Recomended pass through the study plan

Name of the pass: Bachelor specialization Computer Science, in Czech, 2021

Faculty/Institute/Others:
Department:
Pass through the study plan: Bachelor Specialization Computer Science, in Czech, 2021
Branch of study guranteed by the department: Welcome page
Guarantor of the study branch:
Program of study: Informatika
Type of study: Bachelor full-time
Note on the pass: Vedle čistě volitelných předmětů si můžete zapsat jako volitelné předměty i povinné předměty sousedních specializací. Chcete-li splnit skupinu "BI-ZKA.21 Zkouška z angličtiny 2021" předložením certifikátu, který prokazuje vaši znalost angličtiny srovnatelnou nebo převyšující úroveň B2 Společného evropského referenčního rámce pro jazyky, můžete tak učinit v kterémkoliv aktivním semestru během studia.

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

Coding of ways of completion of courses (KZ/Z/ZK) and coding of semesters (Z/L):
KZ - graded assesment, Z - assesment, ZK - examination, L - summer semester, Z - winter semester

Number of semester: 1

Code	**Name of the course / Name of the group of courses** ***(in case of groups of courses the list of codes of their members)*** *Tutors,* ***authors*** *and guarantors (gar.)*	**Completion**	**Credits**	**Scope**	**Semester**	**Role**
BI-DML.21	**Discrete Mathematics and Logic** *Jiřina Scholtzová, Daniel Dombek, Jan Spěvák* ***Daniel Dombek*** *Jan Spěvák (Gar.)*	Z,ZK	5	2P+1R+1C	Z	PP
BI-LA1.21	**Linear Algebra 1** *Jakub Krásenský, Karel Klouda, Luděk Kleprlík* ***Luděk Kleprlík*** *Karel Klouda (Gar.)*	Z,ZK	5	2P+1R+1C	Z	PP
BI-PA1.21	**Programming and Algorithmics 1** *Radek Hušek, Josef Vogel, Miroslav Balík, Ladislav Vagner, Jan Trávníček* ***Jan Trávníček*** *Jan Trávníček (Gar.)*	Z,ZK	7	2P+2R+2C	Z	PP
BI-TZP.21	**Technological Fundamentals of Computers** *Jan Řezníček, Martin Novotný, Vojtěch Miškovský, Jaroslav Borecký, Martin Kohlík, Robert Hülle, Matúš Olekšák* ***Martin Novotný*** *Martin Novotný (Gar.)*	Z,ZK	5	2P+2C	Z	PP
BI-GIT.21	**SW Development Technologies** *Robin Obůrka, Petr Pulc* ***Robin Obůrka*** *Petr Pulc (Gar.)*	Z	3	2P	Z	PP
BI-UOS.21	**Unix-like Operating Systems** *Jan Trdlička, Zdeněk Muzikář, Yelena Trofimova, Jakub Žitný, Tomáš Vondra, Jakub Jančička, Jiří Borský, Lukáš Bařinka, Viktor Černý, ...* ***Zdeněk Muzikář*** *Zdeněk Muzikář (Gar.)*	KZ	5	2P+2C	Z	PP
TV1	**Physical Education**	Z	0	0+2	Z	PT

Number of semester: 2

Code	**Name of the course / Name of the group of courses** ***(in case of groups of courses the list of codes of their members)*** *Tutors,* ***authors*** *and guarantors (gar.)*	**Completion**	**Credits**	**Scope**	**Semester**	**Role**
BI-DBS.21	**Database Systems** *Jan Matoušek, Michal Valenta, Pavel Kříž, Štěpán Pechman, Monika Borkovcová, Dominik Roudný, Jan Bittner, Jiří Hunka, Přemysl Dědic, ...* ***Jiří Hunka*** *Michal Valenta (Gar.)*	Z,ZK	5	2P+2R+1L	L	PP
BI-MA1.21	**Mathematical Analysis 1** *Pavel Paták, Tomáš Kalvoda, Pavel Hrabák, Ivo Petr, Petr Olšák* ***Tomáš Kalvoda*** *Tomáš Kalvoda (Gar.)*	Z,ZK	5	2P+1R+1C	L	PP
BI-PA2.21	**Programming and Algorithmics 2** *Radek Hušek, Josef Vogel, Ladislav Vagner, Jan Trávníček* ***Jan Trávníček*** *Jan Trávníček (Gar.)*	Z,ZK	7	2P+1R+2C	L	PP
BI-SAP.21	**Computer Structure and Architecture** *Jaroslav Borecký, Martin Kohlík, Hana Kubátová, Petr Fišer* ***Hana Kubátová*** *Hana Kubátová (Gar.)*	Z,ZK	5	2P+1R+2C	L	PP
BI-LA2.21	**Linear Algebra 2** *Daniel Dombek, Karel Klouda, Luděk Kleprlík, Marta Nollová, Jakub Šístek* ***Luděk Kleprlík*** *Karel Klouda (Gar.)*	Z,ZK	5	2P+2C	L	PS

