová Alena Šolcová (Gar.)	ZK	3	2P+1C	Z	V
NI-IBE	Information Security	ZK	2	2P	Z	V
NI-IVS	Intelligent embedded systems Miroslav Skrbek Miroslav Skrbek (Gar.)	KZ	4	1P+3C	L	V
NI-IKM	Internet and Classification Methods	Z,ZK	4	1P+1C	L	V
NI-IAM	Martin Hole a Martin Hole a Martin Hole a (Gar.)  Internet and Multimedia	Z,ZK	4	2P+1C	L	V
NI-IOT	Internet of Things Jan Jane ek Jan Jane ek (Gar.)	Z,ZK	4	2P+1C	L	V
BI-JPO.21	Computer Units Pavel Kubalík Pavel Kubalík (Gar.)	Z,ZK	5	2P+2C	Z	V
NI-KTH	Combinatorial Theories of Games Tomáš Valla Tomáš Valla (Gar.)	Z,ZK	4	2P+1C	L	V
NI-FMT	Finite model theory	Z,ZK	4	2P+1C	L	V
NI-CCC	Tomáš Jakl Tomáš Jakl (Gar.)  Creative Coding and Computational Art	KZ	4	1P+2C	Z,L	V
NI-KYB	Radek Richtr, Josef Kortán Radek Richtr Radek Richtr (Gar.)  Cybernality	ZK	5	2P	Z	V
NI-LSM2	Statistical Modelling Lab Kamil Dedecius Kamil Dedecius (Gar.)	KZ	5	3C	Z,L	V
NI-LOM	Linear Optimization and Methods  Dušan Knop Dušan Knop Dušan Knop (Gar.)	Z,ZK	5	2P+1C	Z	V
NI-MPL	Managerial Psychology	ZK	2	2P	Z,L	V
NI-MSI	Jan Fiala Jan Fiala Jan Fiala (Gar.)  Mathematical Structures in Computer Science	Z,ZK	4	2P+1C	L	V
NI-MZI	Jan Starý Jan Starý Jan Starý (Gar.)  Mathematics for data science	Z,ZK	4	2P+1C	L	V
BI-MPP.21	Št pán Starosta  Methods of interfacing peripheral devices	Z,ZK	5	2P+2C		V
NI-MOP	Miroslav Skrbek Miroslav Skrbek Miroslav Skrbek (Gar.)  Modern Object-Oriented Programming in Pharo	KZ	4	3C	 	V
NI-NMU	Marek Skotnica, Jan Blizni enko <b>Robert Pergl</b> Robert Pergl (Gar.)  New media in art and design	ZK	3	2P+0C	 	V
NI-OLI	Zden k Svejkovský <b>Zden k Svejkovský</b> Zden k Svejkovský (Gar.) <b>Linux Drivers</b>			2P+2C		
NI-OLI	Jaroslav Borecký, Miroslav Skrbek Jaroslav Borecký Miroslav Skrbek (Gar.)  Personalized Machine Learning	Z,ZK	4	2P+2C	L	V
NIE-PML	Rodrigo Augusto Da Silva Alves <b>Karel Klouda</b> Rodrigo Augusto Da Silva Alves (Gar.)	Z,ZK	5	2P+1C	Z	V
NI-ARI	Computer arithmetic Pavel Kubalík Pavel Kubalík Pavel Kubalík (Gar.)	Z,ZK	4	2P+1C	Z,L	V
NI-PG1	Computer Grafics 1 Radek Richtr Radek Richtr (Gar.)	ZK	4	2P+1C	L	V
NI-EDW	Enterprise Data Warehouse Systems  Jakub Krej í, Robert Kotlá Jakub Krej í Magda Friedjungová (Gar.)	Z,ZK	5	1P+1C	L	V
NI-PVR	Advanced Virtual Reality Petr Pauš Petr Pauš (Gar.)	KZ	4	2P+1C	Z	V
NI-AML	Advanced machine learning Zden k Buk, Miroslav epek, Rodrigo Augusto Da Silva Alves, Petr Šimánek, Vojt ch Rybá <b>Miroslav epek</b> Miroslav epek (Gar.)	Z,ZK	5	2P + 1C	L	V
NI-IOS	Advanced techniques in iOS applications Rostislav Babá ek, Jakub Olejník, Igor Rosocha Martin P Ipitel Martin P Ipitel (Gar.)	KZ	4	2P+2C	L	V
NI-APT	Advanced Program Testing Pierre Donat-Bouillud Pierre Donat-Bouillud (Gar.)	Z,ZK	5	2P+1C	Z	V
NI-PVS	Advanced embedded systems  Miroslav Skrbek	Z,ZK	4	2P+2C	Z	V
NI-DNP	Advanced .NET Nikolas Jíša Nikolas Jíša (Gar.)	Z,ZK	4	2P+1C	Z	V
NI-PYT	Advanced Python Miroslav Hron ok	KZ	4	3C	Z	V
NIE-PDL	Practical Deep Learning	KZ	5	2P+1C	Z	V
BI-PJP.21	Martin Barus, Yauhen Babakhin Karel Klouda Martin Barus (Gar.)  Programming Languages and Compilers Jan Janoušek, Št pán Plachý, Tomáš Pecka Jan Janoušek Jan Janoušek	Z,ZK	5	2P+1C	L	V
	(Gar.)		1			

BI-PMA	Programming in Mathematica  Zden k Buk Zden k Buk Zden k Buk (Gar.)	Z,ZK	4	2P+2C	Z	V
NI-RUB	Programming in Ruby Cyril erný Cyril erný Cyril erný (Gar.)	KZ	4	3C	Z	V
NI-ROZ	Pattern Recognition Radek Richtr, Michal Haindl Michal Haindl Michal Haindl (Gar.)	Z,ZK	5	2P+1C	Z	V
NI-SCE1	Computer Engineering Seminar Master I Hana Kubátová Miroslav Skrbek Hana Kubátová (Gar.)	Z	4	2C	L,Z	V
NI-SCE2	Computer Engineering Seminar Master II  Hana Kubátová Hana Kubátová Hana Kubátová (Gar.)	Z	4	2C	L,Z	V
NI-SZ1	Knowledge Engineering Seminar Master I Pavel Kordík Magda Friedjungová (Gar.)	Z	4	2C	L,Z	V
NI-SZ2	Knowledge Engineering Seminar Master II Pavel Kordík Magda Friedjungová (Gar.)	Z	4	2C	L,Z	V
PI-SCN	Seminars on Digital Design Petr Fišer Petr Fišer (Gar.)	ZK	4	2P+1C	Z,L	V
BI-SOJ	Machine Oriented Languages	Z,ZK	4	2P+2C	L	V
NI-MLP	Machine Learning in Practice Jan Hu in Daniel Vašata Jan Hu in (Gar.)	Z,ZK	5	2P+1C	Z	V
BI-SVZ.21	Machine vision and image processing Lukáš Brchl, Marcel Ji ina, Jakub Novák Jakub Novák Marcel Ji ina (Gar.)	Z,ZK	5	2P+2C	L,Z	V
NI-SEP	World Economy and Business Tomáš Evan Tomáš Evan Tomáš Evan (Gar.)	Z,ZK	4	2P+1C	Z,L	V
BI-SRC.21	Real-time systems Hana Kubátová Jaroslav Borecký Hana Kubátová (Gar.)	Z,ZK	5	2P+2C	Z	V
NI-TVR	Virtual Reality Technology Tomáš Nová ek Tomáš Nová ek (Gar.)	Z,ZK	3	1P+1C	L,Z	V
NI-TS1	Theoretical Seminar Master I Dušan Knop, Ond ej Suchý, Tomáš Valla Tomáš Valla Tomáš Valla (Gar.)	Z	4	2C	Z	V
NI-TS2	Theoretical Seminar Master II Ond ej Suchý, Tomáš Valla Tomáš Valla Tomáš Valla (Gar.)	Z	4	2C	L	V
NI-TS3	Theoretical Seminar Master III Ond ej Guth, Ond ej Suchý, Tomáš Valla Tomáš Valla Tomáš Valla (Gar.)	Z	4	2C	Z	V
NI-TS4	Theoretical Seminar Master IV Ond ej Suchý, Tomáš Valla Tomáš Valla Ond ej Suchý (Gar.)	Z	4	2C	L	V
NI-TKA	Category Theory Jan Starý Jan Starý (Gar.)	Z,ZK	4	2P+1C	L	V
NI-TNN	Theory of Neural Networks Martin Hole a Martin Hole a Martin Hole a (Gar.)	Z,ZK	5	2P+1C	L	V
NI-CPX	Complexity Theory Dušan Knop, Ond ej Suchý Ond ej Suchý (Gar.)	Z,ZK	5	3P+1C	Z	V
BI-CCN	Compiler Construction Christoph Kirsch Christoph Kirsch (Gar.)	Z,ZK	5	3P	L	V
NI-DVG	Introduction to Discrete and Computational Geometry Maria Saumell Mendiola Maria Saumell Mendiola (Gar.)	Z,ZK	5	2P+1C	L	٧
BI-VHS.21	Virtual game worlds Radek Richtr Radek Richtr Radek Richtr (Gar.)	Z,ZK	5	2P+2C	Z	V
NI-VOL	Elections Dušan Knop Dušan Knop Dušan Knop (Gar.)	Z,ZK	5	2P+1C	L	V
BI-VMM	Selected Mathematical Methods Tomáš Kalvoda Tomáš Kalvoda Tomáš Kalvoda (Gar.)	Z,ZK	4	2P+2C	L	V
NI-VYC	Computability Jan Starý Jan Starý (Gar.)	Z,ZK	4	2P+2C	L	V
NI-VPR	Research Project Št pán Starosta Št pán Starosta Št pán Starosta (Gar.)	Z	5		Z,L	V
NI-ZS10	Master internship abroad for 10 credits Zden k Muziká Zden k Muziká (Gar.)	Z	10		Z,L	V
NI-ZS20	Master internship abroad for 20 credits  Zden k Muziká Zden k Muziká (Gar.)	Z	20		Z,L	V
NI-ZS30	Master internship abroad for 30 credits  Zden k Muziká Zden k Muziká (Gar.)	Z	30		Z,L	V

Characteristics of the courses of this group of Study Plan: Code=NI-V.2021 Name=Purely Elective Master Courses, Version 2021

NI-ATH AlgorithmicTheories of Games

Traditional game theory is a branch of mathematics, which has broad applications in economy, biology, politics and computer science. This theory studies the behaviour of agents (players) of a certain competitive process by designing a mathematical model and investigating the strategies. The traditional task of classical game theory is to find the equilibria, which are the states of the game where no player wants to deviate from his strategy. Due to the recent development of computers, internet, social networks, online auctions, advertising, multiagent systems and other concepts the algorithmic point of view is gaining attention. In addition to existential questions we study the problems of efficient computation of various solution concepts. In this course we introduce the basics of game theory of many players, solution concept (usually equilibria) and methods of their computation.

BI-AG2.21 Algorithms and Graphs 2

Z,ZK

This course, presented in Czech, introduces basic algorithms and concepts of graph theory as a follow=up on the introduction given in the compulsory course BI-AG1.21. It further delves into advances data structures and amortized complexity analysis. It also includes a very light introduction to approximation algorithms. For English version of the course see BIE-AG2.21.

NI-AFP			
1 N1-7-X1 1	Applied Functional Programming	KZ	5
This course is presente	in Czech. Functional programming represents one of the traditional programming paradigms. Traditional and novel functional	al programming la	inguages are on
· · · · · · · · · · · · · · · · · · ·	he functional paradigm becomes an important construct of traditionally imperative languages (C++, C#, Java). As such, mast	tering this paradio	m becomes a
necessary competence	of a software engineer: the theory and especially the practice.		
NI-APH	Architecture of computer games	Z,ZK	4
-	c understanding of the various issues in the field of computer games development, especially from a technical point of view, but a	-	
	t a grasp of component-oriented and functional-oriented architecture, game mechanics, decision-making processes and base	· ·	-
· -	by will also understand the basics of pathfinding, networking and scripting and apply them in practical exercises (labs). An importance of the process of the second stress of th	portant part of the	e course is an
<del>`</del>	ple game, with a strong focus on nontrivial game mechanics.	7.71/	
BI-APS.21	Architectures of Computer Systems onstruction principles of internal architecture of computers with universal processors at the level of machine instructions. Spe	Z,ZK	5
	cessing and on the memory hierarchy. Students will understand the basic concepts of RISC and CISC architectures and the p	=	_
• •	ssors, but also in superscalar processors that can execute multiple instructions in one cycle, while ensuring the correctness of	•	
	ther elaborates the principles and architectures of shared memory multiprocessor and multicore systems and the memory co	•	
systems.			•
NI-BPS	Wireless Computer Networks	Z,ZK	4
	t the modern technologies, protocols, and standards for wireless networks. They will understand the routing mechanisms in a		multicast and
broadcast mechanisms	and data flow control mechanisms. They will also learn about principles of communication in sensor networks. They get know	wledge of security	mechanisms
for wireless networks ar	d get skills of configuration of wireless network elements and simulation of wireless networks using suitable tools.		
BI-BEK.21	Secure Code	Z,ZK	5
The students will learn h	ow to assess security risks and how to take them into account in the design phase of their own code and solutions. After getting	ng familiar with the	threat modeling
theory, students gain pr	actical experience with running programs with reduced privileges and methods of specifying these privileges, since not every	/ program needs t	o run with
• •	Dangers inherent in buffer overflows will be practically demonstrated. Students will be introduced to the principles of securing	-	· ·
-	ystems, web, remote procedure calls, and sockets in general. The module concludes with Denial of Service attacks and the c		
BI-BLE	Blender	Z,ZK	4
	wledge of opensource program Blender from BI-MGA (Multimedia and Graphics Applications) course. It is intended for those		
	mplete and practically oriented introduction to Blender environment. Students may continue to BI-PGA (Programming graphic		
NIE-BLO	Blockchain	Z,ZK	5
	the foundations of blockchain technology, smart contract programming, and gain an overview of most notable blockchain plat	-	_
· ·	re decentralized application, and assess whether integration of a blockchain is suitable for a given problem. The course place		
•	ockchains and information security. It is concluded with a defense of a research or applied semester project, which prepares to	the students for in	nplementing or
	tion of blockchain-based solutions in both academia and business.	147	4
NI-CTF	Capture The Flag	KZ	4
	to introduce students to CTF competitions and let them gain practical experience in the field of cyber security.	7 714	_
NI-DPH	Game Design	Z,ZK	5
•	ts the NI-APH (Architecture of Computer Games) and BI-VHS (Virtual gaming worlds) course, while focusing primarily on gam	•	
<u>-</u>	whedge of the principles used for games design, such as: level design, gameplay design, character design, game mechanics		
projects.	students will get an overview of game development from the designer's perspective, from theoretical concepts to practical imp	piementation app	iled to semestral
NI-DSW	Design Sprint	7	0
-	ojects using the Design Sprint method, developed by Google. THanks to this method the teams are able to go from idea to val		
Students will work on pr		Z	2 n E days During
the course the students		lidated prototype	n 5 days. During
	will get familiar with the method as participants. Through practical challenges they will try the whole 5 day process starting w	lidated prototype	n 5 days. During
testing the prototypes (p	will get familiar with the method as participants. Through practical challenges they will try the whole 5 day process starting w olus final presentation).	lidated prototype	n 5 days. During finishing with
testing the prototypes (p	will get familiar with the method as participants. Through practical challenges they will try the whole 5 day process starting wolus final presentation).  Public Services Design	lidated prototype vith research and KZ	n 5 days. During finishing with
testing the prototypes (pNI-PSD The course will introduce	will get familiar with the method as participants. Through practical challenges they will try the whole 5 day process starting wolus final presentation).  Public Services Design e students to specifics of UX, Service design and development for public sector. We will look into the design and development	lidated prototype vith research and KZ nt process from th	n 5 days. During finishing with  4 e perspective of
testing the prototypes (pNI-PSD) The course will introduct suppliers (devs and des	will get familiar with the method as participants. Through practical challenges they will try the whole 5 day process starting wolus final presentation).  Public Services Design e students to specifics of UX, Service design and development for public sector. We will look into the design and development ignesr) as well as clients. In small teams students will work on projects from partner organizations and will try out collaboration.	lidated prototype vith research and KZ nt process from th	n 5 days. During finishing with  4 e perspective of
testing the prototypes (pNI-PSD The course will introduct suppliers (devs and des Course is aimed at stud	will get familiar with the method as participants. Through practical challenges they will try the whole 5 day process starting we blus final presentation).  Public Services Design e students to specifics of UX, Service design and development for public sector. We will look into the design and development ignesr) as well as clients. In small teams students will work on projects from partner organizations and will try out collaboration ents-designers as well as clients.	lidated prototype vith research and  KZ  nt process from th on with client repr	n 5 days. During finishing with  4 e perspective of esentatives.
testing the prototypes (p. NI-PSD The course will introduct suppliers (devs and des Course is aimed at stud NI-DID	will get familiar with the method as participants. Through practical challenges they will try the whole 5 day process starting we blus final presentation).  Public Services Design e students to specifics of UX, Service design and development for public sector. We will look into the design and development igness) as well as clients. In small teams students will work on projects from partner organizations and will try out collaboration ents-designers as well as clients.  Digital drawing	lidated prototype vith research and  KZ  nt process from th on with client repr	n 5 days. During finishing with  4 e perspective of esentatives.
testing the prototypes (p. NI-PSD The course will introduc suppliers (devs and des Course is aimed at stud NI-DID The course will introduc	will get familiar with the method as participants. Through practical challenges they will try the whole 5 day process starting we blus final presentation).  Public Services Design e students to specifics of UX, Service design and development for public sector. We will look into the design and development igness; as well as clients. In small teams students will work on projects from partner organizations and will try out collaboration ents-designers as well as clients.  Digital drawing e students to the basic principals of digital drawing and graphical design. Students will gain understanding of composition, per	lidated prototype vith research and  KZ  Int process from the on with client representation  Z  erspective and co	n 5 days. During finishing with  4 e perspective of esentatives.  2 lor theory, which
testing the prototypes (p. NI-PSD The course will introduct suppliers (devs and des Course is aimed at stud NI-DID The course will introduct they will practically applied.	will get familiar with the method as participants. Through practical challenges they will try the whole 5 day process starting we blus final presentation).  Public Services Design e students to specifics of UX, Service design and development for public sector. We will look into the design and development igness) as well as clients. In small teams students will work on projects from partner organizations and will try out collaboration ents-designers as well as clients.  Digital drawing e students to the basic principals of digital drawing and graphical design. Students will gain understanding of composition, per yin their own design works. Students will also gain experience in drawing and painting with digital and analog tools. The court	idated prototype vith research and  KZ  nt process from the on with client representative and corse is fit for anyon	n 5 days. During finishing with  4 e perspective of esentatives.  2 lor theory, which
testing the prototypes (p. NI-PSD The course will introduct suppliers (devs and des Course is aimed at stud NI-DID The course will introduct they will practically appl practice or learn drawin	will get familiar with the method as participants. Through practical challenges they will try the whole 5 day process starting we blus final presentation).  Public Services Design e students to specifics of UX, Service design and development for public sector. We will look into the design and development ignesr) as well as clients. In small teams students will work on projects from partner organizations and will try out collaboration ents-designers as well as clients.  Digital drawing e students to the basic principals of digital drawing and graphical design. Students will gain understanding of composition, per yin their own design works. Students will also gain experience in drawing and painting with digital and analog tools. The courge and painting. The course is organized as a thematic practices covering parts of theory and practical exercise to practice gain	idated prototype vith research and  KZ  nt process from the on with client representation  Z  erspective and co rse is fit for anyon ined knowledge.	n 5 days. During finishing with  4 e perspective of esentatives.  2 lor theory, which
testing the prototypes (p. NI-PSD The course will introduct suppliers (devs and des Course is aimed at stud NI-DID The course will introduct they will practically applipractice or learn drawin NI-DZO	will get familiar with the method as participants. Through practical challenges they will try the whole 5 day process starting we blus final presentation).  Public Services Design e students to specifics of UX, Service design and development for public sector. We will look into the design and development ignesr) as well as clients. In small teams students will work on projects from partner organizations and will try out collaboration ents-designers as well as clients.  Digital drawing e students to the basic principals of digital drawing and graphical design. Students will gain understanding of composition, per ye in their own design works. Students will also gain experience in drawing and painting with digital and analog tools. The course and painting. The course is organized as a thematic practices covering parts of theory and practical exercise to practice gain Digital Image Processing	idated prototype vith research and KZ  Int process from the control on with client reproduced by the control of	n 5 days. During finishing with  4 e perspective of esentatives.  2 lor theory, which e who wants to
testing the prototypes (p. NI-PSD The course will introduct suppliers (devs and destroyers is aimed at student NI-DID The course will introduct they will practically application or learn drawin NI-DZO This course presents a	will get familiar with the method as participants. Through practical challenges they will try the whole 5 day process starting we blus final presentation).  Public Services Design e students to specifics of UX, Service design and development for public sector. We will look into the design and development ignesr) as well as clients. In small teams students will work on projects from partner organizations and will try out collaboration ents-designers as well as clients.  Digital drawing e students to the basic principals of digital drawing and graphical design. Students will gain understanding of composition, per yin their own design works. Students will also gain experience in drawing and painting with digital and analog tools. The courge and painting. The course is organized as a thematic practices covering parts of theory and practical exercise to practice gain	idated prototype vith research and  KZ  Int process from the control on with client representation and control of the control	n 5 days. During finishing with  4 e perspective of esentatives.  2 lor theory, which e who wants to  4 e both easy to
testing the prototypes (p. NI-PSD The course will introduct suppliers (devs and destauppliers (devs and destauppliers is aimed at student NI-DID The course will introduct they will practically applipractice or learn drawin NI-DZO This course presents a implement and have an	will get familiar with the method as participants. Through practical challenges they will try the whole 5 day process starting we blus final presentation).  Public Services Design e students to specifics of UX, Service design and development for public sector. We will look into the design and development ignesr) as well as clients. In small teams students will work on projects from partner organizations and will try out collaboration ents-designers as well as clients.  Digital drawing e students to the basic principals of digital drawing and graphical design. Students will gain understanding of composition, per ye in their own design works. Students will also gain experience in drawing and painting with digital and analog tools. The course grand painting. The course is organized as a thematic practices covering parts of theory and practical exercise to practice gain Digital Image Processing comprehensive overview of modern methods for interactive editing of digital images and video. It mainly deals with practical exercises.	idated prototype with research and KZ  Int process from the control of the contro	n 5 days. During finishing with  4 e perspective of esentatives.  2 lor theory, which e who wants to  4 e both easy to tside the domain
testing the prototypes (p. NI-PSD The course will introduct suppliers (devs and destauppliers (devs and destauppliers (devs and destauppliers (devs and destauppliers is aimed at studie NI-DID The course will introduct they will practically applieration or learn drawin NI-DZO This course presents a implement and have an of digital image process	will get familiar with the method as participants. Through practical challenges they will try the whole 5 day process starting we blus final presentation).  Public Services Design e students to specifics of UX, Service design and development for public sector. We will look into the design and development ignesr) as well as clients. In small teams students will work on projects from partner organizations and will try out collaboration ents-designers as well as clients.  Digital drawing e students to the basic principals of digital drawing and graphical design. Students will gain understanding of composition, per organizations were provided in the processing comprehensive overview of modern methods for interactive editing of digital images and video. It mainly deals with practical and interesting theoretical basis. Visually attractive applications provide better understanding of basic theoretical background that is	idated prototype vith research and KZ  Int process from the control of the contro	n 5 days. During finishing with  4 e perspective of esentatives.  2 lor theory, which e who wants to  4 e both easy to tside the domain e-blurring in
testing the prototypes (p. NI-PSD The course will introduct suppliers (devs and destauppliers (devs and destauppliers (devs and destauppliers (devs and destauppliers is aimed at studie NI-DID The course will introduct they will practically applier practice or learn drawin NI-DZO This course presents a implement and have an of digital image process frequency domain, abstitutions.	will get familiar with the method as participants. Through practical challenges they will try the whole 5 day process starting we blus final presentation).  Public Services Design e students to specifics of UX, Service design and development for public sector. We will look into the design and development ignesr) as well as clients. In small teams students will work on projects from partner organizations and will try out collaboration ents-designers as well as clients.  Digital drawing e students to the basic principals of digital drawing and graphical design. Students will gain understanding of composition, per year in their own design works. Students will also gain experience in drawing and painting with digital and analog tools. The courge and painting. The course is organized as a thematic practices covering parts of theory and practical exercise to practice gain Digital Image Processing comprehensive overview of modern methods for interactive editing of digital images and video. It mainly deals with practical interesting theoretical basis. Visually attractive applications provide better understanding of basic theoretical background that is ing. This course will introduce algorithms solving the following practical applications: edge-aware editing, tone mapping, HDR	idated prototype with research and KZ  Int process from the control of the contro	n 5 days. During finishing with  4 e perspective of esentatives.  2 lor theory, which e who wants to  4 e both easy to tside the domain e-blurring in tt enhancement,
testing the prototypes (p. NI-PSD The course will introduct suppliers (devs and destauppliers (devs and destauppliers (devs and destauppliers (devs and destauppliers is aimed at studie NI-DID The course will introduct they will practically applier practice or learn drawin NI-DZO This course presents a implement and have an of digital image process frequency domain, abstitutions.	will get familiar with the method as participants. Through practical challenges they will try the whole 5 day process starting we blus final presentation).  Public Services Design e students to specifics of UX, Service design and development for public sector. We will look into the design and development ignesr) as well as clients. In small teams students will work on projects from partner organizations and will try out collaboration ents-designers as well as clients.  Digital drawing e students to the basic principals of digital drawing and graphical design. Students will gain understanding of composition, per year in their own design works. Students will also gain experience in drawing and painting with digital and analog tools. The courge and painting. The course is organized as a thematic practices covering parts of theory and practical exercise to practice gain Digital Image Processing comprehensive overview of modern methods for interactive editing of digital images and video. It mainly deals with practical anteresting theoretical basis. Visually attractive applications provide better understanding of basic theoretical background that is ing. This course will introduce algorithms solving the following practical applications: edge-aware editing, tone mapping, HDR reaction, hybrid images, gradient domain editing, seamless image stitching and cloning, digital photo-montage, color-to-gray creations.	idated prototype with research and KZ  Int process from the control of the contro	n 5 days. During finishing with  4 e perspective of esentatives.  2 lor theory, which e who wants to  4 e both easy to tside the domain e-blurring in tt enhancement,
testing the prototypes (p. NI-PSD) The course will introduct suppliers (devs and destroyers is aimed at study NI-DID) The course will introduct they will practically applied practice or learn drawing NI-DZO) This course presents a implement and have an of digital image process frequency domain, abstrict interactive as-rigid-as-pin-NI-DDM	will get familiar with the method as participants. Through practical challenges they will try the whole 5 day process starting we blus final presentation).  Public Services Design e students to specifics of UX, Service design and development for public sector. We will look into the design and development ignest) as well as clients. In small teams students will work on projects from partner organizations and will try out collaboration ents-designers as well as clients.  Digital drawing e students to the basic principals of digital drawing and graphical design. Students will gain understanding of composition, per year in their own design works. Students will also gain experience in drawing and painting with digital and analog tools. The course gain and painting. The course is organized as a thematic practices covering parts of theory and practical exercise to practice gain Digital Image Processing comprehensive overview of modern methods for interactive editing of digital images and video. It mainly deals with practical interesting theoretical basis. Visually attractive applications provide better understanding of basic theoretical background that is ing. This course will introduce algorithms solving the following practical applications: edge-aware editing, tone mapping, HDR raction, hybrid images, gradient domain editing, seamless image stitching and cloning, digital photo-montage, color-to-gray cossible image deformation, free-form image registration, texture synthesis, interactive segmentation, colorization, painting, accessible image deformation, free-form image registration, texture synthesis, interactive segmentation, colorization, painting, accessible image deformation, free-form image registration, texture synthesis, interactive segmentation, colorization, painting, accessible image deformation, free-form image registration, texture synthesis, interactive segmentation.	ilidated prototype with research and KZ  Interprocess from the control of the con	n 5 days. During finishing with  4 e perspective of esentatives.  2 lor theory, which e who wants to  4 e both easy to taide the domain e-blurring in at enhancement, a matting.
testing the prototypes (p. NI-PSD) The course will introduct suppliers (devs and destroyers is aimed at study NI-DID) The course will introduct they will practically applied practice or learn drawing NI-DZO) This course presents a implement and have an of digital image process frequency domain, abstrict interactive as-rigid-as-p NI-DDM Course focuses on states.	will get familiar with the method as participants. Through practical challenges they will try the whole 5 day process starting we blus final presentation).  Public Services Design e students to specifics of UX, Service design and development for public sector. We will look into the design and development ignest) as well as clients. In small teams students will work on projects from partner organizations and will try out collaboration ents-designers as well as clients.  Digital drawing e students to the basic principals of digital drawing and graphical design. Students will gain understanding of composition, per year in their own design works. Students will also gain experience in drawing and painting with digital and analog tools. The course gain and painting. The course is organized as a thematic practices covering parts of theory and practical exercise to practice gain Digital Image Processing comprehensive overview of modern methods for interactive editing of digital images and video. It mainly deals with practical interesting theoretical basis. Visually attractive applications provide better understanding of basic theoretical background that is ing. This course will introduce algorithms solving the following practical applications: edge-aware editing, tone mapping, HDR raction, hybrid images, gradient domain editing, seamless image stitching and cloning, digital photo-montage, color-to-gray cossible image deformation, free-form image registration, texture synthesis, interactive segmentation, colorization, painting, and Distributed Data Mining	idated prototype with research and KZ  Interprocess from the control of the contr	n 5 days. During finishing with  4 e perspective of esentatives.  2 lor theory, which e who wants to  4 e both easy to tside the domain e-blurring in the enhancement, a matting.  4 with large scale
testing the prototypes (p. NI-PSD The course will introduct suppliers (devs and destroyers (devs and destroyers) to the course is aimed at study they will practically applied practice or learn drawin NI-DZO This course presents a implement and have an of digital image process frequency domain, abstrict interactive as-rigid-as-p NI-DDM Course focuses on stated data processing framework.	will get familiar with the method as participants. Through practical challenges they will try the whole 5 day process starting we blus final presentation).  Public Services Design e students to specifics of UX, Service design and development for public sector. We will look into the design and development ignest) as well as clients. In small teams students will work on projects from partner organizations and will try out collaboration ents-designers as well as clients.  Digital drawing e students to the basic principals of digital drawing and graphical design. Students will gain understanding of composition, per year in their own design works. Students will also gain experience in drawing and painting with digital and analog tools. The course gain and painting. The course is organized as a thematic practices covering parts of theory and practical exercise to practice gain the processing comprehensive overview of modern methods for interactive editing of digital images and video. It mainly deals with practical interesting theoretical basis. Visually attractive applications provide better understanding of basic theoretical background that is ing. This course will introduce algorithms solving the following practical applications: edge-aware editing, tone mapping, HDR raction, hybrid images, gradient domain editing, seamless image stitching and cloning, digital photo-montage, color-to-gray cossible image deformation, free-form image registration, texture synthesis, interactive segmentation, colorization, painting, and Distributed Data Mining e-of-the-art approaches for distributed data mining and parallelization of machine learning algorithms. Students will gain hand	idated prototype with research and KZ  Interprocess from the control of the contr	n 5 days. During finishing with  4 e perspective of esentatives.  2 lor theory, which e who wants to  4 e both easy to tside the domain e-blurring in the enhancement, a matting.  4 with large scale
testing the prototypes (p. NI-PSD The course will introduct suppliers (devs and destroyers (devs and destroyers) to the course is aimed at study they will practically applied practice or learn drawin NI-DZO This course presents a implement and have an of digital image process frequency domain, abstrict interactive as-rigid-as-p NI-DDM Course focuses on stated data processing framework.	will get familiar with the method as participants. Through practical challenges they will try the whole 5 day process starting we bus final presentation).  Public Services Design e students to specifics of UX, Service design and development for public sector. We will look into the design and development ignesr) as well as clients. In small teams students will work on projects from partner organizations and will try out collaboration ents-designers as well as clients.  Digital drawing e students to the basic principals of digital drawing and graphical design. Students will gain understanding of composition, per ye in their own design works. Students will also gain experience in drawing and painting with digital and analog tools. The course and painting. The course is organized as a thematic practices covering parts of theory and practical exercise to practice gain Digital Image Processing comprehensive overview of modern methods for interactive editing of digital images and video. It mainly deals with practical anteresting theoretical basis. Visually attractive applications provide better understanding of basic theoretical background that is ing. This course will introduce algorithms solving the following practical applications: edge-aware editing, tone mapping, HDR reaction, hybrid images, gradient domain editing, seamless image stitching and cloning, digital photo-montage, color-to-gray cossible image deformation, free-form image registration, texture synthesis, interactive segmentation, colorization, painting, and Distributed Data Mining cof-the-art approaches for distributed data mining and parallelization of machine learning algorithms. Students will gain hand ork Apache Spark and with existing distributed DM / ML algorithms. They will learn principles of their parallel implementation.	idated prototype with research and KZ  Interprocess from the control of the contr	n 5 days. During finishing with  4 e perspective of esentatives.  2 lor theory, which e who wants to  4 e both easy to tside the domain e-blurring in the enhancement, a matting.  4 with large scale
testing the prototypes (p. NI-PSD The course will introduct suppliers (devs and destroyers is aimed at study NI-DID The course will introduct they will practically apply practice or learn drawin NI-DZO This course presents a implement and have an of digital image process frequency domain, abstrinteractive as-rigid-as-p NI-DDM Course focuses on state data processing framew approaches to paralleliz NI-PAM There are many optimiz	will get familiar with the method as participants. Through practical challenges they will try the whole 5 day process starting we bus final presentation).  Public Services Design e students to specifics of UX, Service design and development for public sector. We will look into the design and development ignes; as well as clients. In small teams students will work on projects from partner organizations and will try out collaboration ents-designers as well as clients.  Digital drawing e students to the basic principals of digital drawing and graphical design. Students will gain understanding of composition, per yin their own design works. Students will also gain experience in drawing and painting with digital and analog tools. The cours grand painting. The course is organized as a thematic practices covering parts of theory and practical exercise to practice gain Digital Image Processing comprehensive overview of modern methods for interactive editing of digital images and video. It mainly deals with practical and interesting theoretical basis. Visually attractive applications provide better understanding of basic theoretical background that is ing. This course will introduce algorithms solving the following practical applications: edge-aware editing, tone mapping, HDR praction, hybrid images, gradient domain editing, seamless image stitching and cloning, digital photo-montage, color-to-gray cossible image deformation, free-form image registration, texture synthesis, interactive segmentation, colorization, painting, according to the processing and parameterized Algorithms. They will learn principles of their parallel implementation of other algorithms. The course is prezented in czech language.  Efficient Preprocessing and Parameterized Algorithms are known (e.g. NP-complete problems). Despite that it is often necessare.	ilidated prototype with research and KZ  Interprocess from the control of the con	n 5 days. During finishing with  4 e perspective of esentatives.  2 lor theory, which e who wants to  4 e both easy to tside the domain e-blurring in the enhancement, a matting.  4 with large scale able to propose  4 sse problems
testing the prototypes (p. NI-PSD The course will introduct suppliers (devs and destroyers (devs and destroyers) to suppliers (devs and destroyers). The course will introduct they will practically applied practice or learn drawin NI-DZO This course presents a implement and have an of digital image process frequency domain, abstrinteractive as-rigid-as-p NI-DDM Course focuses on state data processing framew approaches to paralleliz NI-PAM There are many optimize exactly in practice. We want to the course for the	will get familiar with the method as participants. Through practical challenges they will try the whole 5 day process starting we blus final presentation).  Public Services Design e students to specifics of UX, Service design and development for public sector. We will look into the design and development ignesr) as well as clients. In small teams students will work on projects from partner organizations and will try out collaboration ents-designers as well as clients.  Digital drawing e students to the basic principals of digital drawing and graphical design. Students will gain understanding of composition, per in their own design works. Students will also gain experience in drawing and painting with digital and analog tools. The courge and painting. The course is organized as a thematic practices covering parts of theory and practical exercise to practice gain Digital Image Processing comprehensive overview of modern methods for interactive editing of digital images and video. It mainly deals with practical anteresting theoretical basis. Visually attractive applications provide better understanding of basic theoretical background that is ing. This course will introduce algorithms solving the following practical applications: edge-aware editing, tone mapping, HDR reaction, hybrid images, gradient domain editing, seamless image stitching and cloning, digital photo-montage, color-to-gray cossible image deformation, free-form image registration, texture synthesis, interactive segmentation, colorization, painting, and possible image deformation, free-form image registration, texture synthesis, interactive segmentation, students will gain handour of the processing and Parameterized Algorithms. They will learn principles of their parallel implementation to other algorithms. The course is prezented in czech language.  Efficient Preprocessing and Parameterized Algorithms ation problems for which no polynomial time algorithms are known (e.g. NP-complete problems). Despite that it is often necestial demonstrate that many	ilidated prototype with research and KZ  Interprocess from the control of the con	n 5 days. During finishing with  4 e perspective of esentatives.  2 lor theory, which e who wants to  4 e both easy to tside the domain e-blurring in the tenhancement, a matting.  4 with large scale able to propose  4 see problems mmon property
testing the prototypes (p. NI-PSD) The course will introduct suppliers (devs and destroyers (devs and destroyers) The course is aimed at study the suppliers (devs and destroyers) The course will introduct they will practically applied practice or learn drawing they will practice as regional to the supplier of the practice. We will practice will be supplied to the supplier of the supplier	will get familiar with the method as participants. Through practical challenges they will try the whole 5 day process starting whose final presentation).  Public Services Design  e students to specifics of UX, Service design and development for public sector. We will look into the design and development igneer) as well as clients. In small teams students will work on projects from partner organizations and will try out collaboration ents-designers as well as clients.  Digital drawing  e students to the basic principals of digital drawing and graphical design. Students will gain understanding of composition, per yin their own design works. Students will also gain experience in drawing and painting with digital and analog tools. The course and painting. The course is organized as a thematic practices covering parts of theory and practical exercise to practice gain Digital Image Processing  comprehensive overview of modern methods for interactive editing of digital images and video. It mainly deals with practical interesting theoretical basis. Visually attractive applications provide better understanding of basic theoretical background that interesting theoretical basis. Visually attractive applications provide better understanding of basic theoretical background that interesting theoretical basis, visually attractive applications provide better understanding of basic theoretical background that interesting theoretical basis, visually attractive applications provide better understanding of basic theoretical background that interesting theoretical basis, visually attractive applications provide better understanding of basic theoretical background that interesting theoretical basic, visually attractive applications provide better understanding of basic theoretical background that interesting theoretical background that provides a first provide better understanding of basic theoretical background that provides and provides with provides and	ilidated prototype with research and KZ  Interprocess from the control of the con	n 5 days. During finishing with  4 e perspective of esentatives.  2 lor theory, which e who wants to  4 e both easy to tside the domain e-blurring in the enhancement, a matting.  4 with large scale able to propose  4 see problems mmon property small) parameter
testing the prototypes (p. NI-PSD) The course will introduct suppliers (devs and destroyers (devs and destroyers) The course is aimed at study the suppliers (devs and destroyers) The course will introduct they will practically applied practice or learn drawing they will practice as implement and have an of digital image process frequency domain, abstrict interactive as-rigid-as-pinteractive as-pinteractive as-pinteract	will get familiar with the method as participants. Through practical challenges they will try the whole 5 day process starting whose final presentation).  Public Services Design  e students to specifics of UX, Service design and development for public sector. We will look into the design and development gingness) as well as clients. In small teams students will work on projects from partner organizations and will try out collaboration entitled the subjects of the basic principals of digital drawing and graphical design. Students will gain understanding of composition, per yin their own design works. Students will also gain experience in drawing and painting with digital and analog tools. The course and painting. The course is organized as a thematic practices covering parts of theory and practical exercise to practice gain. Digital Image Processing  comprehensive overview of modern methods for interactive editing of digital images and video. It mainly deals with practical interesting theoretical basis. Visually attractive applications provide better understanding of basic theoretical background that interesting theoretical basis. Visually attractive applications provide better understanding of basic theoretical background that interesting theoretical basis. Visually attractive applications provide better understanding of basic theoretical background that interesting theoretical basis, visually attractive applications provide better understanding of basic theoretical background that interesting theoretical basis, visually attractive applications provide better understanding of basic theoretical background that interesting theoretical basis, visually attractive applications provide better understanding of basic theoretical background that interesting theoretical background that provide better understanding of basic theoretical background that provide better understanding of basic theoretical background that provide better understanding of basic theoretical background that provide background that provide backgroun	ilidated prototype with research and KZ  Interprocess from the control of the con	n 5 days. During finishing with  4 e perspective of esentatives.  2 lor theory, which e who wants to  4 e both easy to tside the domain e-blurring in at enhancement, a matting.  4 with large scale able to propose  4 see problems mmon property small) parameter ing of the input,
testing the prototypes (p. NI-PSD) The course will introduct suppliers (devs and destroyers (devs and destroyers) The course is aimed at study they will practically apply practice or learn drawin NI-DZO This course presents a implement and have an of digital image process frequency domain, abstrinteractive as-rigid-as-p NI-DDM Course focuses on state data processing framew approaches to paralleliz NI-PAM There are many optimize exactly in practice. We will consider the imput and polynomially in the which is not possible in	will get familiar with the method as participants. Through practical challenges they will try the whole 5 day process starting wholes final presentation).  Public Services Design e students to specifics of UX, Service design and development for public sector. We will look into the design and development ignest) as well as clients. In small teams students will work on projects from partner organizations and will try out collaboration ents-designers as well as clients.  Digital drawing e students to the basic principals of digital drawing and graphical design. Students will gain understanding of composition, per in their own design works. Students will also gain experience in drawing and painting with digital and analog tools. The courge and painting. The course is organized as a thematic practices covering parts of theory and practical exercise to practice gain Digital Image Processing  Digital Images, gradient domain editing, seamless image stitching and cloning, digital photo-montage, color-to-gray cossible image deformation, free-form image registration, texture synthesis, interactive segmentation, colorization, painting, and procedure of the art approaches for distributed data mining and parallelization of machine learning algorithms. Students will gain handork Apache Spark and with existing distributed DM / ML algorithms. They will learn principles of their parallel implementation to other algorithms. The course is prezented in czech language.  Efficient Preprocessing and Parameterized Algorithms  atton problems for which no polynomial time algorithms are known (e.g. NP-complete problems). Despite that it is often neces will demonstrate that many problems can be solved much more effectively than by naively trying all possible solutions. Often can form practice-e.g., all solutions are relatively small. Parameterized algorithms exploit that by limiting the time complexity experimen	ilidated prototype with research and KZ  Interprocess from the control of the con	n 5 days. During finishing with  4 e perspective of esentatives.  2 lor theory, which e who wants to  4 e both easy to tside the domain e-blurring in the enhancement, a matting.  4 with large scale able to propose  4 see problems mmon property small) parameter ing of the input, ill present a
testing the prototypes (p. NI-PSD The course will introduct suppliers (devs and destrouse is aimed at studie NI-DID The course will introduct they will practically apply practice or learn drawin NI-DZO This course presents a implement and have an of digital image process frequency domain, abstrict interactive as-rigid-as-p NI-DDM Course focuses on state data processing framew approaches to paralleliz NI-PAM There are many optimiz exactly in practice. We will provide the input and polynomially in the which is not possible in plethora of parameterize.	will get familiar with the method as participants. Through practical challenges they will try the whole 5 day process starting wholes final presentation).  Public Services Design e students to specifics of UX, Service design and development for public sector. We will look into the design and development ignesr) as well as clients. In small teams students will work on projects from partner organizations and will try out collaboration ents-designers as well as clients.  Digital drawing e students to the basic principals of digital drawing and graphical design. Students will gain understanding of composition, per yin their own design works. Students will also gain experience in drawing and painting with digital and analog tools. The courg and painting. The course is organized as a thematic practices covering parts of theory and practical exercise to practice gain Digital Image Processing  comprehensive overview of modern methods for interactive editing of digital images and video. It mainly deals with practical enteresting theoretical basis. Visually attractive applications provide better understanding of basic theoretical background that is ing. This course will introduce algorithms solving the following practical applications: edge-aware editing, tone mapping, HDR raction, hybrid images, gradient domain editing, seamless image stitching and cloning, digital photo-montage, color-to-gray cossible image deformation, free-form image registration, texture synthesis, interactive segmentation, colorization, painting, and port-the-art approaches for distributed data mining and parallelization of machine learning algorithms. Students will gain hand on the Apache Spark and with existing distributed DM / ML algorithms. They will learn principles of their parallel implementation of effectively the parameterized Algorithms atton problems for which no polynomial time algorithms are known (e.g. NP-complete problems). Despite that it is often necessial demonstrate that many problems can be solved much more effectively than by n	ilidated prototype with research and KZ  Interprocess from the control of the con	n 5 days. During finishing with  4 e perspective of esentatives.  2 lor theory, which e who wants to  4 e both easy to tside the domain e-blurring in the enhancement, a matting.  4 with large scale able to propose  4 see problems mmon property small) parameter ing of the input, ill present a
testing the prototypes (p. NI-PSD) The course will introduct suppliers (devs and destroyers (devs and destroyers) The course is aimed at study they will practically apply practice or learn drawin NI-DZO This course presents a implement and have an of digital image process frequency domain, abstrinteractive as-rigid-as-p NI-DDM Course focuses on state data processing framew approaches to paralleliz NI-PAM There are many optimize exactly in practice. We will also not miss out the	will get familiar with the method as participants. Through practical challenges they will try the whole 5 day process starting who is final presentation).  Public Services Design e students to specifics of UX, Service design and development for public sector. We will look into the design and development ignest) as well as clients. In small teams students will work on projects from partner organizations and will try out collaboration ents-designers as well as clients.  Digital drawing e students to the basic principals of digital drawing and graphical design. Students will gain understanding of composition, per yin their own design works. Students will also gain experience in drawing and painting with digital and analog tools. The courge and painting. The course is organized as a thematic practices covering parts of theory and practical exercise to practice gain pointing. The course is organized as a thematic practices covering parts of theory and practical exercise to practice gain pointing. The course will introduce algorithms solving the following practical applications: edge-aware editing, tone mapping, Horaction, hybrid images, gradient domain editing, seamless image stitching and cloning, digital photo-montage, color-to-gray cossible image deformation, free-form image registration, texture synthesis, interactive segmentation, colorization, painting, and pointing and parallelization of machine learning algorithms. Students will gain hand ork Apache Spark and with existing distributed DM / ML algorithms. They will learn principles of their parallel implementation e other algorithms. The course is prezented in czech language.  Efficient Preprocessing and Parameterized Algorithms ation problems for which no polynomial time algorithms are known (e.g. NP-complete problems). Despite that it is often neces if more practice-e.g., all solutions are relatively small. Parameterized algorithms exploit that by limiting the time complexity expending the classical complexity. Such a polynomial time reprocessing is then a	ilidated prototype with research and KZ Int process from the on with client representive and corse is fit for anyon ined knowledge.  Z,ZK algorithms that are also valuable out compression, do conversion, contexted ding depth, alphates and will be capated as and will be capated as and will be capated as and in the conventially in this (so all time preprocession method. We we presumably) does	n 5 days. During finishing with  4 e perspective of esentatives.  2 lor theory, which e who wants to  4 e both easy to tside the domain e-blurring in at enhancement, a matting.  4 with large scale able to propose  4 ese problems mmon property small) parameter ing of the input, ill present a senot exist. We
testing the prototypes (p. NI-PSD) The course will introduct suppliers (devs and destroyers (devs and destroyers) The course is aimed at study they will practically apply practice or learn drawing NI-DZO. This course presents a implement and have an of digital image process frequency domain, abstrictive as-rigid-as-p. NI-DDM. Course focuses on state data processing framew approaches to paralleliz NI-PAM. There are many optimize exactly in practice. We will provide the input and polynomially in the which is not possible in plethora of parameteriz will also not miss out the BI-EHA.21	will get familiar with the method as participants. Through practical challenges they will try the whole 5 day process starting wholes final presentation).  Public Services Design e students to specifics of UX, Service design and development for public sector. We will look into the design and development ignes;) as well as clients. In small teams students will work on projects from partner organizations and will try out collaboration entitled. The same students will work on projects from partner organizations and will try out collaborations, as well as clients.  Digital drawing es tudents to the basic principals of digital drawing and graphical design. Students will gain understanding of composition, per in their own design works. Students will also gain experience in drawing and painting with digital and analog tools. The course and painting. The course is organized as a thematic practices covering parts of theory and practical exercise to practice gain Digital Image Processing  comprehensive overview of modern methods for interactive editing of digital images and video. It mainly deals with practical interesting theoretical basis. Visually attractive applications provide better understanding of basic theoretical background that is interesting theoretical basis. Visually attractive applications provide better understanding of basic theoretical background that is interesting theoretical basis. Visually attractive applications provide better understanding of basic theoretical background that is interesting theoretical basis. Visually attractive applications provide better understanding of basic theoretical background that is interesting theoretical basis. Visually attractive applications provide better understanding of basic theoretical background that is interesting the order adjustion of the order applications, colorization, free-form image r	ilidated prototype with research and KZ Int process from the on with client representive and corse is fit for anyon ined knowledge.  Z,ZK  algorithms that and a corporation of the conversion, contexted in the conversion of the corporation of the	n 5 days. During finishing with  4 e perspective of esentatives.  2 lor theory, which e who wants to  4 e both easy to tside the domain e-blurring in the ending. 4 with large scale able to propose  4 se problems mmon property small) parameter ing of the input, ill present a shot exist. We
testing the prototypes (p. NI-PSD) The course will introduct suppliers (devs and destroyers (devs and destroyers) The course is aimed at study they will practically apply practice or learn drawin NI-DZO This course presents a implement and have an of digital image process frequency domain, abstrinteractive as-rigid-as-p NI-DDM Course focuses on state data processing framew approaches to paralleliz NI-PAM There are many optimize exactly in practice. We were (parameter) of the input and polynomially in the which is not possible in plethora of parameteriz will also not miss out the BI-EHA.21 The goal of the course in the supplier of the course in the cour	will get familiar with the method as participants. Through practical challenges they will try the whole 5 day process starting wholes final presentation).  Public Services Design e students to specifics of UX, Service design and development for public sector. We will look into the design and development genes) as well as clients. In small teams students will work on projects from partner organizations and will try out collaborations as well as clients. In small teams students will work on projects from partner organizations and will try out collaborations. Digital drawing e students to the basic principals of digital drawing and graphical design. Students will gain understanding of composition, per understanding of composition, per understanding. The course is organized as a thematic practices covering parts of theory and practical exercise to practice gain Digital Image Processing  comprehensive overview of modern methods for interactive editing of digital images and video. It mainly deals with practical and interesting theoretical basis. Visually attractive applications provide better understanding of basic theoretical background that is interesting theoretical basis. Visually attractive applications provide better understanding of basic theoretical background that is interesting theoretical basis. Visually attractive applications provide better understanding of basic theoretical background that is interesting theoretical basis. Visually attractive applications provide better understanding of basic theoretical background that is interesting theoretical basis. Visually attractive applications provide better understanding of basic theoretical background that is interesting the provide of the provided that interesting the provided in the provided that it is often to the algorithms. The course is preze	ilidated prototype with research and KZ Int process from the on with client representive and corse is fit for anyon ined knowledge.  Z,ZK algorithms that are also valuable out compression, deconversion, contexted ding depth, alphates and will be capable and will be capable is and will be capable in this (so in method. We we presumably) does  Z,ZK Interabilities, and to interabilities.	n 5 days. During finishing with  4 e perspective of esentatives.  2 lor theory, which e who wants to  4 e both easy to tside the domain e-blurring in at enhancement, a matting.  4 with large scale able to propose  4 ese problems mmon property small) parameter ing of the input, ill present a senot exist. We  5 heir possible
testing the prototypes (p. NI-PSD The course will introduct suppliers (devs and destrouse is aimed at studie NI-DID The course will introduct they will practically apply practice or learn drawin NI-DZO This course presents a implement and have an of digital image process frequency domain, abstrict interactive as-rigid-as-p NI-DDM Course focuses on state data processing framew approaches to paralleliz NI-PAM There are many optimize exactly in practice. We will also not miss out the BI-EHA.21 The goal of the course is exploitation in computer	will get familiar with the method as participants. Through practical challenges they will try the whole 5 day process starting wilds final presentation).  Public Services Design e students to specifics of UX, Service design and development for public sector. We will look into the design and development ginesr) as well as clients. In small teams students will work on projects from partner organizations and will try out collaborations. Digital drawing estudents to the basic principals of digital drawing and graphical design. Students will gain understanding of composition, per in their own design works. Students will also gain experience in drawing and painting with digital and analog tools. The course and painting. The course is organized as a thematic practices covering parts of theory and practical exercise to practice gain Digital Image Processing comprehensive overview of modern methods for interactive editing of digital images and video. It mainly deals with practical anteresting theoretical basis. Visually attractive applications provide better understanding of basis theoretical background that is ing. This course will introduce algorithms solving the following practical applications: edge-aware editing, tone mapping, HDR raction, hybrid images, gradient domain editing, seamless image stitching and cloning, digital photo-montage, color-to-gray or particular to the provide deformation, free-form image registration, texture synthesis, interactive segmentation, colorization, painting, and Distributed Data Mining  Distr	ilidated prototype with research and KZ Int process from the on with client representive and corse is fit for anyon ined knowledge.  Z,ZK algorithms that are also valuable out compression, deconversion, contexted ding depth, alphates and will be capable and will be capable is and will be capable in this (so in method. We we presumably) does  Z,ZK Interabilities, and to interabilities.	n 5 days. During finishing with  4 e perspective of esentatives.  2 lor theory, which e who wants to  4 e both easy to tside the domain e-blurring in at enhancement, a matting.  4 with large scale able to propose  4 ese problems mmon property small) parameter ing of the input, ill present a senot exist. We  5 heir possible
testing the prototypes (p. NI-PSD The course will introduct suppliers (devs and destrouse is aimed at studie NI-DID The course will introduct they will practically apply practice or learn drawin NI-DZO This course presents a implement and have an of digital image process frequency domain, abstrict interactive as-rigid-as-p NI-DDM Course focuses on state data processing framew approaches to paralleliz NI-PAM There are many optimize exactly in practice. We will also not miss out the BI-EHA.21 The goal of the course is exploitation in computer	will get familiar with the method as participants. Through practical challenges they will try the whole 5 day process starting wholes final presentation).  Public Services Design e students to specifics of UX, Service design and development for public sector. We will look into the design and development genes) as well as clients. In small teams students will work on projects from partner organizations and will try out collaborations as well as clients. In small teams students will work on projects from partner organizations and will try out collaborations. Digital drawing e students to the basic principals of digital drawing and graphical design. Students will gain understanding of composition, per understanding of composition, per understanding. The course is organized as a thematic practices covering parts of theory and practical exercise to practice gain Digital Image Processing  comprehensive overview of modern methods for interactive editing of digital images and video. It mainly deals with practical and interesting theoretical basis. Visually attractive applications provide better understanding of basic theoretical background that is interesting theoretical basis. Visually attractive applications provide better understanding of basic theoretical background that is interesting theoretical basis. Visually attractive applications provide better understanding of basic theoretical background that is interesting theoretical basis. Visually attractive applications provide better understanding of basic theoretical background that is interesting theoretical basis. Visually attractive applications provide better understanding of basic theoretical background that is interesting the provide of the provided that interesting the provided in the provided that it is often to the algorithms. The course is preze	ilidated prototype with research and KZ Int process from the on with client representive and corse is fit for anyon ined knowledge.  Z,ZK algorithms that are also valuable out compression, deconversion, contexted ding depth, alphates and will be capable and will be capable is and will be capable in this (so in method. We we presumably) does  Z,ZK Interabilities, and to interabilities.	n 5 days. During finishing with  4 e perspective of esentatives.  2 for theory, which e who wants to  4 e both easy to tside the domain e-blurring in at enhancement, a matting.  4 with large scale able to propose  4 ese problems mmon property small) parameter ing of the input, ill present a senot exist. We  5 heir possible

NI-ESC	Experimental Project Course	KZ	8
	urse offers a holistic exploration of the design process, providing students with a well-rounded understanding of the principles -driven solutions that are user-centric and industry-relevant. Throughout the semester, students will work on real-world design	_	
0 0 0,	egrate theory with practical application. Through a hands-on, project-based learning approach, students will develop their ski		,
•	tion, as well as gain experience working in a team to design and prototype a functional solution."		
BI-FMU	Financial and Management Accounting	Z,ZK	5
	s explanation of basic terms in the theory of accounting, the principles of balancing the property amounts and liabilities in the	-	
-	and accounting statements including opening and closing of bookkeeping. The course provides students with a legal modification of the course provides students with a legal modification of the course provides students with a legal modification of the course provides at the co		
·	based on current methods of double-entry bookkeeping for enterprising subjects in the Czech Republic. Principles of manag oduls in Business information systems.	ernent accounting	are base or
BI-FTR.1	Financial Markets	Z,ZK	5
	d in Czech. However, there is an English variant in the program Informatics (B1801 / 4753).	_,,,	
NI-GLR	Games and reinforcement learning	Z,ZK	4
	int learning is very hot recently, because of advances in deep learning, recurrent neural networks and general artificial intellig	ence. This course	is intended to
	al and practical background so you can participate in related research activities. Presented in English.		
NI-GNN	Graph Neural Networks	Z,ZK	. 4
	students to advanced artificial intelligence techniques for working with graphs. Lectures will focus on the latest graph neural n ss, edges and entire graphs. The techniques discussed cover various types of graphs, including time-varying graphs. The last		-
•	is, edges and entire graphs. The techniques discussed cover various types of graphs, including lime-varying graphs. The last iterpretability of graph neural networks. In the exercises, students will try out selected techniques and problems.	part of the course	also covers
NI-GRI	Grid Computing	Z,ZK	5
	n knowledge about the world-wide network and computing infrastructure.	_,,,	
NI-HCM	Mind Hacking	ZK	5
Cognitive security is an	emerging discipline that is closely related to cyber security. While the domain of cyber security is the protection of networks,	information syster	ns and assets,
<del>_</del>	security is the protection of the human mind from intentional and unintentional digital manipulation. The topic of cognitive sec		
	on warfare, increasing digital dependence and the development of artificial intelligence, where these phenomena from the Inter-	net environment h	ave real societal
	ion of social cohesion, threats to democracy or war.	7 71/	4
NI-HSC	Side-Channel Analysis in Hardware dto so-called side-channel information leakage in hardware devices. It focuses on both theoretical analysis and practical atta	Z,ZK	4 familiar with
	annels and they get deeper insight in power attacks. Students learn to implement various profiled and non-profiled attacks ar	-	
	ractice in both designing the SCA countermeasures and analyzing the amount and characteristics of the side-channel inform	•	g
NI-HMI2	History of Mathematics and Informatics	ZK	3
This course is presented	d in Czech. Selected topics {Infinitesimal calculus, probability, number theory, general algebra, different examples of algorithm	ns, transformation	s, recursive
	, etc.) note on possibilities of applications of some mathematical methods in informatics and its development.		
NI-IBE	Information Security	ZK	2
	ion and IS/ICT security management systems (ISMS), methods for information access control, and basic norms and internat		this area. They
	management of internal and external security threats, for IS/IT security audits, and for application security testing (e.g., pending the security and security testing te	KZ	4
NI-IVS Intelligent embedded sy	Intelligent embedded systems stems Intelligence to master's degree is focused on high-level technology embedded systems integrating artificial intelligence. The		4 vance version
	ded system fundamentals course for the bachelor degree. The aim of the course is to teach students humanoid robot prograi		
development. Lectures p	provide basis of motion control, sensor reading, application interfaces, robot navigation and development tools. In labs, studer	nts develop advan	ced applications
combining knowledge o	f various courses like nature inspired algorithms, data mining algorithms, image recognition and web technologies		
NI-IKM	Internet and Classification Methods	Z,ZK	4
	ents get acquainted with classification methods used in four important internet, or generally network applications: in spam filte	_	
-	stems and in intrusion detection systems. However, they will learn more than only how classification is performed when solvinese applications, they get an overview of the fundamentals of classification methods. The course is taught in a 2-weeks cycl	_	
· ·	tercises, the students on the one hand implement simple examples to topics from the lectures, on the other hand consult their		ires and 2-nour
NI-IAM	Internet and Multimedia	Z,ZK	4
	cused on principles and modern technologies for network transmissions of audiovisual (AV) signals. The syllabus includes ac	· '	
presentation of AV signa	als (output), network communication protocols, device interfaces, codecs, data formats and stereoscopy. We will look at practic	al use case scena	rios of real-time
	ns. Within the labs, students will practically assemble AV transmission chains using HW and SW technologies and verify the		
	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
for audience.  NI-IOT	Internet of Things	7 71/	4
-	Internet of Things Internet of Things In the area of hardware and software technologies for the strongly growing computer support of various devices. Its goal is fa	Z,ZK	4 available
	(Raspberry Pi, Arduino Due) and with the language for efficient application development and modification (GNU Forth).	arimarization with	availabio
BI-JPO.21	Computer Units	Z,ZK	5
Students deepen their b	pasic knowledge of digital computer units acquired in the obligatory course of the program (BIE-SAP), get acquainted in detail	· · · · · · · · · · · · · · · · · · ·	
-	er units and processors and their interactions with the environment, including accelerating arithmetic-logic units and using app	•	
	ganization of main memory and other internal memories (addressable, LIFO, FIFO and CAM) will be discussed in detail, inclu	-	
•	nd serial data transmissions. They will also get acquainted with the methodology of controller design, with the principles of cor e architecture of the bus system. The problems will be practically evaluated in the labs and with the help of the educational micro		
	dware design kits (FPGA).	oprogrammed prod	Dessor simulator
NI-KTH	Combinatorial Theories of Games	Z,ZK	4
	is a branch of mathematics, which has broad applications in economy, biology, politics and computer science. This theory str	· · · · · · · · · · · · · · · · · · ·	
(players) of a certain co	mpetitive process by designinng a mathematical model and investigating the strategies. The traditional task of classical game	e theory is to find t	he equilibria,
	he game where no player wants to deviate from his strategy. Historically, the second big development in game theory of two-pl	=	
	; Berlekamp and Guy. They developed a theory, originally used for solving end-games in Go, into a full fledged field. The idea	_	
•	games can be added, that is, played simultaneously. This led to the algrebraic approach to study combinatorial games. The tl blished the theory of positional games (like tic-tac-toe and hex). In analysis of these game, one cannot escape the brute-force		
	oduced the "false probabilistic method", which aims to tackhle this problem. In this course we build the foundation of the theory	_	
	coretical analysis of games and building the theory, not on the programming aspects of game solving algorithms. The course	-	
	se, think and proof. The course is also suitable for bachelors student in the third year, who attended introduction to graph the	ory, as well as for	PhD students
looking for research top	ics.		

	Finite model theory	Z,ZK	4
	to introduce students to the basics of finite model theory. The original motivation is the questions expressibility and verifiability		
	ion in the 1970s, the course has evolved rapidly and touched on many other areas of theoretical computer science, such as	descriptive comp	lexity theory, the
	Problem (CSP), the theory of algorithmic meta-theorems and combinatorics.	V7	4
	Creative Coding and Computational Art ral tasks, get acquainted with creative and yet proven methods of visualizing various types of data. The course freely follows	the basic graphics	•
· · · · · · · · · · · · · · · · · · ·	students to suitable visualization methods for traditional as well as for open data. It combines well-known visualization techn		
	e aim is to create an interesting visualization project. It is planned to work closely with IPR CAMP (Center of Architecture a		ŭ
(Institute of Intermedia F	EL).	•	
NI-KYB	Cybernality	ZK	5
Students get acquainted	with the fundamentals of legislation and international activities in the area of fighting cybercrime. Students will understand	the classification of	of attacks and
	ems for computer surveillance and traffic monitoring in the cyberspace. Students will also familiarize themselves with hacker	activities and beha	avior. The course
	peration of the state agencies and subjects dealing with defence of the cyberspace (especially CSIRT and CERT teams).		
l l	Statistical Modelling Lab	KZ	5
	anced multiple target tracking (MTT). This domain covers simultaneous tracking of multiple targets using radar under the pre ie-art filters, in particular the PHD (Probability Hypothesis Density) and PMBM (Poisson Multi-Bernoulli) filters.	esence of clutter, o	or video tracking.
	Linear Optimization and Methods	Z,ZK	5
	eations of optimization methods in computer science, economics, and industry. They are aware of practical importance of line		gramming. They
	imization software and are familiar with languages used in programming of that software. They get skills in formalization of o		•
· ·	lling of tasks to processors, analysis of network flows), distribution and allocation of resources (transportation problems, transportation proble		•
	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.	Managemental Deviations	71/	0
	Managerial Psychology	ZK	2
	Mathematical Structures in Computer Science	Z,ZK	4
Introduction to category	of programming languages. Data types as continous lattices, Scott topology. Procedures as continuous mappings. The Sco	tt model of lambda	a calculus.
<u> </u>	·	7 71/	4
	Mathematics for data science are introduced to those fields of mathematics that are necessary for understanding standard methods and algorithms used i	Z,ZK	
	ebra (matrix factorisations, eigenvalues, diagonalization), continuous optimisation (optimisation with constraints, duality prir		· ·
	obability theory and statistics.	Topic, granton	
BI-MPP.21	Methods of interfacing peripheral devices	Z,ZK	5
	n methods for interfacing of peripheral devices. Interfacing of real peripheral devices is focused on techniques based on Univ	ersal serial bus (U	SB). The course
includes both PC side ar	nd peripheral devices side. Labs are practically oriented. Students gain experience with implementation of relevant parts of l	JSB devices, Linu	x and Windows
drivers, simple application	n development, and APIs of selected devices.		
NI-MOP	Modern Object-Oriented Programming in Pharo	KZ	4
	ming is currently one of the most widespread paradigms of software creation, especially enterprise information systems, wh	-	
	modern applications. In this course, we build on the knowledge acquired in the course BI-OOP and aim to further deepen the s	_	
	lern pure object system Pharo (https://pharo.org). The course focuses on individual approach to students, their developmen eject programming skills, which are generally applicable in other OO languages, students will also gain the opportunity to wo		
	semestral work with the possibility of cooperation with practice and related bachelor, diploma, postgraduate our direct involv	٠.	•
	New media in art and design	ZK	3
	tudents to the issue of using new media in artistic and design work. Key topics are moving image, internet, computer game	1	_
	ith the largest possible range of creative approaches in new media. The subject emphasizes dialogue with students, especia		-
art projects.		-	
NI-OLI	Linux Drivers	Z,ZK	4
The Linux operating syst	em is an important operating system for personal computer and also for embedded systems. Systems on chip and combining	g powerful proces	sors and FPGAs
	f peripheral subsystems requiring specific software drivers. This course is an advanced course in the Linux driver development		udents. The
	lge of Linux operating system architecture, principles of development of various types drivers, including practical experience		
	Personalized Machine Learning	Z,ZK	5
	arning (PML) is a sub-field of machine learning that aims to create models and predictions based on the unique characteris		
	mmonly used in applications such as recommender systems, which recommend items to users based on their personal inte ields, including education, medicine, and chemical engineering. In this course, we will explore the latest PML methods from the		
_	reds, including education, medicine, and chemical engineering. In this codise, we will explore the latest 1 Miz methods from the	eoretical, algorith	nic, and practical
	Computer arithmetic	Z,ZK	4
	us data representations used in digital devices and will be able to design arithmetic operations implementation units.	_,	•
	Computer Grafics 1	ZK	4
l l	phic courses (mainly BI-PGA and BI-PGR) and the knowledge from these courses is deepened by state-of-the-art knowledge	1	signed for those
interested in advanced c	omputer graphics. Students will gain practical knowledge with realistic texturing and raytracing methods. An integral part of t	the course is the s	tudy of scientific
	uent implementation. The course will be followed by a course PG2 supplementing the knowledge of PG1 on other areas an		
	Enterprise Data Warehouse Systems	Z,ZK	5
· ·	rehouses course focuses on the area of business intelligence. Students will be introduced to business intelligence methods		-
not only in designing wai visualization.	rehouses and various architectures, but also their deployment and maintenance. This course also includes an introduction to	o the area of repo	rting and data
	Advanced Virtual Reality	KZ	4
	Advanced virtual Reality dvanced parts of the virtual reality. It is a continuation of the already running graphic objects, especially the creation of 3D m	1	
	avanced parts of the virtual reality. It is a continuation of the already running graphic objects, especially the creation of 3D file ents 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		
	ly create a complex game for VR.	J. J	
-	Advanced machine learning	Z,ZK	5
	udents to selected advanced topics of machine learning and artificial intelligence. The topics present techniques in the field o		systems, image
processing, control and i	nterconnection of physical laws with the field of machine learning. The aim of the exercise is to familiarize students with the	methods discusse	ed.