TV2	**Physical Education**	Z	0	0+2	L	PT
BI-V.2021	**Čistě volitelné předměty bakalářského programu Informatika, verze od 2021/22 do 2024/25** *BI-ADW.1,BI-ALO,..... (see the list of groups below)*	Min. cours. 0 Max. cours. 94	Min/Max 0/404			V

Number of semester: 3

Code	**Name of the course / Name of the group of courses** ***(in case of groups of courses the list of codes of their members)*** *Tutors, **authors** and guarantors (gar.)*	Completion	Credits	Scope	Semester	Role
BI-AG1.21	**Algorithms and Graphs 1** *Radek Hušek, Dušan Knop, Tomáš Valla, Ondřej Suchý, Michal Opler* ***Dušan Knop*** *Dušan Knop (Gar.)*	Z,ZK	5	2P+2C	Z	PP
BI-AAG.21	**Automata and Grammars** *Jan Janoušek, Jan Holub* ***Jan Holub*** *Jan Holub (Gar.)*	Z,ZK	5	2P+2C	Z	PP
BI-MA2.21	**Mathematical Analysis 2** *Pavel Paták, Tomáš Kalvoda, Pavel Hrabák, Ivo Petr, Petr Olšák* ***Tomáš Kalvoda*** *Tomáš Kalvoda (Gar.)*	Z,ZK	6	3P+2C	Z	PP
BI-APS.21	**Architectures of Computer Systems** *Pavel Tvrdík, Michal Štepanovský* ***Michal Štepanovský*** *Pavel Tvrdík (Gar.)*	Z,ZK	5	2P+2C	Z	PS
BI-PPA.21	**Programming Paradigms** *Tomáš Pecka, Jan Janoušek, Petr Máj, Tomáš Jakl* ***Jan Janoušek*** *Jan Janoušek (Gar.)*	Z,ZK	5	2P+2R	Z	PS
BI-V.2021	**Čistě volitelné předměty bakalářského programu Informatika, verze od 2021/22 do 2024/25** *BI-ADW.1,BI-ALO,..... (see the list of groups below)*	Min. cours. 0 Max. cours. 94	Min/Max 0/404			V

Number of semester: 4

Code	**Name of the course / Name of the group of courses** ***(in case of groups of courses the list of codes of their members)*** *Tutors, **authors** and guarantors (gar.)*	Completion	Credits	Scope	Semester	Role
BI-KAB.21	**Cryptography and Security** *Ivana Trummová, Josef Kokeš, Róbert Lórencz, Jiří Buček, Julia Plotnikova, David Pokorný, Jakub Tetera, Tomáš Rabas, Tomáš Zahradnický, ...* ***Róbert Lórencz*** *Róbert Lórencz (Gar.)*	Z,ZK	5	2P+2C	L	PP
BI-OSY.21	**Operating Systems** *Ladislav Vagner, Jiří Kašpar, Jan Trdlička, Petr Zemánek, Pavel Tvrdík, Michal Štepanovský* ***Pavel Tvrdík*** *Michal Štepanovský (Gar.)*	Z,ZK	5	2P+1R+1L	L	PP
BI-PSI.21	**Computer Networks** *Yelena Trofimova, Viktor Černý, Petr Hodač, Josef Zápotocký, Michal Polák, Michal Hažlinský, Jan Fesl, Vladimír Smotlacha, Josef Koumar, ...* ***Jan Fesl*** *Jan Fesl (Gar.)*	Z,ZK	5	2P+1R+1C	L	PP
BI-AG2.21	**Algorithms and Graphs 2** *Radek Hušek, Dušan Knop, Tomáš Valla, Ondřej Suchý, Michal Opler* ***Ondřej Suchý*** *Ondřej Suchý (Gar.)*	Z,ZK	5	2P+2C	L	PS
BI-PJP.21	**Programming Languages and Compilers** *Tomáš Pecka, Jan Janoušek Jan Janoušek (Gar.)*	Z,ZK	5	2P+1C	L	PS
BI-V.2021	**Čistě volitelné předměty bakalářského programu Informatika, verze od 2021/22 do 2024/25** *BI-ADW.1,BI-ALO,..... (see the list of groups below)*	Min. cours. 0 Max. cours. 94	Min/Max 0/404			V

Number of semester: 5

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
BI-BPR.21	**Bachelor project** ***Zdeněk Muzikář*** *Zdeněk Muzikář (Gar.)*	Z	1	0P+0C	Z,L	PP
BI-PST.21	**Probability and Statistics** *Pavel Hrabák, Kamil Dedecius, Jana Vacková, Petr Novák, Jitka Hrabáková* ***Pavel Hrabák*** *Pavel Hrabák (Gar.)*	Z,ZK	5	2P+2C	Z	PP

BI-LOG.21	**Mathematical Logic** *Kateřina Trlifajová* ***Kateřina Trlifajová*** *Kateřina Trlifajová (Gar.)*	Z,ZK	5	2P+2C	Z	PS
BI-OOP.21	**Object-Oriented Programming** *Petr Máj, Filip Křikava, Filip Říha* ***Filip Křikava*** *Filip Křikava (Gar.)*	Z,ZK	5	2P+2C	Z	PS
BI-PV-TI.21	**Povinně volitelné předměty specializace Teoretická informatika, verze 20201** *BI-SWI.21,BI-ML1.21*	Min. cours. 1 Max. cours. 2	Min/Max 5/10			PV
BI-V.2021	**Čistě volitelné předměty bakalářského programu Informatika, verze od 2021/22 do 2024/25** *BI-ADW.1,BI-ALO,..... (see the list of groups below)*	Min. cours. 0 Max. cours. 94	Min/Max 0/404			V

Number of semester: 6

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
BI-BAP.21	**Bachelor Thesis** *Zdeněk Muzikář* ***Zdeněk Muzikář*** *Zdeněk Muzikář (Gar.)*	Z	14		L,Z	PP
BI-TDP.21	**Documentation and Presentation** *Alena Libánská, Ondřej Guth, Petra Pavlíčková, Dana Vynikarová, Tomáš Nováček* ***Dana Vynikarová*** *Dana Vynikarová (Gar.)*	KZ	3	2P+2C	Z,L	PP
BI-ZUM.21	**Artificial Intelligence Fundamentals** *Pavel Surynek* ***Pavel Surynek*** *Pavel Surynek (Gar.)*	Z,ZK	5	2P+2C	L	PS
BI-ZKA.21	**Zkouška z angličtiny 2021** *BI-ANG1,BIE-EEC,..... (see the list of groups below)*	Min. cours. 1 Max. cours. 1	Min/Max 2/4			PJ
BI-V.2021	**Čistě volitelné předměty bakalářského programu Informatika, verze od 2021/22 do 2024/25** *BI-ADW.1,BI-ALO,..... (see the list of groups below)*	Min. cours. 0 Max. cours. 94	Min/Max 0/404			V

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

Kód	Name of the group of courses and codes of members of this group (for specification see here or below the list of courses)	Completion	Credits	Scope	Semester	Role
BI-PV-TI.21	**Povinně volitelné předměty specializace Teoretická informatika, verze 20201**	**Min. cours. 1 Max. cours. 2**	**Min/Max** 5/10			**PV**

BI-SWI.21	Software Engineering	BI-ML1.21	Machine Learning 1

Kód	Name	Completion	Credits	Scope	Semester	Role
BI-V.2021	**Čistě volitelné předměty bakalářského programu Informatika, verze od 2021/22 do 2024/25**	**Min. cours. 0 Max. cours. 94**	**Min/Max** 0/404			**V**