industries will like mit the likes the ends in mobile development stephnologies for IOS platform. Class covers advanced topics, students need to know at the basics from the beginners class Holds  II-APT  Advanced Program Testing  Advanced All Testing  Ad			
Advanced Program Testing  Advanced Program Testing  Advanced Program Testing  Advanced program testing a program repeats to specification, that charges for not introduce regressions or security issues. The goal of the course is to present which a program repeated program relies positives. Program driving unit toos, expectable, and provide program relies program repeated by the course is handled on the program of the course is handled on the program of the course in the program of the course is handled on the program of the course is the program of the program of the course is the program of the program of the program of the program of the course is the program of the programming in program of the programming in program of the programming in programming the progra	NI-IOS Advanced techniques in iOS applications	KZ	4
IA-PATE   Advanced Program Testing   Page   Advanced Program Testing   Page   Advanced program testing supports in security because it is present in security appoint in the course is closed on ARM prosession and necessarily accounts in the security appoint in a course in closed as series of advanced propose like according to the course in closed as series of advanced propose is a security appoint.  In Page 17   Advanced in the security appoint in the subset of the security appoint in a course in closed as series of advanced propose is security appoint.  In Page 18   Advanced MET   Advanced in the security appoint in the subset in the security appoint in the security appointment in the security appointment i		e basics from the	beginners class
centering a program in excentral bits concurs that a persignan respects its specification, here changes do not introduce regressions or security issues. The goal of the course is the present of the course in the course of the		7.71/	
valenced program basting sobmitiques, beyond writing unit testes, aspecially fuzzing and symbolic averagions.  IFVS   Advanced embedded systems   IFVS   Advanced with the system   IFVS   Advanced with the systems   IFVS   Advanced NET   IFVS   Advanced Python   IFVS   Advanced P		, i	-
II-PVI Advanced embedded systems he course is housed an ABM processors and indicated miles and the course is housed an ABM processors and indicated miles and the course is housed an ABM processors and indicated miles and indicated indicated indicated in the course in includes a sortice of advanced tipics. Me course yet protection of the course is considered with mass strong educine, most course, yeten curred and industrial communication. The students obtain both theoretical and also practical experiences with embedded yeters.  II-DNP   Advanced Cylina   Advanced   NET   Advanced   Adva		Joan of the course	is to present
he course in document on ARM processors and microcompletes and their usage in value range of applications. The course includes a series of advanced opositive selection systems country system control and industrial communication. The students ocean both theoretical and also practical expensions with embedded systems.  LENDR  Advanced: NET  Advanced: NET and will gain knowledge about stochnologies ASPNET, Entire Yearnwork, WPF, NET MAUI and also will get introduce of Apara Works and OIS Subservation all part sectors described in processors and an advanced programment of the processors and organization of the processor and organization of the processor and organization and organization of the processor and organization of the processor and organization organization or the processor organization of the processor organization or the processor organization organization or the processor organization of a translation of a translation organization organization organization of a translation organization organization organization organization of a translation organization org		Z,ZK	4
In Port   Advanced .NET	· · · · · · · · · · · · · · · · · · ·		curity support,
Advanced. NET  Advanced NET  Advanced Python  Advanced Py	working with mass storage devices, motor control, system control and industrial communication. The students obtain both theoretical and also practic	cal experiences w	ith embedded
students will acquire an overview of platform. NET and will gain knowledge about sochoologies ASPNET, Entity Famourick, VIPF. NET MAUL and also will get notices or Aura eveclos and CIT. Sudents will get practical perspersion is insensitive will will be a service of the course in the course is to learn various advanced scientiques and methods in Pytion. The course indirectly continues where Programming in Python (18-PYT) that CIT we course is the programming in Python (18-PYT) that CIT was course in the programming in Python (18-PYT) that CIT was course in the programming in Python (18-PYT) that CIT was course in the programming in Python (18-PYT) that CIT was course in the programming in Python (18-PYT) that CIT was course in the programming in Python (18-PYT) that CIT was course in the python course in the course in designed to provide students with a comprehensive understanding of Deep Learning using the CIT was course, advances will describe products within a course in the course in designed to provide students with a comprehensive understanding of Deep Learning using the CIT was course, advances will describe products within a bridging and to large dependents. The programming in Pytion is the course individed programming in Pytion (18-PYT) and the course individed and course in course, advances will describe products within a bridging and to large dependents. They are introduced to intermediate representations used in current complexs (SML and LIUM They learn to which are coursely inventions of programming in purpose in the programming in Pytion in the course individed on a translation of a tra	systems.		
sections and GRT. Students will get practical expertances in semestral work where they will create a crient-server application utilizing technologies ASPNET, Entity Framework and Blasson, NETMANI or WPRT and also Austral Decope and GRT.  III-PYT Advanced Python  III-PYT Advanced Python  III-PYT Advanced Python  III-PYD Advanced Python or Advanced Py	· · · · · · · · · · · · · · · · · · ·		-
Sizzon, NET MAUL or WPF) and also Azure Devojos and GIT.			
he goal of this course is to learn various advanced techniques and methods in Python. The course is rely nearly and the course is provided and and the course is any hands on and this conjultations, excepting is demonstrated on examples. Classification is based on work in class as well as menestral coursework. The course is leafly exernal course is leafly provided to the course is leafly to the course is designed to provide students with a comprehensive understanding of Deep Learning using PyTorch, a popular open source machine learning framework. Throughout a course, students will develop procate ability in building and reliancy developed the course is designed to provide students with a comprehensive understanding of Deep Learning using PyTorch, a popular open source machine learning framework. Throughout any course is designed to provide students with a complete in the course is designed to provide students with a complete and interest of the course is designed to provide students with a complete course of the course is designed to provide students with a complete course of the course is designed to provide students with a color of the course is a specification of a translation of a term that conforms a given system, to a target code and also to create a complice based on the specification. The correlate course as appellication of a translation of a term that conforms a given system, to a target code and also to create a complicit based on the specification. The correlate course is a specification of a translation of a term that course is a given system, to a target code and also to create a complicit based on the specification. The correlate course is a specification of a translation of a term that course is a specification of a translation of a term that course is a specification of a structure of the course of the	(Blazor, .NET MAUI or WPF) and also Azure DevOps and GIT.	,,	
and than only butorials, everything is demonstrated on examples. Classification is based on work in class as well as semestral coursework. The course is lead by external sealment from Read III.  First Clical Deep Learning  Fir	NI-PYT Advanced Python	KZ	4
seathers from Red Hat.  IE-PDL   Practical Deep Learning   From Item   From It			
III.F.PDL IRCAGE DEEP Learning has course in designed to provide students with a comprehensive understanding of Deep Learning using PyTorch, a popular open-source machine family family in the course, students will develop practical skills in building and training deep neural networks, using PyTorch to solve real-world problems in fields such as computer vision and natural imagings processing.  IR-PLR21 IRCAGE PROGRAMM TO P		ork. The course is	lead by external
his course is designed to provide students with a comprehensive undestanding of Deep Learning using PyTorch a popular open-source machine fearing farmework. Throughout impulage processing.  In course, students will develop practical stalls in building and training deep recurst involveds, using PyTorch to solve real-world problems in fields such as computer vision and natural impulage processing.  In Programming Languages and Compilers  Lower of the stall o		V7	F
is course, students will develop practical skills in building and training deep neutral networks, using PyTorch to solve real-world problems in fields such as computer vision and natural impagase processing.  IR-PJ21 Programming Languages and Compilers  Interest as a sposification of a translation of a test that conforms a given systra, to a target code and also to create a compiler based on the specification. The compiler can translate not have programming in gauges. They are in the interest day a given bythat, to a target code and also to create a compiler based on the specification. The compiler can translate not have programming languages but any test in a longuage greates which exploits object-functional partners.  II-PSL Programming in Scala he course intertooks the motion programming in Scala conditions the motion programming and scalars. As a second of the course intertooks the motion programming in Scala conditions to use of applications functional partners e.g. H-List, Monado, etc. Scala is used by many powerful famomorks and libraries e.g., Play, Cassandra, calciant, etc.  II-PSL Programming in Mathematica and calcimitic solvenes. Students will learn how to use different programming styles (functional programming, rule-based programming, libraries) and the course intertooks of programming in Mathematica.  II-PSL II-PSL Programming in Mathematica and calcimitic solvenes. Students will learn how to use different programming styles (functional programming, rule-based programming, libraries) and programming will be course in programming in Mathematical approach to pattern secognition with emphasis on problems and applications of the statistical approach to pattern scognition. Students will learn the fundamental concepts and methods of pattern recognition, including probability models, parameter enterination, and their numerical aspects.  II-PSL Programming in Students will learn the fundamental concepts and methods of pattern recognition, including probability models, parameter enterination, and their nu	3		-
No.   19-21   Programming Languages and Compilers   Subtents with laws compilers of the compiler of the subtents than hause compiling methods of programming languages. They are introduced to intermediate representations used in current compilers ONU and LLUMA. They learn to reade a specification of a translation of a text that conforms a given syntax, to a target code and also to create a compiler based on the specification. The compiler can translate not hype a programming language but and the programming in Scala has been described by a given LL input grammar.  II-PSL   Programming in Scala has been described by a given LL input grammar.  II-PSL   Programming in Scala has been described by a given LL input grammar.  II-PSL   Programming in Mathematica   Z/ZK   4 has contained in the programming in Mathematica   Z/ZK   4 has been described by many powerful frameworks and tilbraries e.g. Play, Cassandra, catalac, etc.  II-PSL   Programming in Mathematica   Z/ZK   4 has described by many powerful frameworks and tilbraries e.g. Play, Cassandra, catalac, etc.  II-PSL   Programming in Mathematica   Z/ZK   4 has described by many powerful frameworks and tilbraries e.g. Play, Cassandra, catalac, etc.  II-PSL   Programming in Mathematica   Z/ZK   4 has described by many powerful frameworks and tilbraries e.g. Play, Cassandra, catalac, etc.  II-PSL   Programming in Ruby		-	-
inducents learn basic complising methods of programming languages. They are introduced to intermediate representations used in current completes GNU and LLVM. They learn to reseate a specification of a translation of a stranslation of which expolits object-functional paradigm. Scala comprises advance language features: e.g. pattern matching and divance standard bibary. Scala enables to use of applications functional patterns e.g. H-List, Monadis, etc. Scala is used by many powerful frameworks and librarines e.g. Piss, Classandra, celase, etc.  I-PMA Programming in Mathematica  I-PMB Programming in Mathematica  I-RVB Programming in Ruby  I-RVB Pattern Recognition  I-RVB Pattern Recognition of the statistical appreach to pattern recognition with emphasis on problems and applications of the statistical appreach to pattern accognition, including probability models and applications of the statistical appreach to pattern accognition including probability models, parameter estimation, and their numerical appaces.  II-RVB CI  Computer Engineering Seminar Master I  A sharing and Concepture Engineering is a spisicative correct or structures who want to deal with deeper topics of digital design, reliability and resistance to fallures and attacks. Students are approached individually within the subj	language processing.	•	
reate a specification of a translation of a text that conforms a given syntax, to a target code and also to create a compiler based on the specification. The compiler can translate not high sprogramming language but any text in a language generated by a given LL input grammar.  I.F.SL. Programming in Scala he course introduces the modern programming language Scala which exploits object-functional paradigm. Scala comprises advance language features - q. patient matching and disease standard library. Scale 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, Cassandru, cellacs, etc., and the standard library. Scale 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, Cassandru, cellacs, etc., because the working with modern technical and scientific software. Students will learn how to use different programming styles (functional programming, rule-based programming), to, how to create advance interactive applications and vessulisations, data processing and presentations.  II-ROZ Pattern Recognition  II-ROZ Pattern Recognition  II-ROZ Pattern Recognition  II-ROZ Pattern Recognition of the major topics in pattern recognition, including probability models, parameter estimation, and their numerical aspects.  II-ROZ II-ROZ Pattern Recognition of the major topics in pattern recognition, including probability models, parameter estimation, and their numerical aspects.  II-ROZ II-ROZ Pattern Recognition of the major topics in pattern recognition with emphasis on problems and applications of the statistical appropriate probability models in the pattern recognition in the standard supervisor. But to fail in the standard supervisor is a Cale and attacks. Students to applicate in the fundamental concepts and methods of pattern recognition, including probability models, parameter estimation, and their numerical aspects.  II-ROZ II-ROZ Pattern Re	BI-PJP.21 Programming Languages and Compilers	Z,ZK	5
In ya programming language but any text in a language generated by a given LL input grammar.  II-PSL Programming in Scala he course introduces the modern programming language Scala which exploits object-functional paradigm. Scala comprises advance language features - e.g. pattern matching and drance 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, calax, etc.  IN-PMA Programming in Mathematica usubents will be working with modern technical and scientific software. Students will learn how to use different programming styles (functional programming, rule-based programming, t.e.), how to create dynamic interactive applications and visualisations, data processing and presentations.  IN-ROB Programming in Ruby  KZ 4  IN-ROB Pattern Recognition  IN-ROB Pattern Rec			
II-PSL   Programming in Scala   Procramming in space Scala which exploits object-functional paradigm. Scala comprises advance language features = 6.2 pattern matching and drance 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, Islatz. etc.    II-PMA   Programming in Mathematica   Programmi		i. The compiler car	n translate not
he course introduces the modern programming language Scala which exploits object-functional paradigm. Scala comprises advance language features - e.g. pattern inatching and vidence standard libraries e.g. Play. Cessandra. calaz. etc.  3.1-PMA Programming in Mathematica unusers of the programming in Mathematica unusers with the working with modern technical and scientific software. Students will learn how to use different programming styles (functional programming, rule-based programming, t.c.), how to erate dynamic interactive applications and visualisations, data processing and presentations.  1.4-ROZ Pattern Recognition  1.4-ROZ Pattern Recognition  1.4-ROZ Pattern Recognition  1.5-ROZ Computer Engineering seminar Master I  1.5-ROZ Computer Engineering is a (s)elective course for students who want to deal with deeper topics of digital design, reliability and resistance to failures and attacks. Students are approached individually within the subject. Each student or group of students solves some interesting topic with the selected supervisor. Part of the subject is work with scientific riticles and other professional literature and/or work in K. N laboratories. The capacity of the subject is limited by the possibilities of the seminar teachers. The topics are new for each emeaster.  1.5-ROZ Computer Engineering is a (s)elective course for students who want to deal with deeper topics of digital design, reliability and resistance to failures an admitished subject is work with scientific riticles and		7.71/	
twance standard library. Scale enables to use of applications functional patterns e.g. H-List, Monads, etc. Stale is used by many powerful frameworks and libraries e.g. Play, Cassandra, catalax, etc.  3. PNA  Programming in Mathematica  Includents will be working with modern technical and scientific software. Students will learn how to use different programming styles (functional programming, rule-based programming, to,) how to create dynamic interactive applications and visualisations, data processing and presentations.  In PND  Programming in Ruby  Includents will be morking with modern technical and scientific software. Students will learn how to use different programming styles (functional programming, rule-based programming, to,) how to create dynamic interactive applications and visualisations, data processing and presentations.  In PND  Programming in Ruby  In RO  Pattern Recognition  In Eduly  In ROO  Pattern Recognition  In Computer Engineering is a special pattern recognition with emphasis on problems and applications of the statistical approach to pattern secognition. Students will learn the fundamental concepts and methods of pattern recognition, including probability models, parameter estimation, and their numerical aspects.  In SCEI  Computer Engineering Seminar Master I  A Seminar of Computer Engineering is a splieticities course for students who want to deal with deeper topics of digital design, reliability and resistance to failures and stracks. Students are approached individually within the subject is a Number of computer Engineering is a splieticities ourse for students solves some interesting topic with the selected supervisor. Part of the subject is work with scientific ritides and other professional literature and/or work in K N laboratories. The capacity of the subject is limited by the possibilities of the seminar teachers. The topics are new for each emeaster.  In SCEI  Computer Engineering Seminar Master II  Ne Seminar of Computer Engineering Seminar Master II  Ne Seminary you will pr			
scalaz, etc.    Programming in Mathematica   Z,ZK   4			-
trudents will be working with modern technical and scientific software. Students will learn how to use different programming styles (functional programming, rule-based programming), to, how to create dynamic interactive applications and visualisations, data processing and presentations.  II-RUB   Programming in Ruby   KZ   4    III-RUB   Programming in Ruby   KZ   4    III-RUB   Programming in Ruby   KZ   4    III-RUB   Pattern Recognition  III-RUB   Pattern Re	Scalaz, etc.		,,
trudents will be working with modern technical and scientific software. Students will learn how to use different programming styles (functional programming, rule-based programming), to, how to create dynamic interactive applications and visualisations, data processing and presentations.  II-RUB   Programming in Ruby   KZ   4    III-RUB   Programming in Ruby   KZ   4    III-RUB   Programming in Ruby   KZ   4    III-RUB   Pattern Recognition  III-RUB   Pattern Re	BI-PMA Programming in Mathematica	Z,ZK	4
II-RUB   Programming in Ruby   KZ   4   Into curse is presented in Cracch.    Pattern Recognition   Pattern Pattern Recognition   Pattern Pattern Recognition   Pattern Pattern Recognition   Pattern Patter		mming, rule-base	d programming,
Niscourse is presented in Czech.  ViPattern Recognition he 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 statistical approach to pattern seognition. Students will learn the fundamental concepts and methods of pattern recognition, including probability models, parameter estimation, and their numerical aspects.  I-SCE1 Computer Engineering Seminar Master I Re seminar of Computer Engineering Seminar Master I Re seminar of Computer Engineering is a (s)elective course for students who want to deal with deeper topics of digital design, reliability and resistance to failures and attacks. Students re approached individually within the subject. Each student or group of students solves some interesting topic with the selected supervisor. Part of the subject is work with scientific ricles and other professional literature and/or work in K. N laboratories. The capacity of the subject is limited by the possibilities of the seminar teachers. The topics are new for each emeaster.  I-SCE2 Computer Engineering Seminar Master II Re seminar of Computer Engineering is a (s)elective course for students who want to deal with deeper topics of digital design, reliability and resistance to failures and attacks. Students re approached individually within the subject. Each student or group of students solves some interesting topic with the selected supervisor. Part of the subject is work with scientific ricles and other professional literature and/or work in K. N laboratories. The capacity of the subject is limited by the possibilities of the seminar teachers. The topics are new for each emeaster.  I-SCI2 IN In Nowledge Engineering Seminar Master II In 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 research labs around the world. Additionally, you will learn how to procepty present and read scientific papers. The work in the seminar will prepare yo			
II-ROZ Pattern Recognition he 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 statistical approach to pattern seognition. Students will learn the fundamental concepts and methods of pattern recognition, including probability models, parameter estimation, and their numerical aspects.  II-SCE1 Computer Engineering Seminar Master I A seminar of Computer Engineering is a (s)elective course for students who want to deal with deeper topics of digital design, reliability and resistance to failures and attacks. Students re approached individually within the subject. Each student or group of students solves some interesting topic with the selected supervisor. Part of the subject is work with scientific ricides and other professional literature and/or work in K. N laboratories. The capacity of the subject is limited by the possibilities of the seminar teachers. The topics are new for each emester.  II-SCE2 Computer Engineering Seminar Master II  Be Seminar of Computer Engineering is a (s)elective course for students who want to deal with deeper topics of digital design, reliability and resistance to failures and attacks. Students re approached individually within the subject. Each student or group of students solves some interesting topic with the selected supervisor. Part of the subject is work with scientific ritides and other professional literature and/or work in K. N laboratories. The capacity of the subject is limited by the possibilities of the seminar teachers. The topics are new for each emester.  II-SCI Knowledge Engineering Seminar Master II  II with its 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 research labs around the world. Additionally, you will learn how to property present and read scientific papers. The work in the seminar will prepare you to attend (and profit from) top machine learning and AI conferences not summe	1 0 0	KZ	4
he 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 statistical approach to pattern accognition. Students will learn the fundamental concepts and methods of pattern recognition, including probability models, parameter estimation, and their numerical aspects.  INSCE1   Computer Engineering Seminar Master   A seminar of Computer Engineering is a (selective course for students who want to deal with deeper topics of digital design, reliability and resistance to failures and attacks. Students approached individually within the subject. Each student or group of students solves some interesting topic with the selected supervisor. Part of the subject is work with scientific rticles and other professional literature and/or work in K. N laboratories. The capacity of the subject is limited by the possibilities of the seminar teachers. The topics are new for each emester.  INSCE2   Computer Engineering Seminar Master   I		7 7V	
August   Computer Engineering Seminar Master I   Z   A		, i	-
he Seminar of Computer Engineering is a (s)elective course for students who want to deal with deeper topics of digital design, reliability and resistance to failures and attacks. Students re approached individually within the subject. Each student or group of students solves some interesting topic with the selected supervisor. Part of the subject is work with scientific relices and other professional literature and/or work in K. N laboratories. The capacity of the subject is limited by the possibilities of the seminar teachers. The topics are new for each emester.  II-SCE   Computer Engineering Seminar Master II   Z   4   he Seminar of Computer Engineering is a (s)elective course for students who want to deal with deeper topics of digital design, reliability and resistance to failures and attacks. Students re approached individually within the subject. Each student or group of students solves some interesting topic with the selected supervisor. Part of the subject is work with scientific release and other professional literature and/or work in K. N laboratories. The capacity of the subject is limited by the possibilities of the seminar teachers. The topics are new for each emester.  II-SZ1   Knowledge Engineering Seminar Master I   Z   4   hi 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 research labs around the world. diditionally, you will learn how to property present and read scientific papers. The work in the seminar will prepare you to attend (and profit from) top machine learning and Al conferences not summer schools, as well as FIT's own Summer Research Program (VyLet).  II-SZ2   Knowledge Engineering Seminar Master II   Z   4   hi 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 research labs around the world. diditionally, you will learn how to property present and read scientific papers. The work in the seminar w			•
re approached individually within the subject. Each student or group of students solves some interesting topic with the selected supervisor. Part of the subject is work with scientific riticles and other professional literature and/or work in K. N laboratories. The capacity of the subject is limited by the possibilities of the seminar teachers. The topics are new for each emisster.  II-SCE2   Computer Engineering Seminar Master II   Z   4   he Seminar of Computer Engineering is a (s)elective course for students who want to deal with deeper topics of digital design, reliability and resistance to failures and attacks. Students re approached individually within the subject is work with scientific riticles and other professional literature and/or work in K. N laboratories. The capacity of the subject is limited by the possibilities of the seminar teachers. The topics are new for each emisster.  II-SZ1   Knowledge Engineering Seminar Master I   Z   4   In 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 research labs around the world. In 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 research labs around the world.  II-SZ2   Knowledge Engineering Seminar Master II   Z   4   II-SZ3   Knowledge Engineering Seminar Master II   Z   4   II-SZ4   Knowledge Engineering Seminar Master II   Z   4   II-SZ5   Knowledge	NI-SCE1 Computer Engineering Seminar Master I	Z	4
tricles and other professional literature and/or work in K N laboratories. The capacity of the subject is limited by the possibilities of the seminar teachers. The topics are new for each emester.    ISCE2   Computer Engineering Seminar Master II			
HI-SCE2 Computer Engineering Seminar Master II A Seminar of Computer Engineering is a (s)elective course for students who want to deal with deeper topics of digital design, reliability and resistance to failures and attacks. Students re approached individually within the subject. Each student or group of students solves some interesting topic with the selected supervisor. Part of the subject is work with scientific rticles and other professional literature and/or work in K. N laboratories. The capacity of the subject is limited by the possibilities of the seminar teachers. The topics are new for each emester.  II-SZ1 Knowledge Engineering Seminar Master I In 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 research 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 machine learning and Al conferences and summer schools, as well as FIT's own Summer Research Program (VyLet).  II-SZ2 Knowledge Engineering Seminar Master II In 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 research 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 machine learning and Al conferences and summer schools, as well as FIT's own Summer Research Program (VyLet).  IV-SZN Seminars on Digital Design  IV-SZN Seminars on Digital Design Seminar Masser II  IV-SZN Seminars on Digital Design Seminar Masser II  IV-SZN Seminars on Digital D			
H-SCE2   Computer Engineering Seminar Master II   Z   4   he Seminar of Computer Engineering is a (s)elective course for students who want to deal with deeper topics of digital design, reliability and resistance to failures and attacks. Students re approached individually within the subject. Each student or group of students solves some interesting topic with the selected supervisor. Part of the subject is work with scientific ricides and other professional literature and/or work in K N laboratories. The capacity of the subject is limited by the possibilities of the seminar teachers. The topics are new for each emester.  In 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 research labs around the world. dditionally, 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 machine learning and Al conferences and summer schools, as well as FIT's own Summer Research Program (VyLet).  IN SZZ   Knowledge Engineering Seminar Master II   Z   4   In 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 research labs around the world. dditionally, 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 machine learning and Al conferences not summer schools, as well as FIT's own Summer Research Program (VyLet).  IN SCN   Seminars on Digital Design   Zk   4   In 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 research labs around the world. dditionally, 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 machine learning and Al conferences not summer schools, as well as FIT's own Summer Research Pro		mers. The topics a	ire new for each
he Seminar of Computer Engineering is a (s)elective course for students who want to deal with deeper topics of digital design, reliability and resistance to failures and attacks. Students re approached individually within the subject. Each student or group of students solves some interesting topic with the selected supervisor. Part of the subject is work with scientific relocation and other professional literature and/or work in K. N. laboratories. The capacity of the subject is limited by the possibilities of the seminar teachers. The topics are new for each emester.  II-SZ1 Knowledge Engineering Seminar Master I  II 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 research 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 machine learning and Al conferences and summer schools, as well as FIT's own Summer Research Program (VyLet).  II-SZ2 Knowledge Engineering Seminar Master II  In 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 research labs around the world. additionally, you will learn bow to properly present and read scientific papers. The work in the seminar will prepare you to attend (and profit from) top machine learning and Al conferences and summer schools, as well as FIT's own Summer Research Program (VyLet).  II-SZC Seminars on Digital Design  In this subject deals with problems of realization and implementation of digital circuits - both combinational and sequential. Basic means of description of digital circuits and basic logic ynthesis and optimization algorithms are described. Basics of EDA (Electronic Design Automation) systems are given, together with combinatorial problems emerging in EDA.  III-SZC Machine Oriented Languages  III-SZC Machine Oriented Languages  IIII MILI Machine Learning		7	4
Intices and other professional literature and/or work in K N laboratories. The capacity of the subject is limited by the possibilities of the seminar teachers. The topics are new for each emester.    Value   Value	1 . 9 9		
### Windows and 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 research 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 machine learning and AI conferences and summer schools, as well as FIT's own Summer Research Program (VyLet).  #### Windows and Summer Schools, as well as FIT's own Summer Research Program (VyLet).  ###################################	are approached individually within the subject. Each student or group of students solves some interesting topic with the selected supervisor. Part of t	he subject is work	with scientific
New Nowledge Engineering Seminar Master I  In 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 research labs around the world. It is 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 research labs around the world. It is seminar 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 machine learning and Al conferences and summer schools, as well as FIT's own Summer Research Program (VyLet).  IN-SZ2   Knowledge Engineering Seminar Master II   Z   4   In 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 research labs around the world. It is 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 research labs around the world. It is 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 research labs around the world. It is a 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 research labs around the world. It is a 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 research labs around Al conferences not summer Research Program (VyLet).  In SCI   X		hers. The topics a	re new for each
In 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 research labs around the world.  Indicionally, 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 machine learning and Al conferences and summer schools, as well as FIT's own Summer Research Program (VyLet).  IN-SZ2   Knowledge Engineering Seminar Master II   Z   4   A 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 research labs around the world.  Indicionally, 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 machine learning and Al conferences and summer schools, as well as FIT's own Summer Research Program (VyLet).  IN-SCN   Seminars on Digital Design   ZK   4   In this subject deals with problems of realization and implementation of digital circuits - both combinational and sequential. Basic means of description of digital circuits and basic logic ynthesis and optimization algorithms are described. Basics of EDA (Electronic Design Automation) systems are given, together with combinatorial problems emerging in EDA.  IN-SOJ   Machine Oriented Languages   Z,ZK   4   It 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 in defficient 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. The popylying machine learning methods to real projects in practice involves many other necessary tasks - from understanding the intentions of the client to, ideally, technical implementation. The course guides students through all phases of a project according to the	semester.		
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 machine learning and AI conferences and summer schools, as well as FIT's own Summer Research Program (VyLet).    SZ2		1	
NI-SZ2 Knowledge Engineering Seminar Master II  In 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 research labs around the world.  Additionally, you will learn bow to properly present and read scientific papers. The work in the seminar will prepare you to attend (and profit from) top machine learning and AI conferences and summer schools, as well as FIT's own Summer Research Program (VyLet).  PI-SCN Seminars on Digital Design  It is subject deals with problems of realization and implementation of digital circuits - both combinational and sequential. Basic means of description of digital circuits and basic logic ynthesis and optimization algorithms are described. Basics of EDA (Electronic Design Automation) systems are given, together with combinatorial problems emerging in EDA.  BI-SOJ Machine Oriented Languages  It is defficient 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.  WHMLP Machine Learning in Practice  Applying machine learning methods to real projects in practice involves many other necessary tasks - from understanding the intentions of the client to, ideally, technical implementation. The course guides students through all phases of a project according to the standard CRISP-DM methodology, not only theoretically but also practically. The aim is to experience real atap processing and learn how to describe the whole process from exploration to evaluation of the model performance in the form of a clear and understandable report.  BI-SVZ.21 Machine vision and image processing are seconing a common part of life by being universally available. Related to this phenomenon is the need to process and evaluate image information. The course introduces students to different types of camera			
In 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 research labs around the world. It is seminar 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 machine learning and AI conferences and summer schools, as well as FIT's own Summer Research Program (VyLet).    Seminars on Digital Design	and summer schools, as well as FIT's own Summer Research Program (VyLet).	Ū	
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 machine learning and Al conferences and summer schools, as well as FIT's own Summer Research Program (VyLet).  PI-SCN Seminars on Digital Design  his subject deals with problems of realization and implementation of digital circuits - both combinational and sequential. Basic means of description of digital circuits and basic logic ynthesis and optimization algorithms are described. Basics of EDA (Electronic Design Automation) systems are given, together with combinatorial problems emerging in EDA.  BI-SOJ Machine Oriented Languages  Ludents 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 not 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.  IN-MLP Machine Learning in Practice  Applying machine learning methods to real projects in practice involves many other necessary tasks - from understanding the intentions of the client to, ideally, technical implementation, the course guides students through all phases of a project according to the standard CRISP-DM methodology, not only theoretically but also practically. The aim is to experience real ata processing and learn how to describe the whole process from exploration to evaluation of the model performance in the form of a clear and understandable report.  BI-SVZ.21 Machine vision and image processing  Lay Machine vision and image processing  Lay Machine vision and image processing  Lay Machine vision and a variety of methods for image and video processing. The course is focused on practical use of camera systems for solving	NI-SZ2 Knowledge Engineering Seminar Master II	Z	4
PI-SCN Seminars on Digital Design  A bits subject deals with problems of realization and implementation of digital circuits - both combinational and sequential. Basic means of description of digital circuits and basic logic ynthesis and optimization algorithms are described. Basics of EDA (Electronic Design Automation) systems are given, together with combinatorial problems emerging in EDA.  BI-SOJ Machine Oriented Languages  Target Agreement			
PI-SCN   Seminars on Digital Design   ZK   4   This subject deals with problems of realization and implementation of digital circuits - both combinational and sequential. Basic means of description of digital circuits and basic logic synthesis and optimization algorithms are described. Basics of EDA (Electronic Design Automation) systems are given, together with combinatorial problems emerging in EDA.  BI-SOJ   Machine Oriented Languages   Z,ZK   4   Intudents 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.  INI-MLP   Machine Learning in Practice   Z,ZK   5   Interpretation of software with hardware in the projects in practice involves many other necessary tasks - from understanding the intentions of the client to, ideally, technical implementation. The course guides students through all phases of a project according to the standard CRISP-DM methodology, not only theoretically but also practically. The aim is to experience real ata processing and learn how to describe the whole process from exploration to evaluation of the model performance in the form of a clear and understandable report.  BI-SVZ.21   Machine vision and image processing   Z,ZK   5   Interpretation of the standard course is focused on practical use of camera systems for solving the produces students to different types of camera systems and a variety of methods for image and video processing. The course is focused on practical use of camera systems for solving the processing and video processing. The course is focused on practical use of camera systems for solving the processing and video processing. The course is focused on practical		chine learning and	I AI conferences
This subject deals with problems of realization and implementation of digital circuits - both combinational and sequential. Basic means of description of digital circuits and basic logic synthesis and optimization algorithms are described. Basics of EDA (Electronic Design Automation) systems are given, together with combinatorial problems emerging in EDA.  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.  BI-MLP Machine Learning in Practice Z,ZK 5  Applying machine learning methods to real projects in practice involves many other necessary tasks - from understanding the intentions of the client to, ideally, technical implementation. The course guides students through all phases of a project according to the standard CRISP-DM methodology, not only theoretically but also practically. The aim is to experience real ata processing and learn how to describe the whole process from exploration to evaluation of the model performance in the form of a clear and understandable report.  BI-SVZ.21 Machine vision and image processing  CAR 5  CAR 6  CAR 6  CAR 6  CAR 6  CAR 7  CAR 8  CAR 7  CAR		71/	
synthesis and optimization algorithms are described. Basics of EDA (Electronic Design Automation) systems are given, together with combinatorial problems emerging in EDA.  BI-SOJ Machine Oriented Languages  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.  WI-MLP Machine Learning in Practice  JZK 5  Applying machine learning methods to real projects in practice involves many other necessary tasks - from understanding the intentions of the client to, ideally, technical implementation. The course guides students through all phases of a project according to the standard CRISP-DM methodology, not only theoretically but also practically. The aim is to experience real atta processing and learn how to describe the whole process from exploration to evaluation of the model performance in the form of a clear and understandable report.  BI-SVZ.21 Machine vision and image processing  Camera systems are becoming a common part of life by being universally available. Related to this phenomenon is the need to process and evaluate image information. The course introduces students to different types of camera systems and a variety of methods for image and video processing. The course is focused on practical use of camera systems for solving		l l	
Machine Oriented Languages  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.  When I was a supplying machine learning methods to real projects in practice involves many other necessary tasks - from understanding the intentions of the client to, ideally, technical implementation. The course guides students through all phases of a project according to the standard CRISP-DM methodology, not only theoretically but also practically. The aim is to experience real atta processing and learn how to describe the whole process from exploration to evaluation of the model performance in the form of a clear and understandable report.  BI-SVZ.21   Machine vision and image processing camera systems are becoming a common part of life by being universally available. Related to this phenomenon is the need to process and evaluate image information. The course introduces students to different types of camera systems and a variety of methods for image and video processing. The course is focused on practical use of camera systems for solving		_	- 1
Interest to 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.  NI-MLP    Machine Learning in Practice   Z,ZK   5			
This knowledge will be used during reverse engineering, optimization, and evaluation of code security.  NI-MLP   Machine Learning in Practice   Z,ZK   5    Applying machine learning methods to real projects in practice involves many other necessary tasks - from understanding the intentions of the client to, ideally, technical implementation. The course guides students through all phases of a project according to the standard CRISP-DM methodology, not only theoretically but also practically. The aim is to experience real atta processing and learn how to describe the whole process from exploration to evaluation of the model performance in the form of a clear and understandable report.  NI-SVZ.21   Machine vision and image processing   Z,ZK   5    Tamera systems are becoming a common part of life by being universally available. Related to this phenomenon is the need to process and evaluate image information. The course introduces students to different types of camera systems and a variety of methods for image and video processing. The course is focused on practical use of camera systems for solving		, i	essor's features
NI-MLP Machine Learning in Practice  pplying machine learning methods to real projects in practice involves many other necessary tasks - from understanding the intentions of the client to, ideally, technical implementation. The course guides students through all phases of a project according to the standard CRISP-DM methodology, not only theoretically but also practically. The aim is to experience real atta processing and learn how to describe the whole process from exploration to evaluation of the model performance in the form of a clear and understandable report.  BI-SVZ.21 Machine vision and image processing  ameria systems are becoming a common part of life by being universally available. Related to this phenomenon is the need to process and evaluate image information. The course introduces students to different types of camera systems and a variety of methods for image and video processing. The course is focused on practical use of camera systems for solving		w linked to higher l	evel languages.
pplying machine learning methods to real projects in practice involves many other necessary tasks - from understanding the intentions of the client to, ideally, technical implementation. The course guides students through all phases of a project according to the standard CRISP-DM methodology, not only theoretically but also practically. The aim is to experience real atta processing and learn how to describe the whole process from exploration to evaluation of the model performance in the form of a clear and understandable report.  BI-SVZ.21   Machine vision and image processing   Z,ZK   5    Camera systems are becoming a common part of life by being universally available. Related to this phenomenon is the need to process and evaluate image information. The course introduces students to different types of camera systems and a variety of methods for image and video processing. The course is focused on practical use of camera systems for solving	This knowledge will be used during reverse engineering, optimization, and evaluation of code security.	<del></del>	
the course guides students through all phases of a project according to the standard CRISP-DM methodology, not only theoretically but also practically. The aim is to experience real ata processing and learn how to describe the whole process from exploration to evaluation of the model performance in the form of a clear and understandable report.  BI-SVZ.21   Machine vision and image processing   Z,ZK   5    Camera systems are becoming a common part of life by being universally available. Related to this phenomenon is the need to process and evaluate image information. The course introduces students to different types of camera systems and a variety of methods for image and video processing. The course is focused on practical use of camera systems for solving			-
ata processing and learn how to describe the whole process from exploration to evaluation of the model performance in the form of a clear and understandable report.  BI-SVZ.21   Machine vision and image processing   Z,ZK   5  camera systems are becoming a common part of life by being universally available. Related to this phenomenon is the need to process and evaluate image information. The course introduces students to different types of camera systems and a variety of methods for image and video processing. The course is focused on practical use of camera systems for solving		•	•
BI-SVZ.21 Machine vision and image processing  Z,ZK 5  camera systems are becoming a common part of life by being universally available. Related to this phenomenon is the need to process and evaluate image information. The course introduces students to different types of camera systems and a variety of methods for image and video processing. The course is focused on practical use of camera systems for solving		=	
camera systems are becoming a common part of life by being universally available. Related to this phenomenon is the need to process and evaluate image information. The course introduces students to different types of camera systems and a variety of methods for image and video processing. The course is focused on practical use of camera systems for solving			
	1	, ,	-
roblems of practice that the graduates may encounter.		use of camera sys	tems for solving
	problems or practice that the graduates may encounter.		