BI-ADW.1	Windows Administration	BI-ALO	Algebra and Logic	BI-AVI.21	Algorithms visually
BI-A2L	English language, preparation fo ...	BI-APJ	Aplication Programming in Java	NI-AFP	Applied Functional Programming
BIE-ZUM	Artificial Intelligence Fundamen ...	BI-BLE	Blender	NI-DSP	Database Systems in Practes
BI-STO	Storage and Filesystems	NI-PSD	Public Services Design	BIE-DIF	Differential equations
NI-DZO	Digital Image Processing	NI-DDM	Distributed Data Mining	BI-EP1.24	Effective programming 1
BI-EP2	Efficient Programming 2	BI-ANGK	English language, contact prepar ...	BI-EJA	Enterprise Java
BI-EJK	Enterprise Java and Kotlin	BI-FMU	Financial and Management Account ...	BI-HAM	HW accelerated network traffic m ...
BI-HMI	History of Mathematics and Infor ...	BI-ARD	Interactive applications on Ardu ...	NI-IAM	Internet and Multimedia
BIE-CSI	Introduction to Computer Science	FITE-EHD	Introduction to European Economi ...	BIE-IMA2	Introduction to Mathematics 2
BI-CS2	C# language and data access	BI-CS3	Language C# - design of web appl ...	BI-SQL.1	Language SQL, advanced
BI-QAP	Quantum algorithms and programmi ...	NI-LSM	Statistical Modelling Lab	BI-HAS	Human Aspects in Cryptography an ...
NI-MPL	Managerial Psychology	NI-MSI	Mathematical Structures in Compu ...	BI-MPP.21	Methods of interfacing periphera ...
BI-MIT	Mikrotik technologies	NI-MOP	Modern Object-Oriented Programmi ...	BI-MVT.21	Modern Visualisation Technologie ...

BI-MMP	Multimedia team project	BI-ORL	Operations Research and Linear P ...	NI-OLI	Linux Drivers
BI-ACM	Programming Practices 1	FIT-ACM1	Programming Practices 1	FIT-ACM2	Programming Practices 2
BI-ACM2	Programming Practices 2	FIT-ACM3	Programming Practices 3	BI-ACM3	Programming Practices 3
FIT-ACM4	Programming Practices 4	BI-ACM4	Programming Practices 4	FIT-ACM5	Programming Practices 5
FIT-ACM6	Programming Practices 6	BI-AND.21	Programming for the Android Oper ...	BI-CS1	Programming in C#
BI-PJV	Programming in Java	BI-PJS.1	JavaScript Programming	BI-KOT	Programing in Kotlin
NI-PSL	Programming in Scala	BI-PMA	Programming in Mathematica	BI-PHP.1	Programing in PHP
BI-PS2	Programming in shell 2	NI-PDD	Data Preprocessing	BI-PKM	Introduction to mathematics
NI-REV	Reverse Engineering	BI-SCE1	Computer Engineering Seminar I	BI-SCE2	Computer Engineering Seminar II
BI-ST1	Network Technology 1	BI-ST2	Network Technology 2	BI-ST3	Network Technology 3
BI-ST4	Network Technology 4	BI-SKJ.21	Scripting Languages	BI-SOJ	Machine Oriented Languages
FIT-SEP	World Economy and Business	BI-SEP	World Economy and Business	NI-SYP	Parsing and Compilers
BI-GIT	Version control system GIT	BIE-SEG	Systems Engineering	TVK1	Physical Education
TVV	Physical education	TV1	Physical Education	TVV0	Physical education
TV2	Physical Education	TV2K1	Physical Education 2	TVKLV	Physical Education Course
TVKZV	Physical Education Course	BI-TS1	Theoretical Seminar I	BI-TS2	Theoretical Seminar II
BI-TS3	Theoretical Seminar III	BI-TS4	Theoretical Seminar IV	BI-TDA	Test driven architecture
NI-TSP	Testing and Reliability	BI-QUA	Quality Assurance	FI-TOP	Academic writing
BI-CCN	Compiler Construction	BI-TEX	TeX and Typography	BI-EHD	Introduction to European Economi ...
BI-KSA	Cultural and Social Anthropology	BI-ULI	Introduction to Linux	BI-OPT	Introduction to Optical Networks
NI-VCC	Virtualization and Cloud Computi ...	BI-VHS	Virtual game worlds	BI-VR1	Virtual reality I
BI-VR2	Virtual reality II	BI-VAK.21	Selected Applications of Combina ...	BI-VMM	Selected Mathematical Methods
NI-VYC	Computability	BI-ZS10	Bachelor internship abroad for 1 ...	BI-ZS20	Bachelor internship abroad for 2 ...
BI-ZS30	Bachelor internship abroad for 3 ...	BI-ZIVS	Intelligent Embedded System Fund ...	BI-ZPI	Process engineering
BI-ZNF	PHP Framework Nette - basics	BI-IOS	Fundamentals of iOS Application ...	BI-ZWU	Introduction to Web and User Int ...
BI-3DT.1	3D Printing				