NI-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	f technical univer	sity to the
	t does that predominantly by comparing individual countries and key regions of world economy. Students get to know about d	-	
·	iness in diverse societies as well as indexes of economic freedom, corruption and economic development, which are needed	-	
	e on the knowledge in the form of discussions based on individual readings. It is advised to take bachelor level of this course		
BI-SRC.21	Real-time systems	Z,ZK	5
	ic knowledge in the real-time (RT) system theory and in the design methods for RT systems including the dependability issue		-
lectures will be experim	entally verified in computer labs. The course is mainly focused on embedded RT systems, therefore the design kits in the lab	are the same as i	n the BIE-VES
course.			
NI-TVR	Virtual Reality Technology	Z,ZK	3
	ced to the basic concepts of virtual reality. Techniques for displaying virtual worlds (CAVE, HMD,) and the possibilities of co	=	
-	eye tracking) will be discussed. Furthermore, the concepts of mixed and augmented reality will be introduced. Finally, ways o	t using virtual and	augmented
reality will be presented			
NI-TS1	Theoretical Seminar Master I	Z	4
	ntended for students which want to come in deeper contact with contemporary theoretical computer science. It is mostly a class		-
= = = = = = = = = = = = = = = = = = = =	and concern themselves with interesting topics from the latest research in the area. Therefore, an integral part of the course is	a work with scier	ntific papers and
	the capacity is limited by the the potentials of the teachers of the seminar.	7 1	4
NI-TS2	Theoretical Seminar Master II	_ Z	4
	ntended for students which want to come in deeper contact with contemporary theoretical computer science. It is mostly a class		*
· · · · · · · · · · · · · · · · · · ·	and concern themselves with interesting topics from the latest research in the area. Therefore, an integral part of the course is	a work with scier	ntific papers and
	the capacity is limited by the the potentials of the teachers of the seminar.	7	
NI-TS3	Theoretical Seminar Master III	_ Z	4
	ntended for students which want to come in deeper contact with contemporary theoretical computer science. It is mostly a class		*
· · · · · · · · · · · · · · · · · · ·	and concern themselves with interesting topics from the latest research in the area. Therefore, an integral part of the course is	a work with scier	ntific papers and
	the capacity is limited by the the potentials of the teachers of the seminar.		
NI-TS4	Theoretical Seminar Master IV	_ Z	_ 4
	ntended for students which want to come in deeper contact with contemporary theoretical computer science. It is mostly a class		
· · · · · · · · · · · · · · · · · · ·	and concern themselves with interesting topics from the latest research in the area. Therefore, an integral part of the course is	a work with scier	ntific papers and
	the capacity is limited by the the potentials of the teachers of the seminar.		
NI-TKA	Category Theory	Z,ZK	4
NI-TNN	Theory of Neural Networks	Z,ZK	5
-	neural networks from the point of view of the theory of function approximation and from the point of view of probability theory		-
-	ural Networks, such as neurons and connections between them, types of neurons from the point of view of signal transmission		
· · · · · ·	vork training, and the role of time in neural networks. In connection with network topology, we get acquainted with its transform		
	comatic and synaptic mappings, with their composition into mappings computed by the Network, Finally in connection with tra		
	and to the fact that training is actually a specific optimization task, recalling the most typical objective functions and the most		
	work training. We will see the meaninig of all these concepts in the context of common kinds of forward neural networks. Within		
	irst notice the connection of neural networks to expressing functions of many variables using functions of fewer variables (Ko	•	
•	e will see how the universal approximation capacity of neural networks can be mathematically formalized as the sets of mapping the passes of functions in particular in the appearance of supplies in the sets of mapping the passes of functions in particular in the appearance of supplies in the sets of mapping the set of		
=	at Banach spaces of functions, in particular in the spaces of continuous functions, spaces of functions integrable with respect		
	is derivatives, and Sobolev spaces. Within the topic probabilistic approach, we first get acquainted with training based on exp h probabilistic assumptions about training data with which those two kinds of neural networks can be employed. We will see ho		-
·	tancy of network outputs conditioned by its inputs using the expectancy based learning. We recall the strong and the weak la	•	-
· · · · · · · · · · · · · · · · · · ·	ogy of the strong law of large numbers for neural networks and with the assumptions for its validity. Finally, we recall the cent	_	-
•	al networks, with the assumptions for its validity and with the hypothesis tests based on it. We will see how those tests can be		٠ .
topology of the network		,	
NI-CPX	Complexity Theory	Z,ZK	5
	it the fundamental classes of problems in the complexity theory and different models of algoritms and about implications of th		
(in)tractability of difficult	· · · · · · · · · · · · · · · · · · ·	,	9
BI-CCN	Compiler Construction	Z,ZK	5
	lass on compiler construction for bachelor students in computer science. The goal of the class is to introduce basic principles		
•	and implementation of programming languages. Seeing and actually understanding self-compilation is the overarching theme		studo.no to
NI-DVG	Introduction to Discrete and Computational Geometry	Z,ZK	5
	troduce the students to the discipline of Discrete and Computational Geometry. The main goal of the course is to get familiar v	, i	-
<u> </u>	troduce the students to the discipline of Discrete and Computational Geometry. The main goal of the course is to get familiar v	, i	-
DI 1/LIC 24	be able to solve simple algorithmic problems with a geometric component.	vith the most fund	amental notions
BI-VHS.21	be able to solve simple algorithmic problems with a geometric component.  Virtual game worlds	vith the most fund	amental notions
In the course students le	be able to solve simple algorithmic problems with a geometric component.  Virtual game worlds earn methods to create a complex virtual world. It is a follow-up course of basic courses of the PG specialization (BIE-MGA, BIE	Z,ZK E-PGR). Students	amental notions  5 gain knowledge
In the course students loof the theory of game de	be able to solve simple algorithmic problems with a geometric component.  Virtual game worlds earn methods to create a complex virtual world. It is a follow-up course of basic courses of the PG specialization (BIE-MGA, BIE sign, of principles of writing dialogues and characters in order to create a functional virtual world. Within the labs they get practice.	Z,ZK E-PGR). Students	amental notions  5 gain knowledge
In the course students le of the theory of game de work on the semester p	be able to solve simple algorithmic problems with a geometric component.  Virtual game worlds earn methods to create a complex virtual world. It is a follow-up course of basic courses of the PG specialization (BIE-MGA, BIE sign, of principles of writing dialogues and characters in order to create a functional virtual world. Within the labs they get practically reject.	Z,ZK E-PGR). Students	5 gain knowledge
In the course students le of the theory of game de work on the semester p NI-VOL	be able to solve simple algorithmic problems with a geometric component.  Virtual game worlds earn methods to create a complex virtual world. It is a follow-up course of basic courses of the PG specialization (BIE-MGA, BIE sign, of principles of writing dialogues and characters in order to create a functional virtual world. Within the labs they get practicoject.  Elections	Z,ZK E-PGR). Students	amental notions  5 gain knowledge
In the course students le of the theory of game de work on the semester p NI-VOL We will cover the basics	be able to solve simple algorithmic problems with a geometric component.  Virtual game worlds  earn methods to create a complex virtual world. It is a follow-up course of basic courses of the PG specialization (BIE-MGA, BIE sign, of principles of writing dialogues and characters in order to create a functional virtual world. Within the labs they get practicopiect.  Elections  of (committee) elections and, in general, opinion aggregation.	Z,ZK E-PGR). Students cal skills within tea	5 gain knowledge am development
In the course students le of the theory of game de work on the semester political NI-VOL We will cover the basics BI-VMM	be able to solve simple algorithmic problems with a geometric component.  Virtual game worlds For methods to create a complex virtual world. It is a follow-up course of basic courses of the PG specialization (BIE-MGA, BIE sign, of principles of writing dialogues and characters in order to create a functional virtual world. Within the labs they get practiciples.  Elections For (committee) elections and, in general, opinion aggregation.  Selected Mathematical Methods	Z,ZK E-PGR). Students cal skills within tea	5 gain knowledge am development 5
In the course students lead to the theory of game down work on the semester policy in the semester policy will cover the basics BI-VMM We start reviewing geometric students because the semester policy in th	be able to solve simple algorithmic problems with a geometric component.  Virtual game worlds  Farn methods to create a complex virtual world. It is a follow-up course of basic courses of the PG specialization (BIE-MGA, BIE sign, of principles of writing dialogues and characters in order to create a functional virtual world. Within the labs they get practiciples.  Elections  of (committee) elections and, in general, opinion aggregation.  Selected Mathematical Methods  netric properties of linear spaces with inner product. Next, we introduce and analyze the discrete Fourier transform (DFT) and	Z,ZK E-PGR). Students cal skills within tea  Z,ZK  Z,ZK  Z,ZK  I its fast implement	5 gain knowledge am development 5 4 ntation (FFT).
In the course students lead to the theory of game down work on the semester policy will cover the basics BI-VMM We start reviewing geor Further we deal with different starts.	be able to solve simple algorithmic problems with a geometric component.  Virtual game worlds  Farn methods to create a complex virtual world. It is a follow-up course of basic courses of the PG specialization (BIE-MGA, BIE sign, of principles of writing dialogues and characters in order to create a functional virtual world. Within the labs they get practic roject.  Elections  of (committee) elections and, in general, opinion aggregation.  Selected Mathematical Methods  netric properties of linear spaces with inner product. Next, we introduce and analyze the discrete Fourier transform (DFT) and rerential calculus of functions involving multiple variables. We present methods for the localization of extreme values of functions	Z,ZK E-PGR). Students cal skills within tea  Z,ZK  Z,ZK  Z,ZK  dits fast implements. For this purpose.	5 gain knowledge am development  5 httation (FFT). bses, we study
In the course students lead to the theory of game do work on the semester policy in the semester policy. We will cover the basics BI-VMM We start reviewing geor Further we deal with differenced linear spaces as	be able to solve simple algorithmic problems with a geometric component.  Virtual game worlds  Farn methods to create a complex virtual world. It is a follow-up course of basic courses of the PG specialization (BIE-MGA, BIE sign, of principles of writing dialogues and characters in order to create a functional virtual world. Within the labs they get practiciples.  Elections  of (committee) elections and, in general, opinion aggregation.  Selected Mathematical Methods  netric properties of linear spaces with inner product. Next, we introduce and analyze the discrete Fourier transform (DFT) and rerential calculus of functions involving multiple variables. We present methods for the localization of extreme values of function and quadratic forms. In addition, we introduce the least square method. The last part of the course is devoted to optimization and	Z,ZK E-PGR). Students cal skills within tea  Z,ZK  Z,ZK  Z,ZK  dits fast implements. For this purpose.	5 gain knowledge am development  5 httation (FFT). bses, we study
In the course students lead to the theory of game do work on the semester policy in the basics of the theory of game do work on the semester policy in the basics of the b	be able to solve simple algorithmic problems with a geometric component.  Virtual game worlds  Parn methods to create a complex virtual world. It is a follow-up course of basic courses of the PG specialization (BIE-MGA, BIE sign, of principles of writing dialogues and characters in order to create a functional virtual world. Within the labs they get practic roject.  Elections  of (committee) elections and, in general, opinion aggregation.  Selected Mathematical Methods  netric properties of linear spaces with inner product. Next, we introduce and analyze the discrete Fourier transform (DFT) and ferential calculus of functions involving multiple variables. We present methods for the localization of extreme values of function diguadratic forms. In addition, we introduce the least square method. The last part of the course is devoted to optimization and it is analyzed in more detail.	Z,ZK E-PGR). Students cal skills within tea Z,ZK Z,ZK dits fast implements for this purport displays the line	5 gain knowledge am development  5 4 ntation (FFT). oses, we study ar programming
In the course students lead of the theory of game de work on the semester policy in the basics of the theory of game de work on the semester policy in the semes	be able to solve simple algorithmic problems with a geometric component.  Virtual game worlds For methods to create a complex virtual world. It is a follow-up course of basic courses of the PG specialization (BIE-MGA, BIE sign, of principles of writing dialogues and characters in order to create a functional virtual world. Within the labs they get practic roject.  Elections  of (committee) elections and, in general, opinion aggregation.  Selected Mathematical Methods metric properties of linear spaces with inner product. Next, we introduce and analyze the discrete Fourier transform (DFT) and referential calculus of functions involving multiple variables. We present methods for the localization of extreme values of functional quadratic forms. In addition, we introduce the least square method. The last part of the course is devoted to optimization and it is analyzed in more detail.  Computability	Z,ZK E-PGR). Students cal skills within tea  Z,ZK  Z,ZK  Z,ZK  dits fast implements. For this purpose.	5 gain knowledge am development  5 httation (FFT). bses, we study
In the course students lead to the theory of game do work on the semester policy in the basics of the theory of game do work on the semester policy in the semester policy in the policy in the basics of the basics	be able to solve simple algorithmic problems with a geometric component.  Virtual game worlds  Part methods to create a complex virtual world. It is a follow-up course of basic courses of the PG specialization (BIE-MGA, BIE sign, of principles of writing dialogues and characters in order to create a functional virtual world. Within the labs they get practic roject.  Elections  of (committee) elections and, in general, opinion aggregation.  Selected Mathematical Methods  netric properties of linear spaces with inner product. Next, we introduce and analyze the discrete Fourier transform (DFT) and electric forms. In addition, we introduce the least square method. The last part of the course is devoted to optimization and it is analyzed in more detail.  Computability  review functions and effective computability.	Z,ZK E-PGR). Students cal skills within tea Z,ZK Z,ZK dists fast implement ons. For this purpod duality. The line Z,ZK	5 gain knowledge am development  5 4 ntation (FFT). sses, we study ar programming
In the course students lead of the theory of game do work on the semester policy in the basics of the theory of game do work on the semester policy in the p	be able to solve simple algorithmic problems with a geometric component.  Virtual game worlds  Parn methods to create a complex virtual world. It is a follow-up course of basic courses of the PG specialization (BIE-MGA, BIE sign, of principles of writing dialogues and characters in order to create a functional virtual world. Within the labs they get practic roject.  Elections  of (committee) elections and, in general, opinion aggregation.  Selected Mathematical Methods  netric properties of linear spaces with inner product. Next, we introduce and analyze the discrete Fourier transform (DFT) and electric forms. In addition, we introduce the least square methods for the localization of extreme values of functional quadratic forms. In addition, we introduce the least square method. The last part of the course is devoted to optimization and it is analyzed in more detail.  Computability  resive functions and effective computability.  Research Project	Z,ZK E-PGR). Students cal skills within tea Z,ZK Z,ZK dits fast implements for this purport displays the line	5 gain knowledge am development  5 4 ntation (FFT). oses, we study ar programming
In the course students lead of the theory of game do work on the semester policy in the basics of the theory of game do work on the semester policy in the semester policy in the policy	be able to solve simple algorithmic problems with a geometric component.  Virtual game worlds  Part methods to create a complex virtual world. It is a follow-up course of basic courses of the PG specialization (BIE-MGA, BIE sign, of principles of writing dialogues and characters in order to create a functional virtual world. Within the labs they get practic roject.  Elections  of (committee) elections and, in general, opinion aggregation.  Selected Mathematical Methods  netric properties of linear spaces with inner product. Next, we introduce and analyze the discrete Fourier transform (DFT) and electric forms. In addition, we introduce the least square method. The last part of the course is devoted to optimization and it is analyzed in more detail.  Computability  review functions and effective computability.	Z,ZK E-PGR). Students cal skills within tea Z,ZK Z,ZK dists fast implement ons. For this purpod duality. The line Z,ZK	5 gain knowledge am development  5 4 ntation (FFT). sses, we study ar programming

NI-ZS10 Master internship abroad for 10 credits 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 institution. Before the 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 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 institution. The maximum number of credits a student can earn for one internship is 30 credits. This amount can be divided into two subjects if the internship exceeds the academic year's dead-line.

NI-ZS20 Master internship abroad for 20 credits

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 institution. Before the 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 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 institution. The maximum number of credits a student can earn for one internship is 30 credits. This amount can be divided into two subjects if the internship exceeds the academic year's dead-line.

NI-ZS30 Master internship abroad for 30 credits Ζ

30

The course is prezented in chzech language. 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 institution. Before the 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 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 institution. The maximum number of credits a student can earn for one internship is 30 credits. This amount can be divided into two subjects if the internship exceeds the academic year's dead-line.

Code of the group: NI-PB-VS.20

Name of the group: Elective Vocational Courses for Master Specialization Computer security

Requirement credits in the group: Requirement courses in the group:

Credits in the group: 0

Note on the group		izations with	the exc	eption o	f this speci	alizatio
Code	Name of the course / Name of the group of courses (in case of groups of courses the list of codes of their members)	Completion	Credits	Scope	Semester	Role
NI-ADM	Tutors, authors and guarantors (gar.)  Data Mining Algorithms  Pavel Kordík, Daniel Vašata, Rodrigo Augusto Da Silva Alves Daniel Vašata  Pavel Kordík (Gar.)	Z,ZK	5	2P+1C	L	V
NI-ADP	Architecture and Design patterns Filip K ikava, Jan Zimolka, Ji í Borský, Tomáš Chvosta Filip K ikava Filip K ikava (Gar.)	Z,ZK	5	2P+1C	Z	V
NI-AM1	Middleware Architectures 1 Jaroslav Kucha, Tomáš Vitvar Jaroslav Kucha Tomáš Vitvar (Gar.)	Z,ZK	5	2P+1C	Z	V
NI-AM2	Middleware Architectures 2 Jaroslav Kucha , Tomáš Vitvar Jaroslav Kucha Tomáš Vitvar (Gar.)	Z,ZK	5	2P+1C	L	V
NI-BML	Bayesian Methods for Machine Learning Kamil Dedecius, Ond ej Tichý Ond ej Tichý Kamil Dedecius (Gar.)	KZ	5	2P+1C	L	V
NI-BVS	Embedded Security Martin Novotný Martin Novotný Martin Novotný (Gar.)	Z,ZK	5	2P+2C	L	V
NI-BKO	Error Control Codes Pavel Kubalík, Alois Pluhá ek Alois Pluhá ek (Gar.)	Z,ZK	5	2P+1C	L	V
NI-DSV	Distributed Systems and Computing Pavel Tvrdík Jan Fesl Pavel Tvrdík (Gar.)	Z,ZK	5	2P+1C	Z	V
NI-DDW	Web Data Mining Jaroslav Kucha , Milan Doj inovski <b>Jaroslav Kucha</b> Jaroslav Kucha (Gar.)	Z,ZK	5	2P+1C	L	V
NI-EPC	Effective C++ programming Daniel Langr Daniel Langr (Gar.)	Z,ZK	5	2P+1C	Z	V
NI-EVY	Efficient Text Pattern Matching Jan Holub Jan Holub (Gar.)	Z,ZK	5	2P+1C	Z	V
NI-FME	Formal Methods and Specifications Stefan Ratschan Stefan Ratschan (Gar.)	Z,ZK	5	2P+1C	L	V
NI-GEN	Code Generators Petr Máj, Jan Janoušek <b>Petr Máj</b> Jan Janoušek (Gar.)	Z,ZK	5	2P+1C	Z	V
NI-GAK	Graph theory and combinatorics Tomáš Valla Tomáš Valla (Gar.)	Z,ZK	5	2P+2C	L	V
NI-KOD	Data Compression Jan Holub Jan Holub (Gar.)	Z,ZK	5	2P+1C	L	V
NI-MVI	Computational Intelligence Methods Pavel Kordík Pavel Kordík Pavel Kordík (Gar.)	Z,ZK	5	2P+1C	Z	V
NI-MEP	Modelling of Enterprise Processes Robert Pergl, Marek Suchánek, Marek Skotnica Robert Pergl Robert Pergl (Gar.)	Z,ZK	5	2P+1C	Z	V
NI-MPJ	Modelling of Programming Languages	Z,ZK	5	2P+1C	Z	V
NI-MTI	Modern Internet Technologies Viktor erný, Alexandru Moucha Alexandru Moucha Alexandru Moucha (Gar.)	Z,ZK	5	2P+1C	Z	V
NI-NUR	User Interface Design Josef Pavlí ek Josef Pavlí ek (Gar.)	Z,ZK	5	2P+1C	Z	V

NI-NON	Nonlinear Continuous Optimization and Numerical Methods Jaroslav Kruis Jaroslav Kruis (Gar.)	Z,ZK	5	2P+1C	Z	V
NI-NSS	Normalized Software Systems Robert Pergl, Marek Suchánek, Jan Verelst Robert Pergl Robert Pergl (Gar.)	ZK	5	2P	L	V
NI-OSY	Operating Systems and Systems Programming Petr Zemánek, Tomáš Martinec Petr Zemánek Petr Zemánek (Gar.)	Z,ZK	5	2P+1C	Z	V
NI-BUI	Business Informatics Petra Pavlí ková Petra Pavlí ková (Gar.)	Z,ZK	5	2P+2C	L	V
NI-PIS	Enterprise Information Systems Martin Závrbský, Martin Mach, Vlastimil Jinoch, Martin Hasaj David Buchtela David Buchtela (Gar.)	Z,ZK	5	2P+1C	L	V
NI-PAS	Advanced Aspects of Business  David Buchtela, Zden k Ku era David Buchtela Zden k Ku era (Gar.)	Z,ZK	4	2P+1C	Z	V
NI-PDB	Advanced Database Systems Michal Valenta, Yelena Trofimova Michal Valenta (Gar.)	Z,ZK	5	2P+1C	Z	V
NI-GPU	GPU Architectures and Programming Ivan Šime ek Ivan Šime ek Ivan Šime ek (Gar.)	Z,ZK	5	2P+1C	L	V
NI-PDD	Data Preprocessing Marcel Ji ina Marcel Ji ina (Gar.)	Z,ZK	5	2P+1C	Z	V
NI-RUN	Runtime Systems Filip K ikava, Michal Vlasák Filip K ikava Michal Vlasák (Gar.)	Z,ZK	5	2P+1C	L	V
NI-SWE	Semantic Web and Knowledge Graphs Milan Doj inovski, Jakub Klímek Milan Doj inovski (Gar.)	Z,ZK	5	2P+1C	Z	V
NI-SIM	Digital Circuit Simulation and Verification  Martin Kohlík Martin Kohlík Martin Kohlík (Gar.)	Z,ZK	5	2P+1C	L	V
NI-SCR	Statistical Analysis of Time Series  Kamil Dedecius Kamil Dedecius Kamil Dedecius (Gar.)	Z,ZK	5	2P+1C	Z	V
NI-SYP	Parsing and Compilers Jan Janoušek Jan Janoušek (Gar.)	Z,ZK	5	2P+1C	Z	V
NI-DSS	Decision Support Systems Petra Pavlí ková, Robert Pergl, David Buchtela David Buchtela Robert Pergl (Gar.)	Z,ZK	5	2P+1C	Z	V
NI-TES	Systems Theory Stefan Ratschan Stefan Ratschan (Gar.)	Z,ZK	5	2P+1C	Z	V
NI-TSP	Testing and Reliability Petr Fišer Martin Da hel Petr Fišer (Gar.)	Z,ZK	5	2P+2C	Z	V
NI-TSW	Software Product Development Petra Pavlí ková Ond ej Pluha Petra Pavlí ková (Gar.)	KZ	4	1P+2C	Z	V
NI-UMI	Artificial intelligence Pavel Surynek Pavel Surynek (Gar.)	Z,ZK	5	2P+1C	Z	V
NI-EHW	Embedded Hardware Jan Schmidt Jan Schmidt (Gar.)	Z,ZK	5	2P+1C	Z	V
NI-ESW	Embedded Software Hana Kubátová, Miroslav Skrbek Miroslav Skrbek Hana Kubátová (Gar.)	Z,ZK	5	2P+1C	Z	V
NI-VCC	Virtualization and Cloud Computing Tomáš Vondra, Jan Fesl Tomáš Vondra Tomáš Vondra (Gar.)	Z,ZK	5	2P+1C	L	V
NI-APR	Selected Methods for Program Analysis Filip K ikava Filip K ikava (Gar.)	Z,ZK	5	2P+1C	L	V
NI-PON	Selected Topics in Optimization and Numerical mathematics Karel Klouda, St pán Starosta, Daniel Vašata Daniel Vašata Št pán Starosta (Gar.)	Z,ZK	5	2P+1C	L	V
NI-VMM	Retrieval from Multimedia Ji í Novák, Tomáš Skopal <b>Jaroslav Kucha</b> Tomáš Skopal (Gar.)	Z,ZK	5	2P+1C	Z	V
NI-MCC	Multicore CPU Computing Daniel Langr, Ivan Šime ek Ivan Šime ek (Gar.)	Z,ZK	5	2P+1C	Z	V

Characteristics of the courses of this group of Study Plan: Code=NI-PB-v5.20 Name=Elective vocational Course	S IOI WASLEI S	pecialization
Computer security		
NI-ADM Data Mining Algorithms	Z,ZK	5
The course focuses on algorithms used in the fields of machine learning and data mining. However, this is not an introductory course, and the stude	nts should know n	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 mod	dels (e.g., kernel
methods).		
NI-ADP Architecture and Design patterns	Z,ZK	5
The objective of this course is to provide students with both work knowledge about the underlying foundations of object-oriented design and analysi	s as well as with u	inderstanding of
the challenges, issues, and tradeoffs of advanced software design. In the first part of the course, the students will refresh and deepen their knowled	ge 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 proble	ms. In the second p	part the students
will be introduced to the principles of software architecture design and analysis. This includes the classical architectural styles, component based syst	ems, and some ad	vanced software
architectures used in large-scale distributed systems.		
NI-AM1 Middleware Architectures 1	Z,ZK	5
Students will study new trends, concepts, and technologies in the area of service-oriented architectures. The will gain an overview of information sy	stem architecture,	web service
architecture and aplication servers. The will also study principles and technologies for middleware focused on application integrations, asynchronous or	ommunications and	d high availability
of applications.		
NI-AM2 Middleware Architectures 2	Z,ZK	5
Students will learn new trends and technologies on the Web including theoretical foundations. They will gain an overview of Web application architecture	ctures, concepts a	nd technologies
for microservices, distrubuted cache and databases, smart contracts, realtime communication and web security.		

models providing descri from noisy observations and applications will be	Bayesian Methods for Machine Learning on practical use of basic Bayesian modeling methods in the dynamically evolving machine learning theory. In particular, it studing prion of real phenomena, as well as their subsequent use, e.g., for forecasting of future evolution or learning about the hidde etc.). The emphasis is put on understanding of explained principles and methods and their practical adoption. For this purpose presented to students, for instance, 2D/3D object tracking, radiation source term estimation, or separation in medical imaging	n variables (true o	object position world examples
some of them.			
NI-BVS	Embedded Security	Z,ZK	5
Students gain basic kno	wledge in selected topics of cryptography and cryptanalysis. The course focuses particularly on efficient implementations of cr	yptographic primit	ives in hardware
and software (in embedd	ded systems). Students gain a good overview of functionality of (hardware) cryptographic accelerators, smart cards, and resou	rces for securing i	nternal functions
of computer systems.			
NI-BKO	Error Control Codes	Z,ZK	5
The goal of the course i	s to present various ways to detect or correct individual errors and burst errors in data stored into memories or transmitted vi	a channels.	
NI-DSV	Distributed Systems and Computing	Z,ZK	5
_	to methods for coordination of processes in distributed environment characterised by nondeterministic time responses of comput	l ' l	d communication
	sic algorithms that assure correctness of computations realized by a group of loosely coupled processes and mechanisms th		
	safety in case of failures.	g	
NI-DDW	Web Data Mining	Z,ZK	5
	t methods and technologies for web data acquisition, analysis and utilization of the discovered knowledge. Students will gain		-
	ling, Web structure analysis, Web usage analysis, Web content mining and information extraction. Students will also gain an over		- 1
•	inity, web structure analysis, web usage analysis, web content mining and information extraction. Students will also gain an over and recommendation systems.	I view of filost rece	in developments
		7.71/	
NI-EPC	Effective C++ programming	Z,ZK	5
	se the modern features of contemporary versions of the C++ programming language for software development. The course for		nming effectivity
	n of writing maintainable and portable source code and creating correct programs with low memory and processor time requ		
NI-EVY	Efficient Text Pattern Matching	Z,ZK	5
Students get knowledge	of efficient algorithms for text pattern matching. They learn to use so called succinct data structures that are efficient in both according to the succinct data structures that are efficient in both according to the succinct data structures that are efficient in both according to the succinct data structures that are efficient in both according to the succinct data structures that are efficient in both according to the succinct data structures that are efficient in both according to the succinct data structures that are efficient in both according to the succinct data structures that are efficient in both according to the succinct data structures that are efficient in both according to the succinct data structures that are efficient in both according to the succinct data structures that are efficient in both according to the succinct data structures that are efficient in both according to the succinct data structures that are efficient in the succinct data structures are efficient as efficient in the succinct data structures are efficient as efficient data structures are efficient as efficient data structures are efficient as efficient as efficient data structures are efficient as efficient data structures are efficient as effici	cess time and me	mory complexity.
They will be able to use	the knowledge in design of applications that utilize pattern matching.		
NI-FME	Formal Methods and Specifications	Z,ZK	5
Students are able to des	scribe semantics of software formally and to use sound reasoning for construction of correct software. They learn to use some		at allow to prove
basic properties of softv			·
NI-GEN	Code Generators	Z,ZK	5
		Z,ZK	5
NI-GAK	Graph theory and combinatorics	'	•
-	to introduce the most important topics in graph theory, combinatorics, combinatorial structures, discrete models and algorith	· ·	- 1
•	sic principles but also on applications in problem solving and algorithm design. The topics include: generating functions, selected		,, , ,
	y, introduction to probabilistic method, properties of various special classes of graphs and combinatorial structures. The theoretic formal to a support of the complete structures are the complete structures.	ry will be also app	lied in the fields
	ds, formal languages and bioinformatics.		
NI-KOD	Data Compression	Z,ZK	5
	to the basic principles of data compression. They will learn the necessary theoretical background and get an overview of da	•	
•	erview covers principles of integer coding and of statistical, dictionary, and context data compression methods. In addition, st	tudents learn the	fundamentals of
	methods used in image, audio, and video compression.		
NI-MVI	Computational Intelligence Methods	Z,ZK	5
Students will understand	d methods and techniques of computational intelligence that are mostly nature-inspired, parallel by nature, and applicable to	many problems. 7	hey will learn
how these methods wor	k and how to apply them to problems related to data mining, control, intelligen games, optimizations, etc.		
NI-MEP	Modelling of Enterprise Processes	Z,ZK	5
	on introduction to the discipline of Enterprise Engineering. Students learn the importance of a proper methodological approach		ring and
implementation of proce	esses, organisation structures and information support in big enterprises and institutions.		
NI-MPJ	Modelling of Programming Languages	Z,ZK	5
	ation, and code generation processes depend on the semantics of the language; in particular, they are correct if they preserv		
	esemantics of programming languages. The students will learn the language models with emphasis on functional languages, stu		
•	a calculus and here get acquainted with the advanced lambda calculus. The students also get hands-on-experience with sema	· ·	
			5
NI-MTI	Modern Internet Technologies  "Modern Internet Technologies" is designed on four major pillars of networking: 1. Unified Communication and Collaboration	Z,ZK	
· · · · · · · · · · · · · · · · · · ·	"Modern Internet Technologies" is designed on four major pillars of networking: 1. Unified Communication and Collaboration	-	
-	whatever types of protocols for whatever purposes. This architecture is able to be protocol independent and carries voice, vid Design of Extremely Scalable Networks - This provides the insights of network architectures which can accommodate hundre		
•			
	s a paradigm switch from LANs (Local Area Networks) to SPs (Service Providers). 3. Traffic Segregation, Traffic Matching and		
_	ice providers to create private channels of communication between customers, with guaranteed parameters (bandwidth, dela		010001). 4.
	es - They allow traffic to be carried at the optimal speed and allow for graceful degradation of service parameters in case of f		_
NI-NUR	User Interface Design	Z,ZK	5
	t the theorical background of human-computer interaction and user interface (UI) design, will learn formal description of UIs, for		
notions and procesures	They get acquainted with graphical, speech, and multimodal UIs. Thanks to the gained knowledge, the students will be able	to design advanc	ed Uls.
NI-NON	Nonlinear Continuous Optimization and Numerical Methods	Z,ZK	5
Students will be introduced	ced to nonlinear continuous optimization, principles of the most popular methods of optimization and applications of such met	hods to real-world	l problems. They
will also learn the finite	element method and the finite difference method used for solving ordinary and partial differential equations in engineering. TI	hey will learn to so	olve systems of
linear algebraic equation	ns that arise from discretization of the continuous problems by direct and iterative algorithms. They will also learn to impleme	nt these algorithm	ns sequentially
as well as in parallel.			
NI-NSS	Normalized Software Systems	ZK	5
	oundations of normalized systems theory that studies the evolvability of modular structures based on concepts from engineer		-
	thermodynamics. Students will understand a set of principles that indicate where violations of stability and entropy-related is	-	
	nd part of the course, students learn how to construct software architectures using a set of 5 design patterns called elements	-	-
	on systems in terms of storing data, executing actions, workflows, connectors, and triggers, while handling violations of the stab		
	students to realize new levels of evolvability in software architectures.		
	,		

NI-OSY	Operating Systems and Systems Programming	Z,ZK	5 Kay tanisa aras
=	em programming in UNIX environment. Emphasis is given on kernel development with focus on kernel architecture and kernel nemory management, file operations and architecture of modern file systems, device drivers and network programming.The c		
	pgrades of existing kernels, kernel booting, debugging using dynamic instrumentation, and techniques to guarantee portability	-	
	me operating systems are also discussed. Theoretical and general principles are demonstrated on the LINUX kernel. Within la t of LINUX kernel modules.	os, students will v	work on projects
NI-BUI	Business Informatics	Z,ZK	5
	to focus on operational, tactical and strategic management of business informatics. Students will gain knowledge in the areas o	-	- 1
	ectures in enterprise informatics. They will also learn about the principles, models and standards (ITIL, COBIT) in IT managen ource management (sourcing). Students will learn the process of creating and implementing information strategy, IT Governar		· ·
	t of information strategy with global business strategy. They will also gain knowledge in the areas of economic IT management	-	
	nent evaluation and human resources management in IT (roles CIO, CEO, CFO).	771	
NI-PIS	Enterprise Information Systems  In the current IT requirements of large companies in the Czech Republic (Top 100). The basis is Data management, storage of	Z,ZK	5 a) and their use
	nce). The principles of solving the overall architecture of information systems in the banking, insurance and telecommunication		
•	ore, students will get acquainted with the life cycle of information systems in the company / organization and its impact on the b	• • • • • • • • • • • • • • • • • • • •	
company / organization.	ted with technologies that have proven themselves in the elimination of basic risks in the planning, implementation and operate	ion of information	n systems in the
NI-PAS	Advanced Aspects of Business	Z,ZK	4
The aim of the course is	to provide students with advanced (compared to the bachelor's degree) knowledge and skills needed to establish and run the	eir own business	or business
	in law, administration (necessary steps and documents), business economics, foreign trade and related aspects.		
NI-PDB	Advanced Database Systems   wes in problems of evaluation and optimization of SQL queries. The next part of the course deals with new concepts of database.	Z,ZK	5 called NoSOI
	ated new data models (XML, graph databases, column databases) and languages for working with them (XQuery, XPath, CYF	,	
the course deals with pe	erformance evaluation of database machines.		
NI-GPU	GPU Architectures and Programming	Z,ZK	5
<del>-</del>	edge of the internal architecture of modern massively parallel GPU processors. They will learn to program them mainly in the C pread programming technology of GPU processors. As an integral part of the effective computational use of these hierarchical or		- 1
=	on programming techniques and methods of programming multiprocessor GPU systems.	inputational stru	ciures, siudenis
NI-PDD	Data Preprocessing	Z,ZK	5
	e raw data for further processing and analysis. They learn what algorithms can be used to extract information from various data		-
time series, etc., and lea pages.	arn the skills to apply these theoretical concepts to solve specific problems in individual projects - e.g., extraction of characteri	stics from images	s or from web
	Runtime Systems	Z.ZK	5
· ·	of programming languages steadily rises, modern programs require greater and greater support during their runtime. This cour	, ,	_
•	upport, such as runtime-effective program description, memory management support and garbage collection, just-in-time com	pilation, and inte	roperability with
other languages and sys	Semantic Web and Knowledge Graphs	Z,ZK	5
	he most recent concepts and technologies of the Semantic Web. The course will provide an overview of the Semantic Web te		-
	integration, publishing, querying and consumption of semantic data. The students will also gain skills in creation of knowledge	0 ,	
quality assurance.			
NI-SIM	Digital Circuit Simulation and Verification to acquaint the students with principles of digital circuit simulation at RTL (Register Transfer Level) and TLM (Transaction Level)	Z,ZK	5
	s. The course covers recent verification methods, too.	rei Modelling) leve	eis and with the
NI-SCR	Statistical Analysis of Time Series	Z,ZK	5
The course deals with the	ne practical use of the basic time series modelling theory in engineering tasks, ranging from economics (stock exchange price	s, employment) a	and industrial
	signals and processes) to computer networks (network components load, attacks detection). The students learn to select a cor	•	
	ts properties and use it for forecasting of future or intermediate values. The stress is put on understanding and adoption of the n th the lab classes and the lectures exploit freely available software packages in order to provide easy and straightforward tran		
the academic to the real	world.		
NI-SYP	Parsing and Compilers	Z,ZK	5
-	the knowledge of fundamentals of automata theory, formal language and formal translation theories. Students gain knowledge of troduced to special applications of parsers, such as incremental and parallel parsing.	various variants	and applications
NI-DSS	Decision Support Systems	Z,ZK	5
	to provide students with knowledge and skills in decision support systems, their classification (Powerova), selected principles	, ,	_
•	decision support systems. Students will also gain knowledge of multicriterial decision-making methods and game theory. They was a support systems of the control of the con		out the principles
	ologically oriented decision support systems and the basics of distribution, optimization and evolution methods and algorithms.		
NI-TES Today, humankind has the	Systems Theory he ability to develop systems of incredible complexity (e.g., trains, microprocessors, airplanes, nuclear power plants). Howeve	Z,ZK	5 anaging this
	ing the correct behavior of a given system have become critical. A key technique for mastering this complexity is the usage of		
	hat are important for the task at hand, and automated tools for analyzing those models. This subject will present theory and a	Igorithms that for	rm the basis for
the modeling and analys		7.71/	
NI-TSP Students will gain knowl	Testing and Reliability edge about circuit testing and about methods for increasing reliability and security. They will get practical skills to be able to p	Z,ZK repare a test set	5 with the help of
ŭ	cation and to use an ATPG for automatic test generation. They will be able to design easily testable circuits and systems with	•	
· ·	analyze, and control the reliability and availability of the designed circuits.	<del></del>	
NI-TSW	Software Product Development	KZ	4
The course is presented NI-UMI	Artificial intelligence	Z,ZK	5
,	ch and inference algorithms in major formal paradigms used in artificial intelligence such as logic theories, constraint program		-
The main principles and	practical applications of discussed techniques will be illustrated.		

NI-EHW **Embedded Hardware** The course brings basic laws that govern digital design and basic techniques to use them. It deals with both large and small scale systems. This is the base of advanced embedded systems, that profit from their specialized structure for effective computation and acceleration. Design of fast custom computing machines is discussed, including standardized means of internal communication, parallelism extraction and utilization in special structures and system architectures. **Embedded Software** Embedded software course acquainted students with the specifics of software development for embedded systems. The course covers the areas from the basic techniques of programming in C language and code optimizations, through typical areas as the reliable software development, embedded operating systems, signal processing, up to sophisticated techniques combined with artificial intelligence. NI-VCC Virtualization and Cloud Computing Students will gain knowledge of architectures of large computer systems that are used in data centers and computer infrastructure of companies and organizations. They will get acquainted with virtualization principles, tools and technologies that serve to facilitate and automate configuration, testing and monitoring, and to efficiently operate and optimize the performance parameters of modern computer systems. Theoretically and practically, they will get acquainted with containerization as the most effective technology today for the management of complex computer systems and with specific technologies of cloud systems. Finally, they will learn the principles and gain practical skills in the use of modern integration and development tools (Continuous integration and development). NI-APR Selected Methods for Program Analysis Z.ZK 5 Program analysis studies program behavior with the aim of code optimization and error detection. Students will learn static program analysis, which approximates program behavior without the need to actually run the program, as well as dynamic program analysis which analyse programs at runtime. Students will be introduced to the common techniques and algorithms and use them on some classical problems. Selected Topics in Optimization and Numerical mathematics Z.ZK The course focuses on optimization problems that appear in the field of machine learning and artificial intelligence. Students broaden their knowledge of continuous optimization obtained in the course Mathematics for informatics. The methods are explained and described along with the details on how they are implemented on computers. Hence, the relevant concepts of numerical matematics, mainly numerical linear algebra, are explained too. NI-VMM Retrieval from Multimedia Z.ZK 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. NI-MCC Multicore CPU Computing Z.ZK Students will get acquainted in detail with hardware support and programming technologies for the creation of parallel multithreaded computations on multicore processors with shared and virtually shared memories, which are today the most common computing nodes of powerful (super)computer systems. Students will gain knowledge of architecturally specific optimization techniques used to reduce the performance drop due to the widening gap between the computational requirements of multi-core CPUs and memory interface throughput.

## List of courses of this pass:

Name of the course

Completion | Credits

On specific non-trivial multithreaded programs, students will also learn the basics of the art of creating these applications.

Code

DL A C O O 4

BI-AG2.21	Algorithms and Graphs 2	Z,ZK	5
This course, pres	ented in Czech, introduces basic algorithms and concepts of graph theory as a follow=up on the introduction given in the compulsory	course BI-AG1.2	I. It further
delves into advar	ices data structures and amortized complexity analysis. It also includes a very light introduction to approximation algorithms. For Engl	ish version of the	course see
	BIE-AG2.21.		
BI-APS.21	Architectures of Computer Systems	Z,ZK	5
Students will lea	in the construction principles of internal architecture of computers with universal processors at the level of machine instructions. Spec	ial emphasis is giv	en on the
pipelined instruction	n processing and on the memory hierarchy. Students will understand the basic concepts of RISC and CISC architectures and the princ	ciples of instruction	processing
not only in scala	r processors, but also in superscalar processors that can execute multiple instructions in one cycle, while ensuring the correctness of	the sequential mo	del of the
program. The cour	se further elaborates the principles and architectures of shared memory multiprocessor and multicore systems and the memory cohe	rence and consiste	ency in such
	systems.		
BI-BEK.21	Secure Code	Z,ZK	5
The students will le	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	amiliar with the thre	at modeling
theory, students	s gain practical experience with running programs with reduced privileges and methods of specifying these privileges, since not every	program needs to	run with
administrator priv	rileges. Dangers inherent in buffer overflows will be practically demonstrated. Students will be introduced to the principles of securing	data and the relati	onships of
security and	database systems, web, remote procedure calls, and sockets in general. The module concludes with Denial of Service attacks and th	e defense against	them.
BI-BLE	Blender	Z,ZK	4
The course exter	ids knowledge of opensource program Blender from BI-MGA (Multimedia and Graphics Applications) course. It is intended for those is	nterested in 3D gra	aphics and
animation. It	offers a complete and practically oriented introduction to Blender environment. Students may continue to BI-PGA (Programming graph	nics applications) of	course.
BI-CCN	Compiler Construction	Z,ZK	5
This is an introd	uctory class on compiler construction for bachelor students in computer science. The goal of the class is to introduce basic principles	of compilers for st	udents to
understa	and the design and implementation of programming languages. Seeing and actually understanding self-compilation is the overarching	theme of the class	S.
BI-EHA.21	Ethical Hacking	Z,ZK	5
The goal of the o	ourse is to introduce students to the field of penetration testing and ethical hacking. The course deals with cybersecurity threats, vuln	erabilities, and the	ir possible
exploitation in cor	nputer networks, web applications, wireless networks, operating systems, and others like the Internet of Things or cloud. The focus is	on hands-on expe	rience with
	vulnerabilities testing and the following process of penetration test documentation.		
BI-FMU	Financial and Management Accounting	Z,ZK	5
The aim of the cou	rise is explanation of basic terms in the theory of accounting, the principles of balancing the property amounts and liabilities in the pa	rticular accounting	operations,
operations in acco	ounts and accounting statements including opening and closing of bookkeeping. The course provides students with a legal modificatio	n of bookkeeping,	description
of economic ope	rations based on current methods of double-entry bookkeeping for enterprising subjects in the Czech Republic. Principles of manage	ment accounting a	re base of
	Business Inteligence moduls in Business information systems.		
BI-FTR.1	Financial Markets	Z,ZK	5
	This course is presented in Czech. However, there is an English variant in the program Informatics (B1801 / 4753).	•	•

BI-JPO.21 Computer Units Z,ZK 5 Students deepen their basic knowledge of digital computer units acquired in the obligatory course of the program (BIE-SAP), get acquainted in detail with the internal structure and organization of computer units and processors and their interactions with the environment, including accelerating arithmetic-logic units and using appropriate codes for implementation of multiplication. The organization of main memory and other internal memories (addressable, LIFO, FIFO and CAM) will be discussed in detail, including codes for error detection and correction for parallel and serial data transmissions. They will also get acquainted with the methodology of controller design, with the principles of communication of the processor with the environment and the architecture of the bus system. The problems will be practically evaluated in the labs and with the help of the educational microprogrammed processor simulator and programmable hardware design kits (FPGA). BI-MPP.21 Methods of interfacing peripheral devices The course is focused on methods for interfacing of peripheral devices. Interfacing of real peripheral devices is focused on techniques based on Universal serial bus (USB). The course includes both PC side and peripheral devices side. Labs are practically oriented. Students gain experience with implementation of relevant parts of USB devices, Linux and Windows drivers, simple application development, and APIs of selected devices. BI-PJP.21 **Programming Languages and Compilers** Z,ZK Students learn basic compiling methods of programming languages. They are introduced to intermediate representations used in current compilers GNU and LLVM. They learn to create a specification of a translation of a text that conforms a given syntax, to a target code and also to create a compiler based on the specification. The compiler can translate not only a programming language but any text in a language generated by a given LL input grammar. BI-PMA Programming in Mathematica Z,ZK 4 Students will be working with modern technical and scientific software. Students will learn how to use different programming styles (functional programming, rule-based programming etc.), how to create dynamic interactive applications and visualisations, data processing and presentations. Machine Oriented Languages 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. Real-time systems Students obtain the basic knowledge in the real-time (RT) system theory and in the design methods for RT systems including the dependability issues. Theoretical knowledge from lectures will be experimentally verified in computer labs. The course is mainly focused on embedded RT systems, therefore the design kits in the lab are the same as in the BIE-VES course. BI-SVZ.21 Machine vision and image processing Camera systems are becoming a common part of life by being universally available. Related to this phenomenon is the need to process and evaluate image information. The course introduces students to different types of camera systems and a variety of methods for image and video processing. The course is focused on practical use of camera systems for solving problems of practice that the graduates may encounter. BI-VHS.21 Virtual game worlds In the course students learn methods to create a complex virtual world. It is a follow-up course of basic courses of the PG specialization (BIE-MGA, BIE-PGR). Students gain knowledge of the theory of game design, of principles of writing dialogues and characters in order to create a functional virtual world. Within the labs they get practical skills within team development work on the semester project. BI-VMM Selected Mathematical Methods Z,ZK We start reviewing geometric properties of linear spaces with inner product. Next, we introduce and analyze the discrete Fourier transform (DFT) and its fast implementation (FFT). Further we deal with differential calculus of functions involving multiple variables. We present methods for the localization of extreme values of functions. For this purposes, we study normed linear spaces and quadratic forms. In addition, we introduce the least square method. The last part of the course is devoted to optimization and duality. The linear programming and the Simplex method is analyzed in more detail. **Data Mining Algorithms** The course focuses on algorithms used in the fields of machine learning and data mining. However, this is not an introductory course, and the students should know machine 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 models (e.g., kernel methods). NI-ADP Architecture and Design patterns Z,ZK The objective of this course is to provide students with both work knowledge about the underlying foundations of object-oriented design and analysis as well as with understanding of the challenges, issues, and tradeoffs of advanced software design. In the first part of the course, the students will refresh and deepen their knowledge of object-oriented programming and get familiar with the commonly used object-oriented design patterns that represent the best practices for solving common software design problems. 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. NI-AFP Applied Functional Programming ΚZ 5 This course is presented in Czech. Functional programming represents one of the traditional programming paradigms. Traditional and novel functional programming languages are on the rise nowadays and the functional paradigm becomes an important construct of traditionally imperative languages (C++, C#, Java). As such, mastering this paradigm becomes a necessary competence of a software engineer: the theory and especially the practice. NI-AIB Algorithms of Information Security Z.ZK Students will get acquainted with the algorithms of secure key generation and cryptographic error (not only biometric) data processing. Furthermore, students will learn the mathematical principles of cryptographic protocols (identification, authentication, and signature schemes). Another part of the course is dedicated to malware detection and the use of machine learning in detection systems. The last topic includes practical steganographic methods and attacks on steganographic systems NI-AM1 Middleware Architectures 1 Z,ZK 5 Students will study new trends, concepts, and technologies in the area of service-oriented architectures. The will gain an overview of information system architecture, web service architecture and aplication servers. The will also study principles and technologies for middleware focused on application integrations, asynchronous communications and high availability of applications. NI-AM2 Middleware Architectures 2 7.7K 5 Students will learn new trends and technologies on the Web including theoretical foundations. They will gain an overview of Web application architectures, concepts and technologies for microservices, distrubuted cache and databases, smart contracts, realtime communication and web security. NI-AML Advanced machine learning Z,ZK The course introduces students to selected advanced topics of machine learning and artificial intelligence. The topics present techniques in the field of recommendation systems, image processing, control and interconnection of physical laws with the field of machine learning. The aim of the exercise is to familiarize students with the methods discussed. Architecture of computer games Students will gain a basic understanding of the various issues in the field of computer games development, especially from a technical point of view, but also from design and philosophical perspective. They will get a grasp of component-oriented and functional-oriented architecture, game mechanics, decision-making processes and base components that form an integral part of most games. They will also understand the basics of pathfinding, networking and scripting and apply them in practical exercises (labs). An important part of the course is an implementation of a simple game, with a strong focus on nontrivial game mechanics.

NI-APR			
	Selected Methods for Program Analysis	Z,ZK	5
Program analysis	studies program behavior with the aim of code optimization and error detection. Students will learn static program analysis, which app	oroximates prograr	n behavior
without the need	to actually run the program, as well as dynamic program analysis which analyse programs at runtime. Students will be introduced to the	he common techni	iques and
NII ADT	algorithms and use them on some classical problems.	7 71/	
NI-APT	Advanced Program Testing	Z,ZK	5
resurig a program	n is essential to ensure that a program respects its specification, that changes do not introduce regressions or security issues. The goa advanced program testing techniques, beyond writing unit tests, especially fuzzing and symbolic execution.	al of the course is	to present
NI-ARI	Computer arithmetic	Z,ZK	4
TWI 7 CENT	Students will learn various data representations used in digital devices and will be able to design arithmetic operations implementations.		7
NI-ATH	AlgorithmicTheories of Games	Z,ZK	4
	theory is a branch of mathematics, which has broad applications in economy, biology, politics and computer science. This theory stud		of agents
	ain competitive process by designinng a mathematical model and investigating the strategies. The traditional task of classical game the	•	
	s of the game where no player wants to deviate from his strategy. Due to the recent development of computers, internet, social networks		٠. ا
	s and other concepts the algorithmic point of view is gaining attention. In addition to existential questions we study the problems of eff concepts. In this course we introduce the basics of game theory of many players, solution concept (usually equilibria) and methods of	· ·	
NI-BKO	Error Control Codes	Z,ZK	5
_	Lift Control Codes	, ,	
NI-BML	Bayesian Methods for Machine Learning	KZ	5
	sed on practical use of basic Bayesian modeling methods in the dynamically evolving machine learning theory. In particular, it studies the		
models providing	description of real phenomena, as well as their subsequent use, e.g., for forecasting of future evolution or learning about the hidden visual states of the control of the	ariables (true obje	ct position
•	tions etc.). The emphasis is put on understanding of explained principles and methods and their practical adoption. For this purpose, a n		
and applications	will be presented to students, for instance, 2D/3D object tracking, radiation source term estimation, or separation in medical imaging.	The students will tr	y to solve
NI DDC	some of them.	7 71/	4
NI-BPS	Wireless Computer Networks  n about the modern technologies, protocols, and standards for wireless networks. They will understand the routing mechanisms in ad-	Z,ZK	4
	nisms, and data flow control mechanisms. They will also learn about principles of communication in sensor networks. They get knowle		
	for wireless networks and get skills of configuration of wireless network elements and simulation of wireless networks using suitable	-	
NI-BUI	Business Informatics	Z,ZK	5
The aim of the cour	'se is to focus on operational, tactical and strategic management of business informatics. Students will gain knowledge in the areas of bu	ısiness process ma	anagement,
	architectures in enterprise informatics. They will also learn about the principles, models and standards (ITIL, COBIT) in IT management		-
	nd resource management (sourcing). Students will learn the process of creating and implementing information strategy, IT Governance	•	
business and th	e context of information strategy with global business strategy. They will also gain knowledge in the areas of economic IT managemer management, IT investment evaluation and human resources management in IT (roles CIO, CEO, CFO).	nt, revenue and inv	estment
NI-BVS	Embedded Security	Z,ZK	5
_	c knowledge in selected topics of cryptography and cryptanalysis. The course focuses particularly on efficient implementations of cryptography		
ū	abedded systems). Students gain a good overview of functionality of (hardware) cryptographic accelerators, smart cards, and resources	•	
	of computer systems.		
NI-CCC	Creative Coding and Computational Art	KZ	4
=	practical tasks, get acquainted with creative and yet proven methods of visualizing various types of data. The course freely follows the b		rses (MGA, I
	luces students to suitable visualization methods for traditional as well as for open data. It combines well-known visualization technique es. The aim is to create an interesting visualization project. It is planned to work closely with IPR CAMP (Center of Architecture and M		
modern teermologi			hods using
	(Institute of Intermedia FEL).		hods using
NI-CPX	(Institute of Intermedia FEL).	letropolitan Plannii	hods using
NI-CPX Students will lear		/letropolitan Plannii Z,ZK	hods using ng) and IIM
Students will lear	(Institute of Intermedia FEL).  Complexity Theory	/letropolitan Plannii Z,ZK	hods using ng) and IIM
	(Institute of Intermedia FEL).  Complexity Theory In about the fundamental classes of problems in the complexity theory and different models of algoritms and about implications of the (in)tractability of difficult problems.  Capture The Flag	Z,ZK theory concerning	hods using ng) and IIM
Students will lear	(Institute of Intermedia FEL).  Complexity Theory In about the fundamental classes of problems in the complexity theory and different models of algoritms and about implications of the (in)tractability of difficult problems.  Capture The Flag  The course is designed to introduce students to CTF competitions and let them gain practical experience in the field of cyber sec	Z,ZK theory concerning  KZ curity.	hods using ng) and IIM  5 practical
NI-CTF NI-DDM	(Institute of Intermedia FEL).  Complexity Theory In about the fundamental classes of problems in the complexity theory and different models of algoritms and about implications of the (in)tractability of difficult problems.  Capture The Flag The course is designed to introduce students to CTF competitions and let them gain practical experience in the field of cyber section.  Distributed Data Mining	Z,ZK theory concerning  KZ curity.	hods using ng) and IIM  5 g practical  4
NI-CTF NI-DDM Course focuses or	(Institute of Intermedia FEL).  Complexity Theory  In about the fundamental classes of problems in the complexity theory and different models of algoritms and about implications of the (in)tractability of difficult problems.  Capture The Flag  The course is designed to introduce students to CTF competitions and let them gain practical experience in the field of cyber sec  Distributed Data Mining  In state-of-the-art approaches for distributed data mining and parallelization of machine learning algorithms. Students will gain hands on	Z,ZK theory concerning  KZ curity.  KZ on experience with	hods using ng) and IIM  5 g practical  4  4  large scale
NI-CTF NI-DDM Course focuses or	(Institute of Intermedia FEL).  Complexity Theory In about the fundamental classes of problems in the complexity theory and different models of algoritms and about implications of the (in)tractability of difficult problems.  Capture The Flag  The course is designed to introduce students to CTF competitions and let them gain practical experience in the field of cyber sec  Distributed Data Mining In state-of-the-art approaches for distributed data mining and parallelization of machine learning algorithms. Students will gain hands of amework Apache Spark and with existing distributed DM / ML algorithms. They will learn principles of their parallel implementations are	Z,ZK theory concerning  KZ curity.  KZ on experience with	hods using ng) and IIM  5 g practical  4  4  large scale
NI-CTF  NI-DDM  Course focuses or data processing fra	(Institute of Intermedia FEL).  Complexity Theory In about the fundamental classes of problems in the complexity theory and different models of algoritms and about implications of the (in)tractability of difficult problems.  Capture The Flag  The course is designed to introduce students to CTF competitions and let them gain practical experience in the field of cyber secondary in the course of the course o	Z,ZK theory concerning  KZ curity.  KZ on experience with nd will be capable	hods using ng) and IIM  5 practical  4  4 large scale to propose
NI-CTF NI-DDM Course focuses or data processing fra	(Institute of Intermedia FEL).  Complexity Theory In about the fundamental classes of problems in the complexity theory and different models of algoritms and about implications of the (in)tractability of difficult problems.  Capture The Flag  The course is designed to introduce students to CTF competitions and let them gain practical experience in the field of cyber sec  Distributed Data Mining In state-of-the-art approaches for distributed data mining and parallelization of machine learning algorithms. Students will gain hands of amework Apache Spark and with existing distributed DM / ML algorithms. They will learn principles of their parallel implementations are	Z,ZK theory concerning  KZ curity.  KZ on experience with nd will be capable  Z,ZK	hods using ng) and IIM  5 practical  4  4 large scale to propose
NI-CTF  NI-DDM Course focuses or data processing from the course of the	(Institute of Intermedia FEL).  Complexity Theory In about the fundamental classes of problems in the complexity theory and different models of algoritms and about implications of the (in)tractability of difficult problems.  Capture The Flag  The course is designed to introduce students to CTF competitions and let them gain practical experience in the field of cyber secondary in the course of the course o	Z,ZK theory concerning  KZ curity.  KZ on experience with nd will be capable  Z,ZK an overview of Wel	hods using ng) and IIM  5 practical  4 large scale to propose  5 b mining
NI-CTF  NI-DDM Course focuses or data processing from the course of the	(Institute of Intermedia FEL).  Complexity Theory In about the fundamental classes of problems in the complexity theory and different models of algoritms and about implications of the (in)tractability of difficult problems.  Capture The Flag  The course is designed to introduce students to CTF competitions and let them gain practical experience in the field of cyber section in the course of	Z,ZK theory concerning  KZ curity.  KZ on experience with nd will be capable  Z,ZK an overview of Wel	hods using ng) and IIM  5 practical  4 large scale to propose  5 b mining
NI-CTF  NI-DDM Course focuses or data processing from the course of the	(Institute of Intermedia FEL).  Complexity Theory In about the fundamental classes of problems in the complexity theory and different models of algoritms and about implications of the (in)tractability of difficult problems.  Capture The Flag The course is designed to introduce students to CTF competitions and let them gain practical experience in the field of cyber second problems.  Distributed Data Mining Instate-of-the-art approaches for distributed data mining and parallelization of machine learning algorithms. Students will gain hands on amework Apache Spark and with existing distributed DM / ML algorithms. They will learn principles of their parallel implementations are approaches to parallelize other algorithms. The course is prezented in czech language.  Web Data Mining  In latest methods and technologies for web data acquisition, analysis and utilization of the discovered knowledge. Students will gain a crawling, Web structure analysis, Web usage analysis, Web content mining and information extraction. Students will also gain an overview in the field of social web and recommendation systems.  Digital drawing	Z,ZK theory concerning  KZ curity.  KZ on experience with nd will be capable  Z,ZK an overview of Wel w of most recent de	hods using ng) and IIM  5 practical  4 large scale to propose  5 b mining velopments
NI-CTF  NI-DDM Course focuses or data processing from the course for Web  NI-DDW Students will lead techniques for Web  NI-DID The course will intremental techniques for Web	(Institute of Intermedia FEL).  Complexity Theory In about the fundamental classes of problems in the complexity theory and different models of algoritms and about implications of the (in)tractability of difficult problems.  Capture The Flag The course is designed to introduce students to CTF competitions and let them gain practical experience in the field of cyber secondary of the course is designed to introduce students to CTF competitions and let them gain practical experience in the field of cyber secondary of the course is designed to introduce students to CTF competitions and let them gain practical experience in the field of cyber secondary of the course is precedent of the field of cyber secondary of the course in the field of cyber seconda	Z,ZK theory concerning  KZ curity.  KZ on experience with nd will be capable  Z,ZK an overview of Wel w of most recent de	hods using ng) and IIM  5 practical  4 large scale to propose  5 b mining velopments  2 eory, which
NI-CTF  NI-DDM Course focuses or data processing from the course for Web  NI-DDW Students will lead techniques for Web  NI-DID The course will intrope will practically	Complexity Theory In about the fundamental classes of problems in the complexity theory and different models of algoritms and about implications of the (in)tractability of difficult problems.  Capture The Flag The course is designed to introduce students to CTF competitions and let them gain practical experience in the field of cyber secondary in the course of the	Z,ZK theory concerning  KZ curity.  KZ on experience with nd will be capable  Z,ZK an overview of Wel w of most recent de  Z vective and color th is fit for anyone wh	hods using ng) and IIM  5 practical  4 large scale to propose  5 b mining velopments  2 eory, which no wants to
NI-CTF  NI-DDM Course focuses or data processing fra  NI-DDW Students will leatechniques for Web  NI-DID The course will intrintey will practically practice of	(Institute of Intermedia FEL).  Complexity Theory In about the fundamental classes of problems in the complexity theory and different models of algoritms and about implications of the (in)tractability of difficult problems.  Capture The Flag The course is designed to introduce students to CTF competitions and let them gain practical experience in the field of cyber sectors are considered by the course of the field of cyber sectors are considered by the course of the course of the field of cyber sectors are considered by the course of the course of the field of cyber sectors are considered by the course of the course of the field of cyber sectors are considered by the course of the course of the field of cyber sectors are considered by the course of the course of the field of cyber sectors are considered by the course of the field of cyber sectors are considered by the field of cyber sectors and the field of the course of the field of the field of the field of the field of the course of the field of the f	Z,ZK theory concerning  KZ curity.  KZ on experience with nd will be capable  Z,ZK an overview of Wel w of most recent de  Z elective and color th is fit for anyone whose gained knowledd	hods using ng) and IIM  5 practical  4 large scale to propose  5 b mining velopments  2 eory, which no wants to ge.
NI-DDM Course focuses or data processing fra NI-DDW Students will leatechniques for Web NI-DID The course will intre they will practice of NI-DIP	Complexity Theory In about the fundamental classes of problems in the complexity theory and different models of algoritms and about implications of the (in)tractability of difficult problems.  Capture The Flag The course is designed to introduce students to CTF competitions and let them gain practical experience in the field of cyber section of the properties of distributed data mining and parallelization of machine learning algorithms. Students will gain hands of amework Apache Spark and with existing distributed DM / ML algorithms. They will learn principles of their parallel implementations are approaches to parallelize other algorithms. The course is prezented in czech language.  Web Data Mining  In latest methods and technologies for web data acquisition, analysis and utilization of the discovered knowledge. Students will gain as crawling, Web structure analysis, Web usage analysis, Web content mining and information extraction. Students will also gain an overview in the field of social web and recommendation systems.  Digital drawing  oduce students to the basic principals of digital drawing and graphical design. Students will gain understanding of composition, perspect apply in their own design works. Students will also gain experience in drawing and painting with digital and analog tools. The course is learn drawing and painting. The course is organized as a thematic practices covering parts of theory and practical exercise to practice.	Z,ZK theory concerning  KZ curity.  KZ on experience with nd will be capable  Z,ZK an overview of Wel w of most recent de  Z exective and color th is fit for anyone where gained knowleds  Z	hods using ng) and IIM  5 g practical  4 large scale to propose  5 b mining velopments  2 eory, which no wants to ge.  30
NI-DDM Course focuses or data processing fra NI-DDW Students will leatechniques for Web NI-DID The course will intrest will practice of NI-DIP NI-DIP NI-DNP	(Institute of Intermedia FEL).  Complexity Theory In about the fundamental classes of problems in the complexity theory and different models of algoritms and about implications of the (in)tractability of difficult problems.  Capture The Flag The course is designed to introduce students to CTF competitions and let them gain practical experience in the field of cyber section in the course of distributed data mining and parallelization of machine learning algorithms. Students will gain hands on amework Apache Spark and with existing distributed DM / ML algorithms. They will learn principles of their parallel implementations are approaches to parallelize other algorithms. The course is prezented in czech language.  Web Data Mining In latest methods and technologies for web data acquisition, analysis and utilization of the discovered knowledge. Students will gain a crawling, Web structure analysis, Web usage analysis, Web content mining and information extraction. Students will also gain an overview in the field of social web and recommendation systems.  Digital drawing oduce students to the basic principals of digital drawing and graphical design. Students will gain understanding of composition, perspote apply in their own design works. Students will also gain experience in drawing and painting with digital and analog tools. The course is learn drawing and painting. The course is organized as a thematic practices covering parts of theory and practical exercise to practice.  Diploma Project Advanced .NET	Z,ZK theory concerning  KZ curity.  KZ on experience with nd will be capable  Z,ZK an overview of Wele w of most recent de  z exective and color the is fit for anyone where gained knowled or Z Z,ZK	hods using ng) and IIM  5 practical  4 large scale to propose  5 b mining velopments  2 eory, which no wants to ge.  30 4
NI-CTF  NI-DDM Course focuses or data processing from the second of the	Complexity Theory In about the fundamental classes of problems in the complexity theory and different models of algoritms and about implications of the (in)tractability of difficult problems.  Capture The Flag The course is designed to introduce students to CTF competitions and let them gain practical experience in the field of cyber section of the properties of distributed data mining and parallelization of machine learning algorithms. Students will gain hands of amework Apache Spark and with existing distributed DM / ML algorithms. They will learn principles of their parallel implementations are approaches to parallelize other algorithms. The course is prezented in czech language.  Web Data Mining  In latest methods and technologies for web data acquisition, analysis and utilization of the discovered knowledge. Students will gain as crawling, Web structure analysis, Web usage analysis, Web content mining and information extraction. Students will also gain an overview in the field of social web and recommendation systems.  Digital drawing  oduce students to the basic principals of digital drawing and graphical design. Students will gain understanding of composition, perspect apply in their own design works. Students will also gain experience in drawing and painting with digital and analog tools. The course is learn drawing and painting. The course is organized as a thematic practices covering parts of theory and practical exercise to practice.	Aletropolitan Planning  Z,ZK  theory concerning  KZ  curity.  KZ  on experience with not will be capable  Z,ZK  an overview of Well w of most recent de word most recent de rective and color the is fit for anyone where gained knowled a Z  Z,ZK  so will get notions	hods using ng) and IIM  5 practical  4 large scale to propose  5 b mining velopments  2 eory, which no wants to ge.  30  4 of Azure
NI-CTF  NI-DDM Course focuses or data processing from the second of the	Complexity Theory In about the fundamental classes of problems in the complexity theory and different models of algoritms and about implications of the (in)tractability of difficult problems.  Capture The Flag The course is designed to introduce students to CTF competitions and let them gain practical experience in the field of cyber sec  Distributed Data Mining Is tate-of-the-art approaches for distributed data mining and parallelization of machine learning algorithms. Students will gain hands of amework Apache Spark and with existing distributed DM / ML algorithms. The course is prezented in czech language.  Web Data Mining  In altest methods and technologies for web data acquisition, analysis and utilization of the discovered knowledge. Students will gain a crawling, Web structure analysis, Web usage analysis, Web content mining and information extraction. Students will also gain an overview in the field of social web and recommendation systems.  Digital drawing oduce students to the basic principals of digital drawing and graphical design. Students will gain understanding of composition, perspert paptly in their own design works. Students will also gain experience in drawing and painting with digital and analog tools. The course of learn drawing and painting. The course is organized as a thematic practices covering parts of theory and practical exercise to practice.  Diploma Project  Advanced .NET quire an overview of platform .NET and will gain knowledge about technologies ASP.NET, Entity Framework, WPF, .NET MAUI and also	Aletropolitan Planning  Z,ZK  theory concerning  KZ  curity.  KZ  on experience with not will be capable  Z,ZK  an overview of Well w of most recent de word most recent de rective and color the is fit for anyone where gained knowled a Z  Z,ZK  so will get notions	hods using ng) and IIM  5 practical  4 large scale to propose  5 b mining velopments  2 eory, which no wants to ge.  30  4 of Azure
NI-CTF  NI-DDM Course focuses or data processing from the second of the	Complexity Theory In about the fundamental classes of problems in the complexity theory and different models of algoritms and about implications of the (in)tractability of difficult problems.  Capture The Flag The course is designed to introduce students to CTF competitions and let them gain practical experience in the field of cyber section of the position of the course is designed to introduce students to CTF competitions and let them gain practical experience in the field of cyber section of the course is designed to introduce students to CTF competitions and let them gain practical experience in the field of cyber section of the course is designed to introduce students to CTF competitions and let them gain practical experience in the field of cyber section of the discovered in the field of cyber section of the discovered students will gain hands on an approaches to parallelize other algorithms. They will learn principles of their parallel implementations are approaches to parallelize other algorithms. The course is prezented in czech language.  Web Data Mining  In latest methods and technologies for web data acquisition, analysis and utilization of the discovered knowledge. Students will gain an overview in the field of social web and recommendation systems.  Digital drawing  oduce students to the basic principals of digital drawing and graphical design. Students will gain understanding of composition, perspersed papely in their own design works. Students will also gain experience in drawing and painting with digital and analog tools. The course learn drawing and painting. The course is organized as a thematic practices covering parts of theory and practical exercise to practic piploma Project  Advanced .NET  quire an overview of platform .NET and will gain knowledge about technologies ASP.NET, Entity Framework, WPF, .NET MAUI and also to the social experience in semestral work where they will create a client-server application utilizing technologies ASP.	Aletropolitan Planning  Z,ZK  theory concerning  KZ  curity.  KZ  on experience with not will be capable  Z,ZK  an overview of Well w of most recent de word most recent de rective and color the is fit for anyone where gained knowled a Z  Z,ZK  so will get notions	hods using ng) and IIM  5 practical  4 large scale to propose  5 b mining velopments  2 eory, which no wants to ge.  30  4 of Azure
NI-DDM Course focuses or data processing from the course focuses or data processing from the course will lead techniques for Web  NI-DID The course will intractically practice or NI-DIP NI-DIP NI-DIP Students will ac DevOps and GIT NI-DPH The course complete	Complexity Theory In about the fundamental classes of problems in the complexity theory and different models of algoritms and about implications of the (in)tractability of difficult problems.  Capture The Flag The course is designed to introduce students to CTF competitions and let them gain practical experience in the field of cyber sectors of the course is designed to introduce students to CTF competitions and let them gain practical experience in the field of cyber sectors.  Distributed Data Mining In attate-of-the-art approaches for distributed data mining and parallelization of machine learning algorithms. Students will gain hands of amework Apache Spark and with existing distributed DM / ML algorithms. They will learn principles of their parallel implementations are approaches to parallelize other algorithms. The course is prezented in czech language.  Web Data Mining In altest methods and technologies for web data acquisition, analysis and utilization of the discovered knowledge. Students will gain a crawling, Web structure analysis, Web usage analysis, Web content mining and information extraction. Students will also gain an overview in the field of social web and recommendation systems.  Digital drawing oduce students to the basic principals of digital drawing and graphical design. Students will gain understanding of composition, persperate play in their own design works. Students will also gain experience in drawing and painting with digital and analog tools. The course is rearn drawing and painting. The course is organized as a thematic practices covering parts of theory and practical exercise to practic Diploma Project  Advanced .NET  quire an overview of platform .NET and will gain knowledge about technologies ASP.NET, Entity Framework, WPF, .NET MAUI and als .Students will get practical experience in semestral work where they will create a client-server application utilizing technologies ASP. (Blazor, .NET MAUI or WPF) and also Azure DevOps and GIT.  Game Design  ments the NI-APH (Architecture of	Aletropolitan Planning  Z,ZK  theory concerning  KZ  curity.  KZ  on experience with not will be capable  Z,ZK  an overview of Well wof most recent de wof most recent de ception and color the is fit for anyone where gained knowledge Z  Z,ZK  so will get notions NET, Entity Framework Resign. It is intended to the concerning of the ception and color the concerning of the ception and color the ception and ception	hods using high and IIM  5 practical  4 large scale to propose  5 b mining velopments  2 eory, which ho wants to ge.  30  4 of Azure work and  5 d for people
NI-DDM Course focuses or data processing from the course focuses or data processing from the course will lead techniques for Web  NI-DID The course will intremediate or NI-DIP NI-DIP NI-DIP Students will ac DevOps and GIT NI-DPH The course complete interested in deep	Complexity Theory In about the fundamental classes of problems in the complexity theory and different models of algoritms and about implications of the (in)tractability of difficult problems.  Capture The Flag The course is designed to introduce students to CTF competitions and let them gain practical experience in the field of cyber see Distributed Data Mining In state-of-the-art approaches for distributed data mining and parallelization of machine learning algorithms. Students will gain hands on amework Apache Spark and with existing distributed DM / ML algorithms. They will learn principles of their parallel implementations an approaches to parallelize other algorithms. The course is prezented in czech language.  Web Data Mining In latest methods and technologies for web data acquisition, analysis and utilization of the discovered knowledge. Students will gain a crawling, Web structure analysis, Web usage analysis, Web content mining and information extraction. Students will also gain an overview in the field of social web and recommendation systems.  Digital drawing  Oduce students to the basic principals of digital drawing and graphical design. Students will gain understanding of composition, perspervipply in their own design works. Students will also gain experience in drawing and painting with digital and analog tools. The course learn drawing and painting. The course is organized as a thematic practices covering parts of theory and practical exercise to practic Diploma Project  Advanced .NET  quire an overview of platform .NET and will gain knowledge about technologies ASP.NET, Entity Framework, WPF, .NET MAUI and als . Students will get practical experience in semestral work where they will create a client-server application utilizing technologies ASP. (Blazor, .NET MAUI or WPF) and also Azure DevOps and GIT.  Game Design  ments the NI-APH (Architecture of Computer Games) and BI-VHS (Virtual gaming worlds) course, while focusing primarily on game deter knowledge of the principles used for games design,	Aletropolitan Planning  Z,ZK  theory concerning  KZ  curity.  KZ  on experience with not will be capable  Z,ZK  an overview of Well wof most recent de wof most recent de capable of the c	hods using high and IIM  5 practical  4 large scale to propose  5 b mining velopments  2 eory, which ho wants to ge.  30  4 of Azure work and  5 d for people and game
NI-DDM Course focuses or data processing from the course focuses or data processing from the course will lead techniques for Web  NI-DID The course will intremediate or NI-DIP NI-DIP NI-DIP Students will ac DevOps and GIT NI-DPH The course complete interested in deep	Complexity Theory In about the fundamental classes of problems in the complexity theory and different models of algoritms and about implications of the (in)tractability of difficult problems.  Capture The Flag The course is designed to introduce students to CTF competitions and let them gain practical experience in the field of cyber sectors of the course is designed to introduce students to CTF competitions and let them gain practical experience in the field of cyber sectors.  Distributed Data Mining In attate-of-the-art approaches for distributed data mining and parallelization of machine learning algorithms. Students will gain hands of amework Apache Spark and with existing distributed DM / ML algorithms. They will learn principles of their parallel implementations are approaches to parallelize other algorithms. The course is prezented in czech language.  Web Data Mining In altest methods and technologies for web data acquisition, analysis and utilization of the discovered knowledge. Students will gain a crawling, Web structure analysis, Web usage analysis, Web content mining and information extraction. Students will also gain an overview in the field of social web and recommendation systems.  Digital drawing oduce students to the basic principals of digital drawing and graphical design. Students will gain understanding of composition, persperate play in their own design works. Students will also gain experience in drawing and painting with digital and analog tools. The course is rearn drawing and painting. The course is organized as a thematic practices covering parts of theory and practical exercise to practic Diploma Project  Advanced .NET  quire an overview of platform .NET and will gain knowledge about technologies ASP.NET, Entity Framework, WPF, .NET MAUI and als .Students will get practical experience in semestral work where they will create a client-server application utilizing technologies ASP. (Blazor, .NET MAUI or WPF) and also Azure DevOps and GIT.  Game Design  ments the NI-APH (Architecture of	Aletropolitan Planning  Z,ZK  theory concerning  KZ  curity.  KZ  on experience with not will be capable  Z,ZK  an overview of Well wof most recent de wof most recent de capable of the c	hods using high and IIM  5 practical  4 large scale to propose  5 b mining velopments  2 eory, which ho wants to ge.  30  4 of Azure work and  5 d for people and game