BI-ZKA.21	**Zkouška z angličtiny 2021**	**Min. cours. 1 Max. cours. 1**	**Min/Max** 2/4			**PJ**

BI-ANG1	English Language Examination wit ...	BIE-EEC	English language external certif ...	BI-ANG	English Language, Internal Certi ...

List of courses of this pass:

Code	Name of the course	Completion	Credits
BI-3DT.1	3D Printing	KZ	4
BI-A2L	English language, preparation for the B2 level exam	Z	2
The content of the course corresponds to the preparation for the English exam at the B2 level. Requirements for course credit. Academic Achievement - students are due to: -Take an active part in the language instruction. -Meet the requirements for writing assignments - Summary, Abstract, Argumentation Paper. -Succeed in both the midterm and the final term tests with the success rate set at 70%. -80% and over in BOTH tests means ORAL EXAM ONLY (no written part). Requirements will be specified by individual teachers during the first class of the term.			
BI-AAG.21	Automata and Grammars	Z,ZK	5
Students are introduced to basic theoretical and implementation principles of the following topics: construction, use and mutual transformations of finite automata, regular expressions, and regular grammars, context-free grammars, construction and use of pushdown automata, and translation grammars and transducers. They know the hierarchy of formal languages and they understand the relationships between formal languages and automata. They are introduced to the Turing machine and complexity classes P and NP.			
BI-ACM	Programming Practices 1	KZ	5
This is a selective course for preparing talented student for representation in international programming contests.			
BI-ACM2	Programming Practices 2	KZ	5
This is a selective course for preparing talented student for representation in international programming contests.			
BI-ACM3	Programming Practices 3	KZ	5
This is a selective course for preparing talented student for representation in international programming contests.			
BI-ACM4	Programming Practices 4	KZ	5
This is a selective course for preparing talented student for representation in international programming contests.			
BI-ADW.1	Windows Administration	Z,ZK	4
This course is presented in Czech. However, there is an English variant in the program Informatics (B1801 / 4753).			
BI-AG1.21	Algorithms and Graphs 1	Z,ZK	5
The course covers the basics of efficient algorithm design, data structures, and graph theory, belonging to the core knowledge of every computing curriculum. It links and partially develops the knowledge from the course BI-DML.21, in which students acquire the knowledge and skills in combinatorics necessary for evaluating the time and space complexity of algorithms. The course also follows up knowledge from BI-MA1.21, the practical usage of asymptotic mathematics, in particular, the asymptotic notation.			
BI-AG2.21	Algorithms and Graphs 2	Z,ZK	5
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.			