NI-DSS			
	Decision Support Systems	Z,ZK	5
	se is to provide students with knowledge and skills in decision support systems, their classification (Powerova), selected principles of o		
_	ented decision support systems. Students will also gain knowledge of multicriterial decision-making methods and game theory. They will i conceptually and ontologically oriented decision support systems and the basics of distribution, optimization and evolution methods ar		ine principies
NI-DSV	Distributed Systems and Computing	Z,ZK	5
_	iced to methods for coordination of processes in distributed environment characterised by nondeterministic time responses of computing	,	1
	in basic algorithms that assure correctness of computations realized by a group of loosely coupled processes and mechanisms that su	•	
onaoioi rrioy ioa	data and services, and safety in case of failures.	apport mgm aram	y 0. 50t.
NI-DSW	Design Sprint	Z	2
	on projects using the Design Sprint method, developed by Google. THanks to this method the teams are able to go from idea to validate	<del>-</del>	1
	idents will get familiar with the method as participants. Through practical challenges they will try the whole 5 day process starting with		-
	testing the prototypes (plus final presentation).		
NI-DVG	Introduction to Discrete and Computational Geometry	Z,ZK	5
The course intends	to introduce the students to the discipline of Discrete and Computational Geometry. The main goal of the course is to get familiar with	the most fundam	ental notions
	of this discipline, and to be able to solve simple algorithmic problems with a geometric component.		
NI-DZO	Digital Image Processing	Z,ZK	4
This course prese	nts a comprehensive overview of modern methods for interactive editing of digital images and video. It mainly deals with practical algorithms are comprehensive overview of modern methods for interactive editing of digital images and video. It mainly deals with practical algorithms are comprehensive overview of modern methods for interactive editing of digital images and video. It mainly deals with practical algorithms are comprehensive overview of modern methods for interactive editing of digital images and video. It mainly deals with practical algorithms are comprehensive overview of modern methods for interactive editing of digital images and video. It mainly deals with practical algorithms are comprehensive or constant and the constant are constant as a constant and the constant are constant are constant and the constant are constant and the constant are constant are constant are constant and constant are constant are constant are constant are const	orithms that are b	ooth easy to
-	e an interesting theoretical basis. Visually attractive applications provide better understanding of basic theoretical background that is also		
	processing. This course will introduce algorithms solving the following practical applications: edge-aware editing, tone mapping, HDR of the course will introduce algorithms solving the following practical applications: edge-aware editing, tone mapping, HDR of the course will introduce algorithms solving the following practical applications: edge-aware editing, tone mapping, HDR of the course will introduce algorithms solving the following practical applications: edge-aware editing, tone mapping, HDR of the course will introduce algorithms solving the following practical applications: edge-aware editing, tone mapping, HDR of the course will be applied to the course of the course will be applied to the course of the cours	-	_
	abstraction, hybrid images, gradient domain editing, seamless image stitching and cloning, digital photo-montage, color-to-gray conve		
	gid-as-possible image deformation, free-form image registration, texture synthesis, interactive segmentation, colorization, painting, ad		
NI-EDW	Enterprise Data Warehouse Systems	Z,ZK	5
•	ta Warehouses course focuses on the area of business intelligence. Students will be introduced to business intelligence methods and ing warehouses and various architectures, but also their deployment and maintenance. This course also includes an introduction to the		_
not only in design	visualization.	e area or reportir	ig allu uala
NI-EHW	Embedded Hardware	Z,ZK	5
	basic laws that govern digital design and basic techniques to use them. It deals with both large and small scale systems. This is the basic laws that govern digital design and basic techniques to use them.	•	-
-	from their specialized structure for effective computation and acceleration. Design of fast custom computing machines is discussed, in		
oyotoo, alat proli	of internal communication, parallelism extraction and utilization in special structures and system architectures.	nordaning otalidan	a.20aoa
NI-EPC	Effective C++ programming	Z,ZK	5
_	to use the modern features of contemporary versions of the C++ programming language for software development. The course focus	•	-
	iciency in the form of writing maintainable and portable source code and creating correct programs with low memory and processor til		-
NI-ESC	Experimental Project Course	KZ	8
"The Design Proje	ct course offers a holistic exploration of the design process, providing students with a well-rounded understanding of the principles, m	ethodologies, an	d tools used
in designing techno	logy-driven solutions that are user-centric and industry-relevant. Throughout the semester, students will work on real-world design proj	ects, collaborate	with industry
experts, and learn	$to\ integrate\ theory\ with\ practical\ application.\ Through\ a\ hands-on,\ project-based\ learning\ approach,\ students\ will\ develop\ their\ skills$	in user-centered	design and
	user experience evaluation, as well as gain experience working in a team to design and prototype a functional solution."		1
NI-ESW	Embedded Software	Z,ZK	5
	e course acquainted students with the specifics of software development for embedded systems. The course covers the areas from the base		
in C language and	I code optimizations, through typical areas as the reliable software development, embedded operating systems, signal processing, up	to sophisticated	techniques
NII EVO	combined with artificial intelligence.	7 71/	
NI-EVY	Efficient Text Pattern Matching	Z,ZK	5
Students get knowl	edge of efficient algorithms for text pattern matching. They learn to use so called succinct data structures that are efficient in both access They will be able to use the knowledge in design of applications that utilize pattern matching.	time and memor	y complexity
NI-FME		Z,ZK	5
	Formal Methods and Specifications  describe semantics of software formally and to use sound reasoning for construction of correct software. They learn to use some soft		
Oldderits are able i	basic properties of software. They learn to use some some software.	ware tools triat a	lilow to prove
NI-FMT	Finite model theory	Z,ZK	4
	·		1
	se is to introduce students to the basics of finite model theory. The original motivation is the questions expressibility and verifiability of		ร บา บลเลบลระ
The aim of the cou	se is to introduce students to the basics of finite model theory. The original motivation is the questions expressibility and verifiability of l nception in the 1970s, the course has evolved rapidly and touched on many other areas of theoretical computer science, such as des	logical properties	
The aim of the cou	se is to introduce students to the basics of finite model theory. The original motivation is the questions expressibility and verifiability of l nception in the 1970s, the course has evolved rapidly and touched on many other areas of theoretical computer science, such as desi Constraint Satisfaction Problem (CSP), the theory of algorithmic meta-theorems and combinatorics.	logical properties	
The aim of the cou systems. Since its	nception in the 1970s, the course has evolved rapidly and touched on many other areas of theoretical computer science, such as desc Constraint Satisfaction Problem (CSP), the theory of algorithmic meta-theorems and combinatorics.	logical properties criptive complexi	ty theory, the
The aim of the cou systems. Since its NI-GAK	nception in the 1970s, the course has evolved rapidly and touched on many other areas of theoretical computer science, such as described in the science of the course has evolved rapidly and touched on many other areas of theoretical computer science, such as described in the science of the course has evolved rapidly and touched on many other areas of theoretical computer science, such as described in the science of the course has evolved rapidly and touched on many other areas of theoretical computer science, such as described in the science of the course has evolved rapidly and touched on many other areas of the course has evolved rapidly and touched on many other areas of the course has evolved rapidly and touched on many other areas of the course has evolved rapidly and touched on many other areas of the course has evolved and the course of	logical properties criptive complexit	ty theory, the
The aim of the cou systems. Since its NI-GAK The goal of the cla	nception in the 1970s, the course has evolved rapidly and touched on many other areas of theoretical computer science, such as desc Constraint Satisfaction Problem (CSP), the theory of algorithmic meta-theorems and combinatorics.  Graph theory and combinatorics	logical properties criptive complexi Z,ZK The emphasis wi	ty theory, the
The aim of the cou systems. Since its NI-GAK The goal of the cla on undestanding th	Constraint Satisfaction Problem (CSP), the theory of algorithmic meta-theorems and combinatorics.  Graph theory and combinatorics  sis to introduce the most important topics in graph theory, combinatorics, combinatorial structures, discrete models and algorithms.	logical properties criptive complexion Z,ZK The emphasis with ics from graph and	ty theory, the
The aim of the cousystems. Since its  NI-GAK  The goal of the clason undestanding the coloring, Ramsey to	Constraint Satisfaction Problem (CSP), the theory of algorithmic meta-theorems and combinatorics.  Graph theory and combinatorics  sis to introduce the most important topics in graph theory, combinatorics, combinatorial structures, discrete models and algorithmic meta-theorems and combinatorics as is to introduce the most important topics in graph theory, combinatorics, combinatorial structures, discrete models and algorithms. The basic principles but also on applications in problem solving and algorithm design. The topics include: generating functions, selected topin theory, introduction to probabilistic method, properties of various special classes of graphs and combinatorial structures. The theory will of combinatorics on words, formal languages and bioinformatics.	logical properties criptive complexi Z,ZK The emphasis wil ics from graph and	ty theory, the  5 Il be not only d hypergraph t in the fields
The aim of the cou systems. Since its NI-GAK The goal of the cla on undestanding th	Constraint Satisfaction Problem (CSP), the theory of algorithmic meta-theorems and combinatorics.  Graph theory and combinatorics  Graph theory, combinatorics, combinatorial structures, discrete models and algorithmic meta-theorems and combinatorics is is to introduce the most important topics in graph theory, combinatorics, combinatorial structures, discrete models and algorithms. The basic principles but also on applications in problem solving and algorithm design. The topics include: generating functions, selected topineory, introduction to probabilistic method, properties of various special classes of graphs and combinatorial structures. The theory with of combinatorics on words, formal languages and bioinformatics.  Code Generators	logical properties criptive complexi Z,ZK The emphasis wi ics from graph and ill be also applied Z,ZK	ty theory, the
The aim of the cousystems. Since its  NI-GAK  The goal of the clason undestanding the coloring, Ramsey to	Constraint Satisfaction Problem (CSP), the theory of algorithmic meta-theorems and combinatorics.  Graph theory and combinatorics  sis to introduce the most important topics in graph theory, combinatorics, combinatorial structures, discrete models and algorithmic meta-theorems and combinatorics as is to introduce the most important topics in graph theory, combinatorics, combinatorial structures, discrete models and algorithms. The basic principles but also on applications in problem solving and algorithm design. The topics include: generating functions, selected topin theory, introduction to probabilistic method, properties of various special classes of graphs and combinatorial structures. The theory will of combinatorics on words, formal languages and bioinformatics.	logical properties criptive complexi Z,ZK The emphasis wil ics from graph and	ty theory, the  5 Il be not only d hypergraph t in the fields
The aim of the cousystems. Since its  NI-GAK The goal of the claon undestanding the coloring, Ramsey to NI-GEN  NI-GEN	Constraint Satisfaction Problem (CSP), the theory of algorithmic meta-theorems and combinatorics.  Graph theory and combinatorics  sis is to introduce the most important topics in graph theory, combinatorics, combinatorial structures, discrete models and algorithms. The topics include: generating functions, selected topic heory, introduction to probabilistic method, properties of various special classes of graphs and combinatorial structures. The theory with of combinatorics on words, formal languages and bioinformatics.  Code Generators  Games and reinforcement learning  cement learning is very hot recently, because of advances in deep learning, recurrent neural networks and general artificial intelligence.	Iogical properties criptive complexifur Z,ZK  The emphasis with items from graph and items also applied Z,ZK  Z,ZK  Z,ZK  ce. This course is	ty theory, the
The aim of the cousystems. Since its  NI-GAK The goal of the clason undestanding the coloring, Ramsey to the coloring the	Constraint Satisfaction Problem (CSP), the theory of algorithmic meta-theorems and combinatorics.  Graph theory and combinatorics  size is to introduce the most important topics in graph theory, combinatorics, combinatorial structures, discrete models and algorithms. The topics include: generating functions, selected topic heory, introduction to probabilistic method, properties of various special classes of graphs and combinatorial structures. The theory with of combinatorics on words, formal languages and bioinformatics.  Code Generators  Games and reinforcement learning  cement learning is very hot recently, because of advances in deep learning, recurrent neural networks and general artificial intelligence give you both theoretical and practical background so you can participate in related research activities. Presented in English	Iogical properties criptive complexiformula Z,ZK  The emphasis with idea from graph and ill be also applied Z,ZK  Z,ZK  Z,ZK  ce. This course is in.	ty theory, the
The aim of the cousystems. Since its  NI-GAK The goal of the classon undestanding the coloring, Ramsey to the Coloring and th	Constraint Satisfaction Problem (CSP), the theory of algorithmic meta-theorems and combinatorics.  Graph theory and combinatorics  sis is to introduce the most important topics in graph theory, combinatorics, combinatorial structures, discrete models and algorithms. The topics include: generating functions, selected topic heory, introduction to probabilistic method, properties of various special classes of graphs and combinatorial structures. The theory with of combinatorics on words, formal languages and bioinformatics.  Code Generators  Games and reinforcement learning  cement learning is very hot recently, because of advances in deep learning, recurrent neural networks and general artificial intelligence give you both theoretical and practical background so you can participate in related research activities. Presented in English  Graph Neural Networks	Iogical properties criptive complexiform Z,ZK The emphasis will ice from graph and ill be also applied Z,ZK Z,ZK Z,ZK ce. This course is a Z,ZK	ty theory, the
The aim of the cousystems. Since its  NI-GAK The goal of the classon undestanding the coloring, Ramsey to the coloring the coloring that t	Constraint Satisfaction Problem (CSP), the theory of algorithmic meta-theorems and combinatorics.  Graph theory and combinatorics  sis is to introduce the most important topics in graph theory, combinatorics, combinatorial structures, discrete models and algorithmic meta-theorems and combinatorics are basic principles but also on applications in problem solving and algorithm design. The topics include: generating functions, selected topineory, introduction to probabilistic method, properties of various special classes of graphs and combinatorial structures. The theory with of combinatorics on words, formal languages and bioinformatics.  Code Generators  Games and reinforcement learning  cement learning is very hot recently, because of advances in deep learning, recurrent neural networks and general artificial intelligence give you both theoretical and practical background so you can participate in related research activities. Presented in English  Graph Neural Networks  oduces students to advanced artificial intelligence techniques for working with graphs. Lectures will focus on the latest graph neural networks	Iogical properties criptive complexiform and a second properties of the emphasis will confide the emphasis will be also applied a second properties and a second properties are a second properties are a second properties and a second properties are a second properties ar	ty theory, the
The aim of the cousystems. Since its  NI-GAK The goal of the classon undestanding the coloring, Ramsey to the coloring the coloring that t	Constraint Satisfaction Problem (CSP), the theory of algorithmic meta-theorems and combinatorics.  Graph theory and combinatorics  sis is to introduce the most important topics in graph theory, combinatorics, combinatorial structures, discrete models and algorithms. The topics include: generating functions, selected topic heory, introduction to probabilistic method, properties of various special classes of graphs and combinatorial structures. The theory with of combinatorics on words, formal languages and bioinformatics.  Code Generators  Games and reinforcement learning  cement learning is very hot recently, because of advances in deep learning, recurrent neural networks and general artificial intelligence give you both theoretical and practical background so you can participate in related research activities. Presented in English  Graph Neural Networks  oduces students to advanced artificial intelligence techniques for working with graphs. Lectures will focus on the latest graph neural networks, including time-varying graphs. The last pages of graphs, including time-varying graphs. The last pages and entire graphs. The techniques discussed cover various types of graphs, including time-varying graphs. The last pages and graphs including time-varying graphs.	Iogical properties criptive complexiform and a complexiform graph and ill be also applied a course is a course is a course for creating art of the course a course as a course art of the course a course are course is a course are course as a course and course are course as a course are course and course are course and course are course are course and course are course and course are cours	ty theory, the
The aim of the cousystems. Since its  NI-GAK The goal of the classon undestanding the coloring, Ramsey to the coloring of the classon in the coloring of the c	Constraint Satisfaction Problem (CSP), the theory of algorithmic meta-theorems and combinatorics.  Graph theory and combinatorics  sis is to introduce the most important topics in graph theory, combinatorics, combinatorial structures, discrete models and algorithms. The topics include: generating functions, selected topineory, introduction to probabilistic method, properties of various special classes of graphs and combinatorial structures. The theory with of combinatorics on words, formal languages and bioinformatics.  Code Generators  Games and reinforcement learning  cement learning is very hot recently, because of advances in deep learning, recurrent neural networks and general artificial intelligence give you both theoretical and practical background so you can participate in related research activities. Presented in English  Graph Neural Networks  duces students to advanced artificial intelligence techniques for working with graphs. Lectures will focus on the latest graph neural networks, including time-varying graphs. The last pagraph generation and interpretability of graph neural networks. In the exercises, students will try out selected techniques and protections.	Iogical properties criptive complexiform and a second properties are second properties and a second properties and a second properties are secon	ty theory, the
The aim of the cousystems. Since its  NI-GAK The goal of the classon undestanding the coloring, Ramsey to the coloring of the classon in the coloring of the c	Constraint Satisfaction Problem (CSP), the theory of algorithmic meta-theorems and combinatorics.  Graph theory and combinatorics  sis is to introduce the most important topics in graph theory, combinatorics, combinatorial structures, discrete models and algorithms. The basic principles but also on applications in problem solving and algorithm design. The topics include: generating functions, selected topineory, introduction to probabilistic method, properties of various special classes of graphs and combinatorial structures. The theory with of combinatorics on words, formal languages and bioinformatics.  Code Generators  Games and reinforcement learning  cement learning is very hot recently, because of advances in deep learning, recurrent neural networks and general artificial intelligence give you both theoretical and practical background so you can participate in related research activities. Presented in English  Graph Neural Networks  duces students to advanced artificial intelligence techniques for working with graphs. Lectures will focus on the latest graph neural networks, and generation and interpretability of graph neural networks. In the exercises, students will try out selected techniques and proton GPU Architectures and Programming	Iogical properties criptive complexifor and properties criptive complexifor and properties are complexed and properties are consistent and of the course and plems.  Z,ZK  Z,ZK  z,ZK  z,ZK  z,ZK  ce. This course is in.  Z,ZK  etworks for creating art of the course and plems.  Z,ZK	ty theory, the
The aim of the cousystems. Since its  NI-GAK The goal of the class on undestanding the coloring, Ramsey to the coloring of the	computer science, such as description in the 1970s, the course has evolved rapidly and touched on many other areas of theoretical computer science, such as description in the 1970s, the course has evolved rapidly and touched on many other areas of theoretical computer science, such as description in the 1970s, the course has evolved reproduced to probabilistic method, properties of various special classes of graphs and combinatorial structures. The theory with of combinatorics on words, formal languages and bioinformatics.  Code Generators  Games and reinforcement learning  cement learning is very hot recently, because of advances in deep learning, recurrent neural networks and general artificial intelligence give you both theoretical and practical background so you can participate in related research activities. Presented in English  Graph Neural Networks  duces students to advanced artificial intelligence techniques for working with graphs. Lectures will focus on the latest graph neural networks, and generation and interpretability of graph neural networks. In the exercises, students will try out selected techniques and protectures and Programming  nowledge of the internal architecture of modern massively parallel GPU processors. They will learn to program them mainly in the CUD	Iogical properties criptive complexis and properties are complexed.  Z,ZK The emphasis with its from graph and graph	ty theory, the
The aim of the cousystems. Since its  NI-GAK The goal of the classon undestanding the coloring, Ramsey to the coloring of the classon in the coloring of the c	Constraint Satisfaction Problem (CSP), the theory of algorithmic meta-theorems and combinatorics.  Graph theory and combinatorics  Graph theory and combinatorics  sis to introduce the most important topics in graph theory, combinatorics, combinatorial structures, discrete models and algorithms. The basic principles but also on applications in problem solving and algorithm design. The topics include: generating functions, selected topin theory, introduction to probabilistic method, properties of various special classes of graphs and combinatorial structures. The theory with of combinatorics on words, formal languages and bioinformatics.  Code Generators  Games and reinforcement learning  Comment learning is very hot recently, because of advances in deep learning, recurrent neural networks and general artificial intelligence give you both theoretical and practical background so you can participate in related research activities. Presented in English Graph Neural Networks  Graph Neural Networks  In oddes, edges and entire graphs. The techniques discussed cover various types of graphs, including time-varying graphs. The last participate in the programming and interpretability of graph neural networks. In the exercises, students will try out selected techniques and protective of the internal architecture of modern massively parallel GPU processors. They will learn to program them mainly in the CUD didespread programming technology of GPU processors. As an integral part of the effective computational use of these hierarchical compided to the internal architecture of modern massively parallel GPU processors. They will learn to program them he interactical compided the internal architecture of modern massively parallel GPU processors. They will learn to program them he interactical compided programming technology of GPU processors. As an integral part of the effective computational use of these hierarchical compided processors.	Iogical properties criptive complexis and properties are complexed.  Z,ZK The emphasis with its from graph and graph	ty theory, the
The aim of the cousystems. Since its  NI-GAK The goal of the classon undestanding the coloring, Ramsey to the coloring, Ramsey to the coloring of the coloring	Constraint Satisfaction Problem (CSP), the theory of algorithmic meta-theorems and combinatorics.  Graph theory and combinatorics  sis to introduce the most important topics in graph theory, combinatorics, combinatorial structures, discrete models and algorithms. The topics include: generating functions, selected topinatorics of combinatorics on words, formal languages and bioinformatics.  Code Generators  Games and reinforcement learning  cement learning is very hot recently, because of advances in deep learning, recurrent neural networks and general artificial intelligence give you both theoretical and practical background so you can participate in related research activities. Presented in English Graph Neural Networks  diduces students to advanced artificial intelligence techniques for working with graphs. Lectures will focus on the latest graph neural networks and entire graphs. The techniques discussed cover various types of graphs, including time-varying graphs. The last pagraph generation and interpretability of graph neural networks. In the exercises, students will try out selected techniques and protective of the internal architecture of modern massively parallel GPU processors. They will learn to program them mainly in the CUD ridespread programming technology of GPU processors. As an integral part of the effective computational use of these hierarchical computations and methods of programming multiprocessor GPU systems.	Iogical properties criptive complexis and a second policy and a se	ty theory, the
The aim of the cousystems. Since its  NI-GAK The goal of the classon undestanding the coloring, Ramsey to the coloring of the classon in the coloring of the c	Constraint Satisfaction Problem (CSP), the theory of algorithmic meta-theorems and combinatorics.  Graph theory and combinatorics  Graph theory and combinatorics  sis to introduce the most important topics in graph theory, combinatorics, combinatorial structures, discrete models and algorithms. The basic principles but also on applications in problem solving and algorithm design. The topics include: generating functions, selected topin theory, introduction to probabilistic method, properties of various special classes of graphs and combinatorial structures. The theory with of combinatorics on words, formal languages and bioinformatics.  Code Generators  Games and reinforcement learning  Comment learning is very hot recently, because of advances in deep learning, recurrent neural networks and general artificial intelligence give you both theoretical and practical background so you can participate in related research activities. Presented in English Graph Neural Networks  Graph Neural Networks  In oddes, edges and entire graphs. The techniques discussed cover various types of graphs, including time-varying graphs. The last participate in the programming and interpretability of graph neural networks. In the exercises, students will try out selected techniques and protective of the internal architecture of modern massively parallel GPU processors. They will learn to program them mainly in the CUD didespread programming technology of GPU processors. As an integral part of the effective computational use of these hierarchical compided to the internal architecture of modern massively parallel GPU processors. They will learn to program them he interactical compided the internal architecture of modern massively parallel GPU processors. They will learn to program them he interactical compided programming technology of GPU processors. As an integral part of the effective computational use of these hierarchical compided processors.	Iogical properties criptive complexis and properties are complexed.  Z,ZK The emphasis with its from graph and graph	ty theory, the

NI-HCM Mind Hacking ZK 5 Cognitive security is an emerging discipline that is closely related to cyber security. While the domain of cyber security is the protection of networks, information systems and assets, the domain of cognitive security is the protection of the human mind from intentional and unintentional digital manipulation. The topic of cognitive security is growing in importance in the context of information warfare, increasing digital dependence and the development of artificial intelligence, where these phenomena from the Internet environment have real societal impacts such as disruption of social cohesion, threats to democracy or war. NI-HMI2 History of Mathematics and Informatics This course is presented in Czech. Selected topics {Infinitesimal calculus, probability, number theory, general algebra, different examples of algorithms, transformations, recursive functions, eliptic curves, etc.) note on possibilities of applications of some mathematical methods in informatics and its development. NI-HSC Side-Channel Analysis in Hardware This course is dedicated to so-called side-channel information leakage in hardware devices. It focuses on both theoretical analysis and practical attacks. Students get familiar with various kinds of side channels and they get deeper insight in power attacks. Students learn to implement various profiled and non-profiled attacks and get familiar with higher-order attacks. They also get practice in both designing the SCA countermeasures and analyzing the amount and characteristics of the side-channel information leakage Hardware Security NI-HWB The course provides the knowledge needed for the analysis and design of computer systems security solutions. Students get an overview of safeguards against abuse of the system using hardware means. They will be able to safely use and integrate hardware components into systems and test them for resistance to attacks. Students will gain knowledge about the cryptographic accelerators, PUF, random number generators, smart cards, biometric devices, and devices for internal security functions of the computer. NI-IAM Internet and Multimedia The NI-IAM course is focused on principles and modern technologies for network transmissions of audiovisual (AV) signals. The syllabus includes acquisition of AV signals (input), presentation of AV signals (output), network communication protocols, device interfaces, codecs, data formats and stereoscopy. We will look at practical use case scenarios of real-time audiovisual transmissions. Within the labs, students will practically assemble AV transmission chains using HW and SW technologies and verify the effect of various components on the quality and latency of AV transmissions. Students will learn how to build Internet infrastructure for end-to-end AV transmissions from the recording the scene up to the presentation NI-IBE Information Security Students learn information and IS/ICT security management systems (ISMS), methods for information access control, and basic norms and international standards in 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., penetration testing) NI-IKM Internet and Classification Methods In this course, the students get acquainted with classification methods used in four important internet, or generally network applications: in spam filtering, in recommendation systems, in malware detection systems and in intrusion detection systems. However, they will learn more than only how classification is performed when solving these four kinds of problems. On the background of these applications, they get an overview of the fundamentals of classification methods. The course is taught in a 2-weeks cycle with 2-hour lectures and 2-hour exercises. During the exercises, the students on the one hand implement simple examples to topics from the lectures, on the other hand consult their semester tasks. NI-IOS Advanced techniques in iOS applications Students will learn the latest trends in mobile development technologies for iOS platform. Class covers advanced topics, students need to know all the basics from the beginners class NI-IOT Internet of Things The subject is focused on the area of hardware and software technologies for the strongly growing computer support of various devices. Its goal is familiarization with available development elements (Raspberry Pi, Arduino Due) and with the language for efficient application development and modification (GNU Forth). NI-IVS Intelligent embedded systems ΚZ Intelligent embedded systems course for master's degree is focused on high-level technology embedded systems integrating artificial intelligence. The course is an advance version of the Intelligent embedded system fundamentals course for the bachelor degree. The aim of the course is to teach students humanoid robot programming and advance application development. Lectures provide basis of motion control, sensor reading, application interfaces, robot navigation and development tools. In labs, students develop advanced applications combining knowledge of various courses like nature inspired algorithms, data mining algorithms, image recognition and web technologies NI-KOD **Data Compression** Students are introduced to the basic principles of data compression. They will learn the necessary theoretical background and get an overview of data compression methods being used in practice. The overview covers principles of integer coding and of statistical, dictionary, and context data compression methods. In addition, students learn the fundamentals of lossy data compression methods used in image, audio, and video compression. NI-KOP Combinatorial Optimization Z,ZK 6 The students will gain knowledge and understanding necessary deployment of combinatorial heuristics at a professional level. They will be able not only to select and implement but also to apply and evaluate heuristics for practical problems. Advanced Cryptology Students will learn the essentials of cryptanalysis and the mathematical principles of constructing symmetric and asymmetric ciphers. They will know the mathematical principles of random number generators. They will have an overview of cryptanalysis methods, elliptic curve cryptography and quantum cryptography, which they can apply to the integration of their own systems or to the creation of their own software solutions. Combinatorial Theories of Games Traditional game theory is a branch of mathematics, which has broad applications in economy, biology, politics and computer science. This theory studies the behaviour of agents (players) of a certain competitive process by designing a mathematical model and investigating the strategies. The traditional task of classical game theory is to find the equilibria. which are the states of the game where no player wants to deviate from his strategy. Historically, the second big development in game theory of two-player full-information combinatorial games, was by Conway, Berlekamp and Guy. They developed a theory, originally used for solving end-games in Go, into a full fledged field. The idea is to evaluate games such that otherwise incompatible games can be added, that is, played simultaneously. This led to the algrebraic approach to study combinatorial games. The third most important step is the work of Beck, who established the theory of positional games (like tic-tac-toe and hex). In analysis of these game, one cannot escape the brute-force traversal of the game tree, which is no efficient. Beck introduced the "false probabilistic method", which aims to tackhle this problem. In this course we build the foundation of the theory of combinatorial and positional games. We focus on theoretical analysis of games and building the theory, not on the programming aspects of game solving algorithms. The course requires independent work, ability to mathematically analyse, think and proof. The course is also suitable for bachelors student in the third year, who attended introduction to graph theory, as well as for PhD students looking for research topics. Cybernality Students get acquainted with the fundamentals of legislation and international activities in the area of fighting cybercrime. Students will understand the classification of attacks and have an overview of systems for computer surveillance and traffic monitoring in the cyberspace. Students will also familiarize themselves with hacker activities and behavior. The course will also discuss the cooperation of the state agencies and subjects dealing with defence of the cyberspace (especially CSIRT and CERT teams). Linear Optimization and Methods Students learn the applications of optimization methods in computer science, economics, and industry. They are aware of practical importance of linear and integer programming. They are able to work with optimization software and are familiar with languages used in programming of that software. They get skills in formalization of optimization problems in computer science (such as scheduling of tasks to processors, analysis of network flows), distribution and allocation of resources (transportation problems, travelling salesman problems, etc.),

issues from economics, and modelling of conflicts via the game theory. They get an overview of computational complexity of optimization problems. The in linear programming.	ey get orientation in	algorithms
NI-LSM2 Statistical Modelling Lab	KZ	5
The topic of LSM2 is advanced multiple target tracking (MTT). This domain covers simultaneous tracking of multiple targets using radar under the presentation of the control of LSM2 is advanced multiple target tracking (MTT).	ence of clutter, or vid	leo tracking.
We aim at the state-of-the-art filters, in particular the PHD (Probability Hypothesis Density) and PMBM (Poisson Multi-Bernoull		Г
NI-MCC Multicore CPU Computing	Z,ZK	5
Students will get acquainted in detail with hardware support and programming technologies for the creation of parallel multithreaded computations on mention and with all support and programming performing performing performance of parallel multithreaded computations on mention and with all support and performance of parallel multithreaded computations on mentions and with all support and performance of parallel multithreaded computations on mentions and with all support and performance of parallel multithreaded computations on mentions and with all support and programming technologies for the creation of parallel multithreaded computations on mentions and with all support and programming technologies for the creation of parallel multithreaded computations on mentions and with all support and programming technologies for the creation of parallel multithreaded computations on mentions and with all support and programming technologies for the creation of parallel multithreaded computations and the programming technologies for the creation of parallel multithreaded computations and the programming technologies for the creation of parallel multithreaded computations and the programming technologies for the creation of parallel multithreaded computations and the programming technologies for the creation of parallel multithreaded computations and the programming technologies for the creation of parallel multithreaded computations and the programming technologies for the creation of parallel multithreaded computations and the programming technologies for the creation of parallel multithreaded computations and the programming technologies for the creation of parallel multithreaded computations and the programming technologies for the creation of parallel multithreaded computations and the programming technologies for the creation of the creation of the parallel multithreaded computations are creation of the cr	•	
and virtually shared memories, which are today the most common computing nodes of powerful (super)computer systems. Students will gain knowled optimization techniques used to reduce the performance drop due to the widening gap between the computational requirements of multi-core CPUs and	_	
On specific non-trivial multithreaded programs, students will also learn the basics of the art of creating these applications	=	unougnpuu
NI-MEP Modelling of Enterprise Processes	Z,ZK	5
The subject is focused on introduction to the discipline of Enterprise Engineering. Students learn the importance of a proper methodological appro	ach for (re)engineer	ring and
implementation of processes, organisation structures and information support in big enterprises and institutions.		
NI-MKY   Mathematics for Cryptology	Z,ZK	5
Students will gain deeper knowledge of algebraic procedures solving the most important mathematical problems concerning the security of ciphers. In	•	
on the problem of solving a system of polynomial equations over a finite field, the problem of factorization of large numbers and the problem of discr factorization will also be solved on elliptic curves. Students will further become familiar with modern encryption systems based o		iobieiii oi
NI-MLP Machine Learning in Practice	Z,ZK	5
Applying machine learning methods to real projects in practice involves many other necessary tasks - from understanding the intentions of the client to, ic	1 '	-
The course guides students through all phases of a project according to the standard CRISP-DM methodology, not only theoretically but also practical	ly. The aim is to exp	erience real
data processing and learn how to describe the whole process from exploration to evaluation of the model performance in the form of a clear and	d understandable re	
NI-MOP   Modern Object-Oriented Programming in Pharo	KZ	4
Object-oriented programming is currently one of the most widespread paradigms of software creation, especially enterprise information systems, where	•	
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 skil of object systems in modern pure object system Pharo (https://pharo.org). The course focuses on individual approach to students, their development		
addition to deepening object programming skills, which are generally applicable in other OO languages, students will also gain the opportunity to work		
technologies in terms of semestral work with the possibility of cooperation with practice and related bachelor, diploma, postgraduate our direct involve	ment in the Pharo C	Consortium.
NI-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	•	
multi-variate integration. The third large topic is computer arithmetics and number representation in a computer along with error manipulation. The last to		
algorithm and their stability analysis. The topics are completed with demonstration of applications in computer science. The course focuses on clear property of Drogramming Longue and Course focuses on clear property of Drogramming Course focus and Course fo		
NI-MPJ   Modelling of Programming Languages  The analysis, transformation, and code generation processes depend on the semantics of the language; in particular, they are correct if they preserve	Z,ZK	5 e language
This course explores the semantics of programming languages. The students will learn the language models with emphasis on functional languages, students will searn the language models with emphasis on functional languages, students will searn the language models with emphasis on functional languages.		
the basics of the lambda calculus and here get acquainted with the advanced lambda calculus. The students also get hands-on-experience with semant	· · · · · · · · · · · · · · · · · · ·	
NI-MPL Managerial Psychology	ZK	2
NI-MPR Master Project	Z	7
NI-MPR Master Project  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 t	Z asks that should be	7 carried out
NI-MPR  Master Project  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 touring the semester. If the requirements they agreed upon are met, the supervisor awards the student an assessment for the course MI-MPR at the ending the semester.	Z asks that should be nd of the semester.	7 carried out 2. External
NI-MPR  Master Project  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 t during the semester. If the requirements they agreed upon are met, the supervisor awards the student an assessment for the course MI-MPR at the e Master these (MT) supervisor fills his/her assessment into the paper "Form to award assessment by an external Final theses (FT) supervisor" (for the	Z asks that should be nd of the semester. e courses BIE-BAP,	7 carried out 2. External MIE-MPR,
NI-MPR  Master Project  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 touring the semester. If the requirements they agreed upon are met, the supervisor awards the student an assessment for the course MI-MPR at the ending the semester.	Z asks that should be nd of the semester. e courses BIE-BAP, assessment to the I	7 carried out 2. External MIE-MPR, S based on
NI-MPR  Master Project  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 t during the semester. If the requirements they agreed upon are met, the supervisor awards the student an assessment for the course MI-MPR at the e Master these (MT) supervisor fills his/her assessment into the paper "Form to award assessment by an external Final theses (FT) supervisor" (for the MIE-DIP). Students, then, ensure that the assessment is registered into the information system (IS) by asking their internal FT opponent to award the	Z asks that should be nd of the semester. c courses BIE-BAP, assessment to the I d of the department	7 carried out 2. External MIE-MPR, S based on responsible
NI-MPR  Master Project  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 t during the semester. If the requirements they agreed upon are met, the supervisor awards the student an assessment for the course MI-MPR at the e Master these (MT) supervisor fills his/her assessment into the paper "Form to award assessment by an external Final theses (FT) supervisor" (for the MIE-DIP). Students, then, ensure that the assessment is registered into the information system (IS) by asking their internal FT opponent to award the 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 head for the topic of the MT. 3. If the FT topic that the student has reserved is rather general, the immediate tasks the supervisor assigns to the student for aim at fine-tuning the FT topic so that the FTT will be complete and approvable at the end of the semester.	Z asks that should be nd of the semester. c courses BIE-BAP, assessment to the I d of the department the upcoming seme	7 carried out 2. External MIE-MPR, S based on responsible
NI-MPR  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 to during the semester. If the requirements they agreed upon are met, the supervisor awards the student an assessment for the course MI-MPR at the experiment of the supervisor fills his/her assessment into the paper "Form to award assessment by an external Final theses (FT) supervisor" (for the MIE-DIP). Students, then, ensure that the assessment is registered into the information system (IS) by asking their internal FT opponent to award the 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 head for the topic of the MT. 3. If the FT topic that the student has reserved is rather general, the immediate tasks the supervisor assigns to the student for aim at fine-tuning the FT topic so that the FTT will be complete and approvable at the end of the semester.  NI-MSI  Mathematical Structures in Computer Science	Z asks that should be nd of the semester. c courses BIE-BAP, assessment to the I d of the department the upcoming seme	7 carried out 2. External MIE-MPR, S based on responsible ster should
NI-MPR  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 touring the semester. If the requirements they agreed upon are met, the supervisor awards the student an assessment for the course MI-MPR at the embedding of the supervisor fills his/her assessment into the paper "Form to award assessment by an external Final theses (FT) supervisor" (for the MIE-DIP). Students, then, ensure that the assessment is registered into the information system (IS) by asking their internal FT opponent to award the 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 head for the topic of the MT. 3. If the FT topic that the student has reserved is rather general, the immediate tasks the supervisor assigns to the student for aim at fine-tuning the FT topic so that the FTT will be complete and approvable at the end of the semester.  NI-MSI  Mathematical Structures in Computer Science  Mathematical semantics of programming languages. Data types as continuous lattices, Scott topology. Procedures as continuous mappings. The Scott	Z asks that should be nd of the semester. c courses BIE-BAP, assessment to the I d of the department the upcoming seme	7 carried out 2. External MIE-MPR, S based on responsible ster should
NI-MPR  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 touring the semester. If the requirements they agreed upon are met, the supervisor awards the student an assessment for the course MI-MPR at the elements (MT) supervisor fills his/her assessment into the paper "Form to award assessment by an external Final theses (FT) supervisor" (for the MIE-DIP). Students, then, ensure that the assessment is registered into the information system (IS) by asking their internal FT opponent to award the 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 head for the topic of the MT. 3. If the FT topic that the student has reserved is rather general, the immediate tasks the supervisor assigns to the student for aim at fine-tuning the FT topic so that the FTT will be complete and approvable at the end of the semester.  NI-MSI  Mathematical Structures in Computer Science  Mathematical semantics of programming languages. Data types as continuous lattices, Scott topology. Procedures as continuous mappings. The Scott Introduction to category theory.	Z asks that should be nd of the semester. c courses BIE-BAP, assessment to the I d of the department the upcoming seme  Z,ZK tt model of lambda	7 carried out 2. External MIE-MPR, S based on responsible ster should 4 calculus.
NI-MPR  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 touring the semester. If the requirements they agreed upon are met, the supervisor awards the student an assessment for the course MI-MPR at the educing the semester. If the requirements they agreed upon are met, the supervisor awards the student an assessment for the course MI-MPR at the educing the semester. If the requirements they agreed upon are met, the supervisor awards the student an assessment for the course MI-MPR at the education of the semester. If the requirements they agreed upon are met, the supervisor awards the student for the supervisor ill his/her assessment into the paper "Form to award these (IFT) supervisor. If the case the FT opponent is external as well, the assessment will be registered to the IS by the head for the topic of the MT. 3. If the FT topic that the student has reserved is rather general, the immediate tasks the supervisor assigns to the student for aim at fine-tuning the FT topic so that the FTT will be complete and approvable at the end of the semester.  NI-MSI  Mathematical Structures in Computer Science  Mathematical semantics of programming languages. Data types as continuous lattices, Scott topology. Procedures as continuous mappings. The Scot Introduction to category theory.  NI-MTI  Modern Internet Technologies	Z asks that should be nd of the semester. e courses BIE-BAP, assessment to the I d of the department the upcoming seme  Z,ZK tt model of lambda	7 carried out 2. External MIE-MPR, S based on responsible ster should  4 calculus.
NI-MPR  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 touring the semester. If the requirements they agreed upon are met, the supervisor awards the student an assessment for the course MI-MPR at the elements (MT) supervisor fills his/her assessment into the paper "Form to award assessment by an external Final theses (FT) supervisor" (for the MIE-DIP). Students, then, ensure that the assessment is registered into the information system (IS) by asking their internal FT opponent to award the 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 head for the topic of the MT. 3. If the FT topic that the student has reserved is rather general, the immediate tasks the supervisor assigns to the student for aim at fine-tuning the FT topic so that the FTT will be complete and approvable at the end of the semester.  NI-MSI  Mathematical Structures in Computer Science  Mathematical semantics of programming languages. Data types as continuous lattices, Scott topology. Procedures as continuous mappings. The Scott Introduction to category theory.	Z asks that should be nd of the semester. e courses BIE-BAP, assessment to the I d of the department the upcoming seme  Z,ZK tt model of lambda  Z,ZK A single network, of	7 carried out 2. External MIE-MPR, S based on responsible ster should  4 calculus.  5 oriented on
NI-MPR  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 touring the semester. If the requirements they agreed upon are met, the supervisor awards the student an assessment for the course MI-MPR at the experiment of the supervisor fills his/her assessment into the paper "Form to award assessment by an external Final theses (FT) supervisor" (for the MIE-DIP). Students, then, ensure that the assessment is registered into the information system (IS) by asking their internal FT opponent to award the 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 head for the topic of the MT. 3. If the FT topic that the student has reserved is rather general, the immediate tasks the supervisor assigns to the student for aim at fine-tuning the FT topic so that the FTT will be complete and approvable at the end of the semester.  NI-MSI  Mathematical Structures in Computer Science  Mathematical semantics of programming languages. Data types as continuous lattices, Scott topology. Procedures as continuous mappings. The Scotland Internet Technologies  SYNOPSIS The subject "Modern Internet Technologies" is designed on four major pillars of networking: 1. Unified Communication and Collaboration of the semester.	Z asks that should be nd of the semester. e courses BIE-BAP, assessment to the I d of the department the upcoming seme  Z,ZK of model of lambda  Z,ZK of a single network, co	7 carried out 2. External MIE-MPR, S based on responsible ster should  4 calculus.  5 oriented on re seamless
NI-MPR  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 t during the semester. If the requirements they agreed upon are met, the supervisor awards the student an assessment for the course MI-MPR at the e Master these (MT) supervisor fills his/her assessment into the paper "Form to award assessment by an external Final theses (FT) supervisor" (for the MIE-DIP). Students, then, ensure that the assessment is registered into the information system (IS) by asking their internal FT opponent to award the 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 head for the topic of the MT. 3. If the FT topic that the student has reserved is rather general, the immediate tasks the supervisor assigns to the student for aim at fine-tuning the FT topic so that the FTT will be complete and approvable at the end of the semester.  NI-MSI  Mathematical Structures in Computer Science  Mathematical semantics of programming languages. Data types as continous lattices, Scott topology. Procedures as continuous mappings. The Scotland Internet Technologies  SYNOPSIS The subject "Modern Internet Technologies" is designed on four major pillars of networking: 1. Unified Communication and Collaboration of the corry whatever types of protocols for whatever purposes. This architecture is able to be protocol independent and carries voice, vided integrated services. 2. Design of Extremely Scalable Networks - This provides the insights of network architectures which can accommodate hundreds of devices. Thus, there is a paradigm switch from LANs (Local Area Networks) to SPs (Service Providers). 3. Traffic Segregation, Traffic Matching and	Z asks that should be nd of the semester. e courses BIE-BAP, assessment to the I d of the department the upcoming seme  Z,ZK at model of lambda  Z,ZK A single network, of and data to achiev of millions of users d Traffic Prioritisatio	7 carried out 2. External MIE-MPR, S based on responsible ster should  4 calculus.  5 oriented on re seamless and billions n - These
NI-MPR  Master Project  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 t during the semester. If the requirements they agreed upon are met, the supervisor awards the student an assessment for the course MI-MPR at the e Master these (MT) supervisor fills his/her assessment into the paper "Form to award assessment by an external Final theses (FT) supervisor" (for the MIE-DIP). Students, then, ensure that the assessment is registered into the information system (IS) by asking their internal FT opponent to award the 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 hear for the topic of the MT. 3. If the FT topic that the student has reserved is rather general, the immediate tasks the supervisor assigns to the student for aim at fine-tuning the FT topic so that the FTT will be complete and approvable at the end of the semester.  NI-MSI  Mathematical Structures in Computer Science  Mathematical semantics of programming languages. Data types as continuous lattices, Scott topology. Procedures as continuous mappings. The Scontinuous Internet Technologies  SYNOPSIS The subject "Modern Internet Technologies" is designed on four major pillars of networking: 1. Unified Communication and Collaboration of TCP/IP is able to carry whatever types of protocols for whatever purposes. This architecture is able to be protocol independent and carries voice, video integrated services. 2. Design of Extremely Scalable Networks - This provides the insights of network architectures which can accommodate hundreds of devices. Thus, there is a paradigm switch from LANs (Local Area Networks) to SPs (Service Providers). 3. Traffic Segregation, Traffic Matching and technologies allow service providers to create private channels of communication between customers, with guaranteed parameters (bandwidth, deleted).	Z asks that should be nd of the semester. e courses BIE-BAP, assessment to the I d of the department the upcoming seme  Z,ZK att model of lambda  Z,ZK A single network, of and data to achiev of millions of users d Traffic Prioritisatio ay, jitter, type of pro	7 carried out 2. External MIE-MPR, S based on responsible ster should  4 calculus.  5 oriented on re seamless and billions n - These
NI-MPR  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 touring the semester. If the requirements they agreed upon are met, the supervisor awards the student an assessment for the course MI-MPR at the experiments these (MT) supervisor fills his/her assessment into the paper "Form to award assessment by an external Final theses (FT) supervisor" (for the MIE-DIP). Students, then, ensure that the assessment is registered into the information system (IS) by asking their internal FT opponent to award the 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 hear for the topic of the MT. 3. If the FT topic that the student has reserved is rather general, the immediate tasks the supervisor assigns to the student for aim at fine-tuning the FT topic so that the FTT will be complete and approvable at the end of the semester.  NI-MSI  Mathematical Structures in Computer Science  Mathematical semantics of programming languages. Data types as continuous lattices, Scott topology. Procedures as continuous mappings. The Scotnov Introduction to category theory.  NI-MTI  SYNOPSIS The subject "Modern Internet Technologies" is designed on four major pillars of networking: 1. Unified Communication and Collaboration TCP/IP is able to carry whatever types of protocols for whatever purposes. This architecture is able to be protocol independent and carries voice, vider integrated services. 2. Design of Extremely Scalable Networks - This provides the insights of network architectures which can accommodate hundreds of devices. Thus, there is a paradigm switch from LANs (Local Area Networks) to SPs (Service Providers). 3. Traffic Segregation, Traffic Matching an technologies allow service providers to create private channels of communication between customers, with guaranteed parameters (bandwidth, del Acceleration Technologies - They allow t	Z asks that should be nd of the semester. e courses BIE-BAP, assessment to the I d of the department the upcoming seme  Z,ZK att model of lambda  Z,ZK A single network, co and data to achiev of millions of users d Traffic Prioritisatio ay, jitter, type of pro in case of failures.	7 carried out 2. External MIE-MPR, S based on responsible ster should  4 calculus.  5 oriented on e seamless and billions n - These tocol). 4.
NI-MPR  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 to during the semester. If the requirements they agreed upon are met, the supervisor awards the student an assessment for the course MI-MPR at the expension of the semester. If the requirements they agreed upon are met, the supervisor awards the student an assessment for the course MI-MPR at the expension of the supervisor fills his/her assessment into the paper "Form to award assessment by an external Final theses (FT) supervisor" (for the MIE-DIP). Students, then, ensure that the assessment is registered into the information system (IS) by asking their internal FT opponent to award the 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 head for the topic of the MT. 3. If the FT topic that the student has reserved is rather general, the immediate tasks the supervisor assigns to the student for aim at fine-tuning the FT topic so that the FTT will be complete and approvable at the end of the semester.  NI-MSI  Mathematical Structures in Computer Science  Mathematical semantics of programming languages. Data types as continuous lattices, Scott topology. Procedures as continuous mappings. The Scontinuous and Internet Technologies  SYNOPSIS The subject "Modern Internet Technologies" is designed on four major pillars of networking: 1. Unified Communication and Collaboration of CPIP is able to carry whatever types of protocols for whatever purposes. This architecture is able to be protocol independent and carries voice, vider integrated services. 2. Design of Extremely Scalable Networks - This provides the insights of network architectures which can accommodate hundreds of devices. Thus, there is a paradigm switch from LANs (Local Area Networks) to SPs (Service Providers). 3. Traffic Segregation, Traffic Matching an technologies allow service providers to create	Z asks that should be nd of the semester. e courses BIE-BAP, assessment to the I d of the department the upcoming seme  Z,ZK att model of lambda  Z,ZK A single network, of and data to achiev of millions of users d Traffic Prioritisatio ay, jitter, type of pro in case of failures.  Z,ZK	7 carried out 2. External MIE-MPR, S based on responsible ster should  4 calculus.  5 oriented on re seamless and billions n - These tocol). 4.
NI-MPR  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 touring the semester. If the requirements they agreed upon are met, the supervisor awards the student an assessment for the course MI-MPR at the experiments these (MT) supervisor fills his/her assessment into the paper "Form to award assessment by an external Final theses (FT) supervisor" (for the MIE-DIP). Students, then, ensure that the assessment is registered into the information system (IS) by asking their internal FT opponent to award the 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 hear for the topic of the MT. 3. If the FT topic that the student has reserved is rather general, the immediate tasks the supervisor assigns to the student for aim at fine-tuning the FT topic so that the FTT will be complete and approvable at the end of the semester.  NI-MSI  Mathematical Structures in Computer Science  Mathematical semantics of programming languages. Data types as continuous lattices, Scott topology. Procedures as continuous mappings. The Scotnov Introduction to category theory.  NI-MTI  SYNOPSIS The subject "Modern Internet Technologies" is designed on four major pillars of networking: 1. Unified Communication and Collaboration TCP/IP is able to carry whatever types of protocols for whatever purposes. This architecture is able to be protocol independent and carries voice, vider integrated services. 2. Design of Extremely Scalable Networks - This provides the insights of network architectures which can accommodate hundreds of devices. Thus, there is a paradigm switch from LANs (Local Area Networks) to SPs (Service Providers). 3. Traffic Segregation, Traffic Matching an technologies allow service providers to create private channels of communication between customers, with guaranteed parameters (bandwidth, del Acceleration Technologies - They allow t	Z asks that should be nd of the semester. e courses BIE-BAP, assessment to the I d of the department the upcoming seme  Z,ZK att model of lambda  Z,ZK A single network, co and data to achiev of millions of users d Traffic Prioritisatio ay, jitter, type of pro in case of failures.  Z,ZK many problems. The	7 carried out 2. External MIE-MPR, S based on responsible ster should  4 calculus.  5 oriented on re seamless and billions n - These tocol). 4.
NI-MPR  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 to during the semester. If the requirements they agreed upon are met, the supervisor awards the student an assessment for the course MI-MPR at the experiments these (MT) supervisor fills his/her assessment into the paper "Form to award assessment by an external Final theses (FT) supervisor" (for the MIE-DIP). Students, then, ensure that the assessment is registered into the information system (IS) by asking their internal FT opponent to award the 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 hear for the topic of the MT. 3. If the FT topic that the student has reserved is rather general, the immediate tasks the supervisor assigns to the student for aim at fine-tuning the FT topic so that the FTT will be complete and approvable at the end of the semester.  NI-MSI  Mathematical Structures in Computer Science  Mathematical semantics of programming languages. Data types as continous lattices, Scott topology. Procedures as continuous mappings. The Scontinuous Internet Technologies  SYNOPSIS The subject "Modern Internet Technologies" is designed on four major pillars of networking: 1. Unified Communication and Collaboration  TCP/IP is able to carry whatever types of protocols for whatever purposes. This architecture is able to be protocol independent and carries voice, vider integrated services. 2. Design of Extremely Scalable Networks - This provides the insights of network architectures which can accommodate hundreds of devices. Thus, there is a paradigm switch from LANs (Local Area Networks) to SPs (Service Providers). 3. Traffic Segregation, Traffic Matching an technologies allow service providers to create private channels of communication between customers, with guaranteed parameters (bandwidth, del Acceleration Technologies - They allow traffic to be	Z asks that should be nd of the semester. e courses BIE-BAP, assessment to the I d of the department the upcoming seme  Z,ZK att model of lambda  Z,ZK A single network, co and data to achiev of millions of users d Traffic Prioritisatio ay, jitter, type of pro in case of failures.  Z,ZK many problems. The	7 carried out 2. External MIE-MPR, S based on responsible ster should  4 calculus.  5 oriented on re seamless and billions n - These tocol). 4.
NI-MPR  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 to during the semester. If the requirements they agreed upon are met, the supervisor awards the student an assessment for the course MI-MPR at the e Master these (MT) supervisor fills his/her assessment into the paper "Form to award assessment by an external Final theses (FT) supervisor" (for the MIE-DIP). Students, then, ensure that the assessment is registered into the information system (IS) by asking their internal FT opponent to award the 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 head for the topic of the MT. 3. If the FT topic that the student has reserved is rather general, the immediate tasks the supervisor assigns to the student for aim at fine-tuning the FT topic so that the FTT will be complete and approvable at the end of the semester.  NI-MSI  Mathematical Structures in Computer Science  Mathematical semantics of programming languages. Data types as continous lattices, Scott topology. Procedures as continuous mappings. The Scot Introduction to category theory.  NI-MTI  SYNOPSIS The subject "Modern Internet Technologies" is designed on four major pillars of networking: 1. Unified Communication and Collaboration TCP/IP is able to carry whatever types of protocols for whatever purposes. This architecture is able to be protocol independent and carries voice, vide integrated services. 2. Design of Extremely Scalable Networks - This provides the insights of network architectures which can accommodate hundreds of devices. Thus, there is a paradigm switch from LANs (Local Area Networks) to SPs (Service Providers). 3. Traffic Segregation, Traffic Matching an technologies allow service providers to create private channels of communication between customers, with guaranteed parameters (bandwidth, del Acceleration Technologies - They allow traffic	Z asks that should be nd of the semester. e courses BIE-BAP, assessment to the I d of the department the upcoming seme  Z,ZK att model of lambda  Z,ZK and data to achiev of millions of users d Traffic Prioritisatio ay, jitter, type of pro in case of failures.  Z,ZK many problems. The t, etc.  Z,ZK data science. The str	7 carried out 2. External MIE-MPR, S based on responsible ster should  4 calculus.  5 oriented on re seamless and billions n - These tocol). 4.  5 y will learn  4 udied topics
NI-MPR  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 to during the semester. If the requirements they agreed upon are met, the supervisor awards the student an assessment for the course MI-MPR at the e Master these (MT) supervisor fills his/her assessment into the paper "Form to award assessment by an external Final theses (FT) supervisor" (for the MIE-DIP). Students, then, ensure that the assessment is registered into the information system (IS) by asking their internal FT opponent to award the 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 head for the topic of the MT. 3. If the FT topic that the student has reserved is rather general, the immediate tasks the supervisor assigns to the student for aim at fine-tuning the FT topic so that the FTT will be complete and approvable at the end of the semester.  NI-MSI  Mathematical Structures in Computer Science  Mathematical semantics of programming languages. Data types as continuous lattices, Scott topology. Procedures as continuous mappings. The Scontroduction to category theory.  NI-MTI  Modern Internet Technologies  SYNOPSIS The subject "Modern Internet Technologies" is designed on four major pillars of networking: 1. Unified Communication and Collaboration. TCP/IP is able to carry whatever types of protocols for whatever purposes. This architecture is able to be protocol independent and carries voice, vide integrated services. 2. Design of Extremely Scalable Networks - This provides the insights of network architectures which can accommodate hundreds of devices. Thus, there is a paradigm switch from LANs (Local Area Networks) to SPs (Service Providers). 3. Traffic Segregation, Traffic Matching an technologies allow service providers to create private channels of communication between customers, with guaranteed parameters (bandwidth, del Acceleration Tech	Z asks that should be nd of the semester. e courses BIE-BAP, assessment to the I d of the department the upcoming seme  Z,ZK att model of lambda  Z,ZK and data to achiev of millions of users d Traffic Prioritisatio ay, jitter, type of pro in case of failures.  Z,ZK many problems. The t, etc.  Z,ZK data science. The str	7 carried out 2. External MIE-MPR, S based on responsible ster should  4 calculus.  5 oriented on re seamless and billions n - These tocol). 4.  5 y will learn  4 udied topics
NI-MPR  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 to during the semester. If the requirements they agreed upon are met, the supervisor wards the student an assessment for the course MI-MPR at the emaster these (MT) supervisor fills his/her assessment into the paper "Form to award assessment by an external Final theses (FT) supervisor" (for the MIE-DIP). Students, then, ensure that the assessment is registered into the information system (IS) by asking their internal FT opponent to award the 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 head for the topic of the MT. 3. If the FT topic that the student has reserved is rather general, the immediate tasks the supervisor assigns to the student for aim at fine-tuning the FT topic so that the FTT will be complete and approvable at the end of the semester.  NI-MSI    Mathematical Structures in Computer Science	Z asks that should be nd of the semester. e courses BIE-BAP, assessment to the I d of the department the upcoming seme  Z,ZK att model of lambda  Z,ZK and data to achiev of millions of users d Traffic Prioritisatio ay, jitter, type of pro in case of failures.  Z,ZK many problems. The the strongle, gradient methods  Z,ZK to the strongle and the strongle and the strongle.	7 carried out 2. External MIE-MPR, S based on responsible ster should  4 calculus.  5 oriented on re seamless and billions n - These tocol). 4.  5 y will learn  4 udied topics nods) and
NI-MPR  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 t during the semester. If the requirements they agreed upon are met, the supervisor awards the student an assessment for the course MI-MPR at the e Master these (MT) supervisor fills his/her assessment into the paper "Form to award assessment by an external Final theses (FT) supervisor" (for the MIE-DIP). Students, then, ensure that the assessment is registered into the information system (IS) by asking their internal FT opponent to award the 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 hear for the topic of the MT. 3. If the FT topic that the student has reserved is rather general, the immediate tasks the supervisor assigns to the student for aim at fine-tuning the FT topic so that the FTT will be complete and approvable at the end of the semester.  NI-MSI    Mathematical Structures in Computer Science	Z asks that should be nd of the semester. e courses BIE-BAP, assessment to the I d of the department the upcoming seme  Z,ZK att model of lambda  Z,ZK at model of lambda  Z,ZK and data to achiev of millions of users d Traffic Prioritisatio ay, jitter, type of pro in case of failures.  Z,ZK many problems. The , etc.  Z,ZK data science. The strength, gradient methology.	7 carried out 2. External MIE-MPR, S based on responsible ster should  4 calculus.  5 oriented on re seamless and billions n - These tocol). 4.  5 y will learn  4 udied topics nods) and
NI-MPR  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 to during the semester. If the requirements they agreed upon are met, the supervisor wards the student an assessment for the course MI-MPR at the emaster these (MT) supervisor fills his/her assessment into the paper "Form to award assessment by an external Final theses (FT) supervisor" (for the MIE-DIP). Students, then, ensure that the assessment is registered into the information system (IS) by asking their internal FT opponent to award the 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 head for the topic of the MT. 3. If the FT topic that the student has reserved is rather general, the immediate tasks the supervisor assigns to the student for aim at fine-tuning the FT topic so that the FTT will be complete and approvable at the end of the semester.  NI-MSI    Mathematical Structures in Computer Science	Z asks that should be nd of the semester. e courses BIE-BAP, assessment to the I d of the department the upcoming seme  Z,ZK att model of lambda  Z,ZK and data to achiev of millions of users d Traffic Prioritisatio ay, jitter, type of pro in case of failures.  Z,ZK atta science. The striciple, gradient method	7 carried out 2. External MIE-MPR, S based on responsible ster should  4 calculus.  5 priented on re seamless and billions n - These tocol). 4.  5 y will learn  4 udied topics nods) and 3 n goal is to
NI-MPR  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 to during the semester. If the requirements they agreed upon are met, the supervisor awards the student an assessment for the course MI-MPR at the example these (MT) supervisor fills his/her assessment into the paper "Form to award stasessment by an external Final theses (FT) supervisor" (for the MIE-DIP). Students, then, ensure that the assessment is registered into the information system (IS) by asking their internal FT opponent to award the 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 hear for the topic of the MT. 3. If the FT topic that the student has reserved is rather general, the immediate tasks the supervisor assigns to the student for aim at fine-tuning the FT topic so that the FTT will be complete and approvable at the end of the semester.  NI-MSI    Mathematical Structures in Computer Science	Z asks that should be nd of the semester. e courses BIE-BAP, assessment to the I d of the department the upcoming seme  Z,ZK att model of lambda  Z,ZK and data to achiev of millions of users d Traffic Prioritisatio ay, jitter, type of pro in case of failures.  Z,ZK atta science. The striciple, gradient method	7 carried out 2. External MIE-MPR, S based on responsible ster should  4 calculus.  5 priented on re seamless and billions n - These tocol). 4.  5 y will learn  4 udied topics nods) and 3 n goal is to
NI-MPR  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 tduring the semester. If the requirements they agreed upon are met, the supervisor awards the student an assessment for the course MI-MPR at the e Master these (MT) supervisor fills his/her assessment into the paper "Form to award assessment by an external Final theses (FT) supervisor" (for the MIE-DIP). Students, then, ensure that the assessment into the paper "Form to award assessment by an external Final theses (FT) supervisor" (for the MIE-DIP). Students, then, ensure that the assessment in the first popenent is external as well, the assessment will be registered to the IS by the head for the topic of the MT. 3. If the FT topic that the student has reserved is rather general, the immediate tasks the supervisor assigns to the student for aim at fine-tuning the FT topic so that the FTT will be complete and approvable at the end of the semester.  NI-MSI  Mathematical Structures in Computer Science  Mathematical semantics of programming languages. Data types as continous lattices, Scott topology. Procedures as continuous mappings. The Scot Introduction to category theory.  NI-MTI  Modern Internet Technologies  SYNOPSIS The subject "Modern Internet Technologies" is designed on four major pillars of networking: 1. Unified Communication and Collaboration TCP/IP is able to carry whatever types of protocols for whatever purposes. This architecture is able to be protocol independent and carries voice, vider integrated services. 2. Design of Extremely Scalable Networks - This provides the insights of network architectures which can accommodate hundreds of devices. Thus, there is a paradigm switch from LANs (Local Area Networks) to SPs (Service Providers). 3. Traffic Segregation, Traffic Matching an technologies allow service providers to create private channels of communication between customers, with guaranteed parameters (bandwidth, defence that the publica	Z asks that should be nd of the semester. e courses BIE-BAP, assessment to the I d of the department the upcoming seme  Z,ZK att model of lambda  Z,ZK and data to achiev of millions of users d Traffic Prioritisatio and data to achiev of millions of users d Traffic Prioritisatio in case of failures.  Z,ZK many problems. The , etc.  Z,ZK atta science. The stracticle, gradient methology in lectures devoted  Z,ZK and sound. The main y in lectures devoted	7 carried out 2. External MIE-MPR, S based on responsible ster should  4 calculus.  5 priented on re seamless and billions n - These tocol). 4.  5 y will learn  4 udied topics nods) and 3 n goal is to d to specific
NI-MPR  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 tduring the semester. If the requirements they agreed upon are met, the supervisor awards the student an assessment for the course MI-MPR at the e Master these (MT) supervisor fills his/her assessment into the paper "Form to award assessment by an external Final theses (FT) supervisor" (for the MIE-DIP). Students, then, ensure that the assessment is registered into the information system (IS) by asking their internal FT opponent to award the 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 head for the topic of the MT. 3. If the FT topic that the student has reserved is rather general, the immediate tasks the supervisor assigns to the student for for the topic of the MT. 3. If the FT topic that the student has reserved is rather general, the immediate tasks the supervisor assigns to the student for for the topic of the MT. 3. If the FT topic that the student has reserved is rather general, the immediate tasks the supervisor assigns to the student for for the topic of the MT. 3. If the FT topic that the student for aim at fine-tuning the FT topic so that the FTT will be complete and approvable at the end of the semester.  NI-MSI  Mathematical Structures in Computer Science  Mathematical semantics of programming languages. Data types as continuous lattices, Scott topology, Procedures as continuous mappings. The Science Mathematical semantics of programming languages. Data types as continuous the programming languages. Data types as continuous data topic pillars of networking: 1. Unified Communication and Collaboration. TCP/IP is able to carry whatever types of protocols for whatever purposes. This architecture is able to be protocol independent and carries voice, vider integrated services. 2. Design of Extremely Scalable Networks. This provides the insights	Z asks that should be nd of the semester. e courses BIE-BAP, assessment to the I d of the department the upcoming seme  Z,ZK att model of lambda  Z,ZK and data to achiev of millions of users d Traffic Prioritisatio ay, jitter, type of pro in case of failures.  Z,ZK many problems. The the tiple, gradient method and sound. The state and sound. The main and in lectures devoted  Z,ZK and sound. The main and in lectures devoted  Z,ZK and sound. The main and in lectures devoted  Z,ZK and sound. The main and in lectures devoted  Z,ZK and sound. The main and in lectures devoted  Z,ZK and sound. The main	7 carried out 2. External MIE-MPR, S based on responsible ster should  4 calculus.  5 oriented on re seamless and billions n - These tocol). 4.  5 y will learn  4 udied topics nods) and  3 n goal is to d to specific  5 blems. They
NI-MPR  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 to during the semester. If the requirements they agreed upon are met, the supervisor awards the student an assessment for the course MI-MPR at the during the semester. If the requirements they agreed upon are met, the supervisor awards the student an assessment for the course MI-MPR at the daster these (MT) supervisor fills his/her assessment is registered into the paper "Form to award assessment by an external Final theses (FT) supervisor" (for the MIE-DIP). Students, then, ensure that the assessment is registered into the information system (IS) by asking their internal FT opponent to award the 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 head for the topic of the MT. 3. If the FT topic that the student has reserved is rather general, the immediate tasks the supervisor assigns to the student for aim at fine-tuning the FT topic so that the FTT will be complete and approvable at the end of the semester.  NI-MSI    Mathematical Structures in Computer Science	Z asks that should be nd of the semester. e courses BIE-BAP, assessment to the I d of the department the upcoming seme  Z,ZK att model of lambda  Z,ZK and att to achiev of millions of users d Traffic Prioritisatio ay, jitter, type of pro in case of failures.  Z,ZK att many problems. The the training and sound. The main y in lectures devoted  Z,ZK and sound. The main y in lectures devoted  Z,ZK and sound pro ey will learn to solve	7 carried out 2. External MIE-MPR, S based on responsible ster should  4 calculus.  5 priented on re seamless and billions n - These tocol). 4.  5 y will learn  4 udied topics nods) and  3 n goal is to d to specific  5 blems. They systems of
NI-MPR  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 tduring the semester. If the requirements they agreed upon are met, the supervisor awards the student an assessment for the course MI-MPR at the e Master these (MT) supervisor fills his/her assessment into the paper "Form to award assessment by an external Final theses (FT) supervisor" (for the MIE-DIP). Students, then, ensure that the assessment is registered into the information system (IS) by asking their internal FT opponent to award the 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 head for the topic of the MT. 3. If the FT topic that the student has reserved is rather general, the immediate tasks the supervisor assigns to the student for for the topic of the MT. 3. If the FT topic that the student has reserved is rather general, the immediate tasks the supervisor assigns to the student for for the topic of the MT. 3. If the FT topic that the student has reserved is rather general, the immediate tasks the supervisor assigns to the student for for the topic of the MT. 3. If the FT topic that the student for aim at fine-tuning the FT topic so that the FTT will be complete and approvable at the end of the semester.  NI-MSI  Mathematical Structures in Computer Science  Mathematical semantics of programming languages. Data types as continuous lattices, Scott topology, Procedures as continuous mappings. The Science Mathematical semantics of programming languages. Data types as continuous the programming languages. Data types as continuous data topic pillars of networking: 1. Unified Communication and Collaboration. TCP/IP is able to carry whatever types of protocols for whatever purposes. This architecture is able to be protocol independent and carries voice, vider integrated services. 2. Design of Extremely Scalable Networks. This provides the insights	Z asks that should be nd of the semester. e courses BIE-BAP, assessment to the I d of the department the upcoming seme  Z,ZK att model of lambda  Z,ZK and att to achiev of millions of users d Traffic Prioritisatio ay, jitter, type of pro in case of failures.  Z,ZK att many problems. The the training and sound. The main y in lectures devoted  Z,ZK and sound. The main y in lectures devoted  Z,ZK and sound pro ey will learn to solve	7 carried out 2. External MIE-MPR, S based on responsible ster should  4 calculus.  5 priented on re seamless and billions n - These tocol). 4.  5 y will learn  4 udied topics nods) and  3 n goal is to d to specific  5 blems. They systems of