<table>
<tr><td>BI-ALO</td><td>Algebra and Logic</td><td>Z,ZK</td><td>4</td></tr>
<tr><td colspan="4">The course extends and deepens the study of topics touched upon in the basic course in logic.</td></tr>
<tr><td>BI-AND.21</td><td>Programming for the Android Operating System</td><td>KZ</td><td>4</td></tr>
<tr><td colspan="4">This course is presented in Czech.</td></tr>
<tr><td>BI-ANG</td><td>English Language, Internal Certificate</td><td>ZK</td><td>2</td></tr>
<tr><td colspan="4">Course information and teaching materials can be found at https://moodle-vyuka.cvut.cz/course/search.php?search=BI-ANG</td></tr>
<tr><td>BI-ANG1</td><td>English Language Examination without Preparatory Courses</td><td>Z,ZK</td><td>2</td></tr>
<tr><td>BI-ANGK</td><td>English language, contact preparation for the B2 level exam</td><td>Z</td><td>2</td></tr>
<tr><td colspan="4">The content of the course corresponds to the preparation for the English exam at the B2 level. Requirements for course credit. Academic Achievement - students are due to: -Take an active part in the language instruction. -Meet the requirements for writing assignments - Summary, Abstract, Argumentation Paper. -Succeed in both the midterm and the final term tests with the success rate set at 70%. -80% and over in BOTH tests means ORAL EXAM ONLY (no written part). Requirements will be specified by individual teachers during the first class of the term.</td></tr>
<tr><td>BI-APJ</td><td>Aplication Programming in Java</td><td>Z,ZK</td><td>4</td></tr>
<tr><td colspan="4">This course is presented in Czech. Advanced technologies in Java.</td></tr>
<tr><td>BI-APS.21</td><td>Architectures of Computer Systems</td><td>Z,ZK</td><td>5</td></tr>
<tr><td colspan="4">Students will learn the construction principles of internal architecture of computers with universal processors at the level of machine instructions. Special emphasis is given on the pipelined instruction processing and on the memory hierarchy. Students will understand the basic concepts of RISC and CISC architectures and the principles of instruction processing not only in scalar processors, but also in superscalar processors that can execute multiple instructions in one cycle, while ensuring the correctness of the sequential model of the program. The course further elaborates the principles and architectures of shared memory multiprocessor and multicore systems and the memory coherence and consistency in such systems.</td></tr>
<tr><td>BI-ARD</td><td>Interactive applications on Arduino</td><td>KZ</td><td>4</td></tr>
<tr><td colspan="4">The subject is designed for students of first grade of bachelor study as introduction to embedded systems. Students will learn how to design simple applications for modern programmable kits and control varied peripherals with help of available libraries. The goal of the subject is to show varied software approaches to control embedded systems, i.e. to see the results not only on display of a PC. Thanks to possible control on higher (objective) layer, this platform is frequently used for artist performance and therefore is suitable even for Web and Software Engineering students.</td></tr>
<tr><td>BI-AVI.21</td><td>Algorithms visually</td><td>Z,ZK</td><td>4</td></tr>
<tr><td colspan="4">The course complements other algorithm courses at FIT. It brings knowledge about particular important algorithms from different fields of the computer science that extend substantially knowledge presented in BI-AG1 and BI-AG2. A wide scope of covered subject is made possible due to using visualization bz Algovision (www.algovision.org<http://www.algovision.org>) that make understanding the principles of algorithms easy.</td></tr>
<tr><td>BI-BAP.21</td><td>Bachelor Thesis</td><td>Z</td><td>14</td></tr>
<tr><td>BI-BLE</td><td>Blender</td><td>Z,ZK</td><td>4</td></tr>
<tr><td colspan="4">The course extends knowledge of opensource program Blender from BI-MGA (Multimedia and Graphics Applications) course. It is intended for those interested in 3D graphics and animation. It offers a complete and practically oriented introduction to Blender environment. Students may continue to BI-PGA (Programming graphics applications) course.</td></tr>
<tr><td>BI-BPR.21</td><td>Bachelor project</td><td>Z</td><td>1</td></tr>
<tr><td colspan="4">1. At the beginning of the semester, the student reserves the topic of the bachelor's thesis and connects with the supervisor. He / she will arrange the partial tasks that he / she will perform during the semester to process the assignment. If he completes these tasks, the supervisor will award him a credit from the subject BI-BPR at the end of the semester. 2. The external supervisor enters the information on granting the credit using the form "Granting credit from the external supervisor of the final thesis" (http://fit.cvut.cz/student/studijni/formulare). The completed and signed form must be delivered in person or by email to the SZZ coordinator, who will arrange for the credit to be granted. 3. If the topic of the work that the student has reserved is formulated more generally, the tasks assigned to him by the supervisor for the semester should be aimed primarily at fine-tuning the assignment so that the assignment can be supplemented and approved at the end of the semester.</td></tr>