NI-NSS	Normalized Software Systems	ZK	5
	the foundations of normalized systems theory that studies the evolvability of modular structures based on concepts from engineering from thermodynamics. Students will understand a set of principles that indicate where violations of stability and entropy-related issue		
	second part of the course, students will understand a set of principles that indicate where violations of stability and entropy-related issue second part of the course, students learn how to construct software architectures using a set of 5 design patterns called elements. The	· -	
	rmation systems in terms of storing data, executing actions, workflows, connectors, and triggers, while handling violations of the stability		
	This knowledge allows students to realize new levels of evolvability in software architectures.		
NI-NUR	User Interface Design	Z,ZK	5
	stand the theorical background of human-computer interaction and user interface (UI) design, will learn formal description of UIs, formal		
NI-OLI	ocesures. They get acquainted with graphical, speech, and multimodal Uls. Thanks to the gained knowledge, the students will be able Linux Drivers	Z,ZK	4
_	g system is an important operating system for personal computer and also for embedded systems. Systems on chip and combining po	,	
	iability of peripheral subsystems requiring specific software drivers. This course is an advanced course in the Linux driver developmen	•	
	urse provides knowledge of Linux operating system architecture, principles of development of various types drivers, including practical	al experience.	
NI-OSY	Operating Systems and Systems Programming	Z,ZK	5
	s system programming in UNIX environment. Emphasis is given on kernel development with focus on kernel architecture and kernel do ment, memory management, file operations and architecture of modern file systems, device drivers and network programming. The co	-	
· -	ess, upgrades of existing kernels, kernel booting, debugging using dynamic instrumentation, and techniques to guarantee portability. S		
	eal-time operating systems are also discussed. Theoretical and general principles are demonstrated on the LINUX kernel. Within labs,	-	
	focused on development of LINUX kernel modules.		
NI-PAM	Efficient Preprocessing and Parameterized Algorithms	Z,ZK	4
=	optimization problems for which no polynomial time algorithms are known (e.g. NP-complete problems). Despite that it is often necess . We will demonstrate that many problems can be solved much more effectively than by naively trying all possible solutions. Often one	-	
, ,	inputs from practice-e.g., all solutions are relatively small. Parameterized algorithms exploit that by limiting the time complexity exponen		
	n the input size (which can be huge). Parameterized algorithms also represent a way to formalize the notion of effective polynomial time.		
	sible in the classical complexity. Such a polynomial time preprocessing is then a suitable first step, whatever is the subsequent solution		
	eterized algorithm design methods and we will also show how to prove that for some problem (and parameter) such an algorithm (pro	• /	t exist. We
NI-PAS	will also not miss out the relations to other approaches to hard problems such as moderately exponential algorithms or approximation	Z,ZK	4
	Advanced Aspects of Business  burse is to provide students with advanced (compared to the bachelor's degree) knowledge and skills needed to establish and run the	, , , , , , , , , , , , , , , , , , ,	
	management, especially in law, administration (necessary steps and documents), business economics, foreign trade and related a		
NI-PDB	Advanced Database Systems	Z,ZK	5
	emselves in problems of evaluation and optimization of SQL queries. The next part of the course deals with new concepts of database		
databases), with th	ne related new data models (XML, graph databases, column databases) and languages for working with them (XQuery, XPath, CYPH	IER, Gremlin). The	last part of
NI-PDD	the course deals with performance evaluation of database machines.  Data Preprocessing	Z,ZK	5
	repare raw data for further processing and analysis. They learn what algorithms can be used to extract information from various data s		
	and learn the skills to apply these theoretical concepts to solve specific problems in individual projects - e.g., extraction of characterist		- 1
	pages.		
NI-PDP	Parallel and Distributed Programming	Z,ZK	6
	imputer architectures is primarily influenced by the shift of the Moore's law into parallelization of CPUs at the level of computing cores ibiquitous commodity and parallel programming becomes the basic paradigm of development of efficient applications for these platfor		
_	es of parallel and distributed computing systems, their models, theory of interconnection networks and collective communication oper	_	
	parallel programming of shared and distributed memory computers. They get acquianted with fundamental parallel algorithms and on		- 1
learn the technique	es of design of efficient and scalable parallel algorithms and methods of performance evaluation of their implementations. The course practical programming in OpenMP and MPI for solving a particular nontrivial problem.	includes a semeste	er project of
NI-PG1	Computer Grafics 1	ZK	4
	pon graphic courses (mainly BI-PGA and BI-PGR) and the knowledge from these courses is deepened by state-of-the-art knowledge. Th	l l	
	nced computer graphics. Students will gain practical knowledge with realistic texturing and raytracing methods. An integral part of the	-	
	subsequent implementation. The course will be followed by a course PG2 supplementing the knowledge of PG1 on other areas and	topics of computer	
NI-PIS	Enterprise Information Systems	Z,ZK	5
	sed on the current IT requirements of large companies in the Czech Republic (Top 100). The basis is Data management, storage of bi telligence). The principles of solving the overall architecture of information systems in the banking, insurance and telecommunications		
	thermore, students will get acquainted with the life cycle of information systems in the company / organization and its impact on the bus		
Students will be ac	quainted with technologies that have proven themselves in the elimination of basic risks in the planning, implementation and operation	n of information sys	stems in the
	company / organization.		
NI-PON	Selected Topics in Optimization and Numerical mathematics	Z,ZK	5
	s on optimization problems that appear in the field of machine learning and artificial intelligence. Students broaden their knowledge of col ematics for informatics. The methods are explained and described along with the details on how they are implemented on computers.		
iii iilo oodioo waaii	of numerical matematics, mainly numerical linear algebra, are explained too.	Tronoc, and roloval	in concepte
NI-PSD	Public Services Design	KZ	4
	roduce students to specifics of UX, Service design and development for public sector. We will look into the design and development produce students to specifics of UX, Service design and development for public sector.	•	
suppliers (devs a	and designesr) as well as clients. In small teams students will work on projects from partner organizations and will try out collaboration	n with client represe	entatives.
NI-PSL	Course is aimed at students-designers as well as clients.  Programming in Scala	Z,ZK	4
	Programming in Scara uces the modern programming language Scala which exploits object-functional paradigm. Scala comprises advance language feature	'	
	ibrary. Scala enables to use of applications functional patterns e.g. H-List, Monads, etc. Scala is used by many powerful frameworks and		
	Scalaz, etc.		
NI-PVR	Advanced Virtual Reality	KZ	4
	ces advanced parts of the virtual reality. It is a continuation of the already running graphic objects, especially the creation of 3D models students to their application in virtual reality. Lectures will focus on virtual reality technology, its use in various applications and will also		- 1
-	ines (mainly Unity3D). The course is freely connected with the subject VHS (virtual game worlds), students will be able to apply the kn	_	
	in virtual reality, or directly create a complex game for VR.		

NI-PVS Advanced embedded systems Z,ZK The course is focused on ARM processors and microcontrollers and their usage in wide range of applications. The course includes a series of advanced topics like security support, working with mass storage devices, motor control, system control and industrial communication. The students obtain both theoretical and also practical experiences with embedded systems. NI-PYT ΚZ Advanced Python 4 The goal of this course is to learn various advanced techniques and methods in Python. The course indirectly continues where Programming in Python (BI-PYT) left of. The course is very hands-on and it has only tutorials, everything is demonstrated on examples. Classification is based on work in class as well as semestral coursework. The course is lead by external teachers from Red Hat. NI-REV Reverse Engineering Z,ZK 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 the 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 dedicated 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 dedicated to debuggers: 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 computer malware scene. The focus of the course is on the seminars, where students will solve practically oriented tasks from the real world. Pattern Recognition Z,ZK 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 statistical approach to pattern recognition. Students will learn the fundamental concepts and methods of pattern recognition, including probability models, parameter estimation, and their numerical aspects NI-RUB Programming in Ruby This course is presented in Czech. NI-RUN Runtime Systems Z.ZK 5 As the abstraction level of programming languages steadily rises, modern programs require greater and greater support during their runtime. This course introduces students to various aspects of the runtime support, such as runtime-effective program description, memory management support and garbage collection, just-in-time compilation, and interoperability with other languages and systems. NI-SBF System Security and Forensics Z,ZK 5 Students will get familiar with aspects of system security (principles of end station security, principles of security policies, security models, authentication concepts). Furthermore, students will get familiar with forensic analysis as a tool for investigating security incidents (techniques used by malicious software/attackers and forensic analysis techniques and the importance of operating system/operating system artifacts or file system for attack analysis and detection). NI-SCE1 Computer Engineering Seminar Master I The Seminar of Computer Engineering is a (s)elective course for students who want to deal with deeper topics of digital design, reliability and resistance to failures and attacks. Students are approached individually within the subject. Each student or group of students solves some interesting topic with the selected supervisor. Part of the subject is work with scientific articles and other professional literature and/or work in K N laboratories. The capacity of the subject is limited by the possibilities of the seminar teachers. The topics are new for each semester. NI-SCE2 Computer Engineering Seminar Master II 7 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 resistance to failures and attacks. Students are approached individually within the subject. Each student or group of students solves some interesting topic with the selected supervisor. Part of the subject is work with scientific articles and other professional literature and/or work in K N laboratories. The capacity of the subject is limited by the possibilities of the seminar teachers. The topics are new for each semester. Statistical Analysis of Time Series The course deals with the practical use of the basic time series modelling theory in engineering tasks, ranging from economics (stock exchange prices, employment) and industrial problems (modelling of signals and processes) to computer networks (network components load, attacks detection). The students learn to select a convenient process model, estimate 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 main principles based on practical real-world examples. Both the lab classes and the lectures exploit freely available software packages in order to provide easy and straightforward transfer of students' knowledge from the academic to the real world. NI-SEP World Economy and Business Z,ZK This course is presented in Czech. However, there is an English variant in the program Informatics (N1801 / 4793). The course introduces students of technical university to the international business. It does that predominantly by comparing individual countries and key regions of world economy. Students get to know about different religions and cultures, necessary for doing business in diverse societies as well as indexes of economic freedom, corruption and economic development, which are needed for the right investment decision. Seminars help to improve on the knowledge in the form of discussions based on individual readings. It is advised to take bachelor level of this course BIE-SEP as a prerequisite. NI-SIB **Network Security** Z,ZK 5 NI-SIM Digital Circuit Simulation and Verification 5 Z.ZK The aim of the course is to acquaint the students with principles of digital circuit simulation at RTL (Register Transfer Level) and TLM (Transaction Level Modeling) levels and with the properties of proper tools. The course covers recent verification methods, too. Semantic Web and Knowledge Graphs The students will learn the most recent concepts and technologies of the Semantic Web. The course will provide an overview of the Semantic Web technologies, methods and best practices for modelling, integration, publishing, querying and consumption of semantic data. The students will also gain skills in creation of knowledge graphs and their systematic quality assurance. Parsing and Compilers 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. NI-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 research 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 machine learning and Al conferences and summer schools, as well as FIT's own Summer Research Program (VyLet). NI-SZ2 Knowledge Engineering Seminar Master II 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 research 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 machine learning and Al conferences and summer schools, as well as FIT's own Summer Research Program (VyLet). Systems Theory Today, humankind has the ability to develop systems of incredible complexity (e.g., trains, microprocessors, airplanes, nuclear power plants). However, the costs of managing 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 models that describe 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 form the basis for the modeling and analysis of complex systems.

N.II. T.I.C.A	- T	7.71	
NI-TKA	Category Theory	Z,ZK	4
NI-TNN	Theory of Neural Networks	Z,ZK	5
In this course, we s	tudy neural networks from the point of view of the theory of function approximation and from the point of view of probability theory. A	t first, we recall bas	sic concepts
	al neural Networks, such as neurons and connections between them, types of neurons from the point of view of signal transmission,		
	, network training, and the role of time in neural networks. In connection with network topology, we get acquainted with its transforma		
1	- · · · · · · · · · · · · · · · · · · ·		1
	n with somatic and synaptic mappings, with their composition into mappings computed by the Network, Finally in connection with training the control of the c		
·	ining and to the fact that training is actually a specific optimization task, recalling the most typical objective functions and the most im	•	
employed for neura	I 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 networ	ks, we first notice the connection of neural networks to expressing functions of many variables using functions of fewer variables (Ko	Imogorov theorem	, Vituškin
theorem). Afterward	ds, we will see how the universal approximation capacity of neural networks can be mathematically formalized as the sets of mappings	s computed by neu	ral networks
being dense in im	portant Banach spaces of functions, in particular in the spaces of continuous functions, spaces of functions integrable with respect t	o a finite measure.	spaces of
	inuous derivatives, and Sobolev spaces. Within the topic probabilistic approach, we first get acquainted with training based on expec		•
	d with probabilistic assumptions about training data with which those two kinds of neural networks can be employed. We will see how	0	
1		-	
	al expectancy of network outputs conditioned by its inputs using the expectancy based learning. We recall the strong and the weak la	•	, , ,
acquainted with a	n analogy of the strong law of large numbers for neural networks and with the assumptions for its validity. Finally, we recall the centra	Il limit theorem, get	t acquinted
with its analogy f	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	e employed to sear	ch for the
	topology of the network.		
NI-TS1	Theoretical Seminar Master I	Z	4
		_	
	r is intended for students which want to come in deeper contact with contemporary theoretical computer science. It is mostly a classic		
are treated individu	ally and concern themselves with interesting topics from the latest research in the area. Therefore, an integral part of the course is a	work with scientific	papers and
	other scholarly literature. The capacity is limited by the the potentials of the teachers of the seminar.		
NI-TS2	Theoretical Seminar Master II	Z	4
	r is intended for students which want to come in deeper contact with contemporary theoretical computer science. It is mostly a classic	ı — al reading group T	he students
	ally and concern themselves with interesting topics from the latest research in the area. Therefore, an integral part of the course is a		
are treated individu		WOLK WILL SCIETIUIC	, hahais aiin
	other scholarly literature. The capacity is limited by the the potentials of the teachers of the seminar.	ı	
NI-TS3	Theoretical Seminar Master III	Z	4
Theoretical semina	r is intended for students which want to come in deeper contact with contemporary theoretical computer science. It is mostly a classic	al reading group. T	he students
are treated individu	ally and concern themselves with interesting topics from the latest research in the area. Therefore, an integral part of the course is a	work with scientific	papers and
	other scholarly literature. The capacity is limited by the the potentials of the teachers of the seminar.		
NII TO 4			
NI-TS4	Theoretical Seminar Master IV	Z	4
Theoretical semina	r is intended for students which want to come in deeper contact with contemporary theoretical computer science. It is mostly a classic	al reading group. T	he students
are treated individu	ally and concern themselves with interesting topics from the latest research in the area. Therefore, an integral part of the course is a	work with scientific	papers and
	other scholarly literature. The capacity is limited by the the potentials of the teachers of the seminar.		
NI-TSP	Testing and Reliability	Z,ZK	5
	,		
_	knowledge about circuit testing and about methods for increasing reliability and security. They will get practical skills to be able to pre	•	
the intuitive path se	ensitization and to use an ATPG for automatic test generation. They will be able to design easily testable circuits and systems with bu	iilt-in-self-test equip	pment. They
	will be able to compute, analyze, and control the reliability and availability of the designed circuits.		
NI-TSW	Software Product Development	KZ	4
	The course is presented in Czech.	1	-
NII TVD	·	7 71/	
NI-TVR	Virtual Reality Technology	Z,ZK	3
	troduced to the basic concepts of virtual reality. Techniques for displaying virtual worlds (CAVE, HMD,) and the possibilities of cont	-	
tracking, hand tra	cking, eye tracking) will be discussed. Furthermore, the concepts of mixed and augmented reality will be introduced. Finally, ways of	using virtual and a	ugmented
	reality will be presented.		
NI-UMI	Artificial intelligence	Z,ZK	5
			-
The course covers	s search and inference algorithms in major formal paradigms used in artificial intelligence such as logic theories, constraint programm	ning and automate	a pianning.
	The main principles and practical applications of discussed techniques will be illustrated.		
NI-VCC	Virtualization and Cloud Computing	Z,ZK	5
	n knowledge of architectures of large computer systems that are used in data centers and computer infrastructure of companies and	1	ey will aet
_	rtualization principles, tools and technologies that serve to facilitate and automate configuration, testing and monitoring, and to efficie	-	
-	rameters of modern computer systems. Theoretically and practically, they will get acquainted with containerization as the most effect		
			-
management of cor	mplex computer systems and with specific technologies of cloud systems. Finally, they will learn the principles and gain practical skills in	i tile use of moder	ir integration
	and development tools (Continuous integration and development).		
NI-VMM	Retrieval from Multimedia	Z,ZK	5
The student obtains	s general knowledge regarding interfaces of portals providing multimedia content, the principles of similarity search, the methods of fea	ture extraction from	n multimedia
	objects, indexing, and structure of distributed search engines.		
NII VOI		7 71/	_
NI-VOL	Elections	Z,ZK	5
	We will cover the basics of (committee) elections and, in general, opinion aggregation.		
NI-VPR	Research Project	Z	5
	Student obtains the credits for published scientific outputs. The details are at https://courses.fit.cvut.cz/NI-VPR/en.	ı	
NII V/ONA		7 71/	7
NI-VSM	Selected statistical Methods	Z,ZK	7
The course leads	the student through advanced probabilistic and statistical methods used in information technology praxis. Particularly it deals with m	ultivariate normal o	distribution,
application of enti	ropy in coding theory, hypothesis testing (T-tests, goodness of fit tests, independence test). Second part of the course deals with rand	dom processes wit	h focus on
	Markov chains. The high point of the course is the Queuing theory and its application in networks.		
NI-VYC	Computability	Z,ZK	4
141-410	ı	2,21	+
==	Classical theory of recursive functions and effective computability.	_	
NI-ZS10	Master internship abroad for 10 credits	Z	10
Each student can	once within his / her master's degree have a foreign internship at a foreign university or other foreign scientific and/or research institu	ition. Before the int	ernship the
	the vice-dean for study affairs assesses the professional content. The student must provide evidence of the professional content and e		
	MI-ZS20, MI-ZS30 are used used for the evidence and evaluation of the internship in IS KOS. Every 10 credits correspond to 4 week		
	on. The maximum number of credits a student can earn for one internship is 30 credits. This amount can be divided into two subjects		-
a ioreign mondiculo		" me memonib ex	CCCUS IIIE
	academic year's dead-line.		

NI-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 institu	tion. Before the int	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 ex	tent of the internsl	hip. 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 week	s of full-time empl	oyment with
a foreign institution	on. The maximum number of credits a student can earn for one internship is 30 credits. This amount can be divided into two subjects	if the internship ex	ceeds the
	academic year's dead-line.		
NI-ZS30	Master internship abroad for 30 credits	Z	30
The course is prez	ented in chzech language. Each student can once within his / her master's degree have a foreign internship at a foreign university or	other foreign scie	ntific and/or
research institution	Before the internship the Dean of the FIT, or the vice-dean for study affairs assesses the professional content. The student must provide	de 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 KO	S. Every 10 credits	correspond
to 4 weeks of full-t	ime employment with a foreign institution. The maximum number of credits a student can earn for one internship is 30 credits. This ar	nount can be divid	led into two
	subjects if the internship exceeds the academic year's dead-line.		
NIE-BLO	Blockchain	Z,ZK	5
	stand the foundations of blockchain technology, smart contract programming, and gain an overview of most notable blockchain platforr	•	
	secure decentralized application, and assess whether integration of a blockchain is suitable for a given problem. The course places a	•	
relationship betwe	en blockchains and information security. It is concluded with a defense of a research or applied semester project, which prepares the	students for imple	ementing or
	supervising implementation of blockchain-based solutions in both academia and business.		
NIE-PDL	Practical Deep Learning	KZ	5
	igned to provide students with a comprehensive understanding of Deep Learning using PyTorch, a popular open-source machine lea	•	
the course, student	s will develop practical skills in building and training deep neural networks, using PyTorch to solve real-world problems in fields such a	as computer vision	and natural
	language processing.		
NIE-PML	Personalized Machine Learning	Z,ZK	5
	hine learning (PML) is a sub-field of machine learning that aims to create models and predictions based on the unique characteristic		
	is commonly used in applications such as recommender systems, which recommend items to users based on their personal interest		
to a wide range of o	ther fields, including education, medicine, and chemical engineering. In this course, we will explore the latest PML methods from theore		and practical
	perspectives. Specifically, we will focus on cutting-edge models that are of interest to both the research and commercial commu		
PI-SCN	Seminars on Digital Design	ZK	4

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

For updated information see <a href="http://bilakniha.cvut.cz/en/FF.html">http://bilakniha.cvut.cz/en/FF.html</a> Generated: day 2024-05-17, time 06:21.