<tr><td>BI-CCN</td><td>Compiler Construction</td><td>Z,ZK</td><td>5</td></tr>
<tr><td colspan="4">This is an introductory class on compiler construction for bachelor students in computer science. The goal of the class is to introduce basic principles of compilers for students to understand the design and implementation of programming languages. Seeing and actually understanding self-compilation is the overarching theme of the class.</td></tr>
<tr><td>BI-CS1</td><td>Programming in C#</td><td>KZ</td><td>4</td></tr>
<tr><td colspan="4">The goal of the course is to introduce .NET Framework as a multi-language development platform. Then, programming language C#, its fundamental construction, types of variables, operators, arrays, loops, definitions and calls of functions will be discussed. Attention is focused on the object oriented programming in C# - class definition and class instancing, constructors, methods, properties, static members, Garbage Collector, inheritance and polymorphism, collections, delegates, and generics. Debugging and exception processing, as well as work with files are emphasized.</td></tr>
<tr><td>BI-CS2</td><td>C# language and data access</td><td>KZ</td><td>4</td></tr>
<tr><td colspan="4">The C# language and data access course objective is to introduce students several data access technologies - database, XML, NoSQL - on the Microsoft platform. The students will get to know objects used to retrieve data - Connection, Command, Data Reader and DataAdapter v ADO.NET. Next, they will learn to use current technologies such as LINQ - a set of features for querying and updating data, integrated directly with the .NET platform languages, which enable LINQ use with Objects, XML and SQL (LINQ to Objects, LINQ to XML and LINQ to SQL). Another objective is the Entity Framework - an object-relational mapper that enables .NET developers to work with relational data using domain-specific objects (ORM). This part of the course introduces Code First, Database First, Model First approaches. The students will also get to know the Conceptual Model, Storage Model and Mapping (XML description).</td></tr>
<tr><td>BI-CS3</td><td>Language C# - design of web applications</td><td>KZ</td><td>4</td></tr>
<tr><td colspan="4">The students will be introduced to current technologies in web application development on the .NET platform. They will acquire a comprehensive overview of the development possibilities on thisplatform. They will learn to create WebAPI and to use it by client programs.</td></tr>
<tr><td>BI-DBS.21</td><td>Database Systems</td><td>Z,ZK</td><td>5</td></tr>
<tr><td colspan="4">Students are introduced to the database engine architecture and typical user roles. They are briefly introduced to various database models. They learn to design small databases (including integrity constraints) using a conceptual model and implement them in a relational database engine. They get a hands-on experience with the SQL language, as well as with its theoretical foundation - the relational database model. They learn the principles of normalizing a relational database schema. They understand the fundamental concepts of transaction processing, controlling parallel user access to a single data source, as well as recovering a database engine from a failure. They are briefly introduced to special ways of storing data in relational databases with respect to speed of access to large quantities of data. This introductory-level course does not cover: Administration of database systems, debugging and optimizing database applications, distributed database systems, data stores.</td></tr>
<tr><td>BI-DML.21</td><td>Discrete Mathematics and Logic</td><td>Z,ZK</td><td>5</td></tr>
<tr><td colspan="4">Students will get acquainted with the basic concepts of propositional logic and predicate logic and learn to work with their laws. Necessary concepts from set theory will be explained. Special attention is paid to relations, their general properties, and their types, especially functional relations, equivalences, and partial orders. The course also lays down the basics of combinatorics and number theory, with emphasis on modular arithmetics.</td></tr>
<tr><td>BI-EHD</td><td>Introduction to European Economic History</td><td>Z,ZK</td><td>3</td></tr>
<tr><td colspan="4">This course is presented in Czech. However, there is an English variant in the program Informatics (B1801 / 4753).</td></tr>
</table>

BI-EJA	Enterprise Java	Z,ZK	4
The course is on advanced technologies in the Java programming language. The focus is on technologies for development of enterprise information systems which are connected to a database and are accessed through the web interface.			
BI-EJK	Enterprise Java and Kotlin	Z,ZK	4
The course is on advanced technologies in the Java and Kotlin programming languages. The focus is on technologies for developing enterprise information systems with microservice architecture, that can be deployed to the cloud.			
BI-EP1.24	Effective programming 1	KZ	4
The course is taught in Czech.			
BI-EP2	Efficient Programming 2	KZ	4
Continuation of Efficient Programming 1. Students will practice implementation of algorithms by solving typical problems. Various ways of solving individual problems are discussed, with the aim to choose the best one and avoid implementation errors.			
BI-FMU	Financial and Management Accounting	Z,ZK	5
The aim of the course is explanation of basic terms in the theory of accounting, the principles of balancing the property amounts and liabilities in the particular accounting operations, operations in accounts and accounting statements including opening and closing of bookkeeping. The course provides students with a legal modification of bookkeeping, description of economic operations based on current methods of double-entry bookkeeping for enterprising subjects in the Czech Republic. Principles of management accounting are base of Business Inteligence moduls in Business information systems.			
BI-GIT	Version control system GIT	KZ	2
Students will be introduced to basic principles of version control systems. These principles will be then shown on DCVS Git both theoretically and practically. In this particular system even the implementation details will be shown. Students will be challenged to use Git as users, project managers, team leaders as well as Git server administrators.			
BI-GIT.21	SW Development Technologies	Z	3
This course is aimed at one of the rudimental team software development technology - version control. To be more specific, we will introduce students to Git, the information manager from hell, as Linus Torvalds nicknamed it, and provide a comprehensive guide into its depths, as well as for day-to-day use.			
BI-HAM	HW accelerated network traffic monitoring	KZ	4
This course introduces students to modern and widely used technologies and principles in the area of network infrastructure and traffic monitoring. The monitoring and analysis of network traffic are mandatory skills to network operators (planning and development of resources and infrastructure) and security analysts alike (as a source of information and data for analysis). The goals of the course are to acquaint students with the modern trends and cornerstone principles in the area of monitoring network traffic on a hardware and software level and to develop their practical abilities in this field.			
BI-HAS	Human Aspects in Cryptography and Security	Z,ZK	5
This course is for students interested not only in technical scope of computer science, but also in making products usable - for users and for developers. Students of this course can use their gained knowledge to design, plan and analyse their own projects in the context of human-centered security.			
BI-HMI	History of Mathematics and Informatics	Z,ZK	3
This course is presented in Czech.			
BI-IOS	Fundamentals of iOS Application Development for iPhone and iPad	KZ	4
This course is presented in Czech.			
BI-KAB.21	Cryptography and Security	Z,ZK	5
Students will understand the mathematical foundations of cryptography and gain an overview of current cryptographic algorithms. They will be able to use cryptographic keys and certificates in systems based on them and learn the basics of safe use of symmetric and asymmetric cryptographic systems and hash functions in applications. Within labs, students will gain practical skills in using standard cryptographic methods with an emphasis on security and will also get acquainted with the basic procedures of cryptanalysis.			
BI-KOT	Programing in Kotlin	Z,ZK	4
Kotlin is a modern, statically-styled object-functional language that exploits the extensive Java language ecosystem while delivering a number of advanced language constructions. The language is fully Java compliant and allows for mixed projects that preserve existing parts written in Java, and continue with the development of a modern, object-functional way with minimum of boiler-plate code. Last but not least, Kotlin is suitable for designing of DSLs (Domain-Specific Languages).			
BI-KSA	Cultural and Social Anthropology	ZK	2
The one-semester course aims to acquaint students with the basics of social and cultural anthropology as a scientific discipline dealing with the diversity of the world - examples from anthropological research from our "exotic" cultures (topics: kinship, religion, social exclusion, migration, globalization, , material culture, language, health, history, death, etc ...) will be shown. The course is presented in Czech.			
BI-LA1.21	Linear Algebra 1	Z,ZK	5
We will introduce students to the basic concepts of linear algebra, such as vectors, matrices, vector spaces. We will define vector spaces over the field of real and complex numbers and also over finite fields. We will present the concepts of basis and dimension and learn to solve systems of linear equations using the Gaussian elimination method (GEM) and show the connection with linear manifolds. We define the regularity of matrices and learn to find their inversions using GEM. We will also learn to find eigenvalues and eigenvectors of a matrix. We will also demonstrate some applications of these concepts in computer science.			
BI-LA2.21	Linear Algebra 2	Z,ZK	5
Studenti si v tomto předmětu rozšíří znalosti z předmětu BI-LA1, kde se pracovalo pouze s vektory ve formě n-tic čísel. Zde si zavedeme vektorový prostor v abstraktní obecné formě. Seznámíme se také s pojmem skalární součin a lineární zobrazení, což nám dovolí ukázat souvislost s lineární algebrou, geometrií a počítačovou grafikou. Dalším velkým tématem bude numerická lineární algebra, kde si ukážeme potíže s řešením soustav lineárních rovnic na počítači a možnosti, jak se s tímto problémem vypořádat s důrazem na rozklady matic. Ukážeme si také aplikace lineární algebry v různých oborech.			
BI-LOG.21	Mathematical Logic	Z,ZK	5
The course focuses on the basics of propositional and predicate logic. It starts from the semantic point of view. Based on the notion of truth, satisfiability, logical equivalence, and the logical consequence of formulas are defined. Methods for determining the satisfiability of formulas, some of which are used for automated proving, are explained. This relates to the P vs. NP problem and Boolean functions in propositional logic. In predicate logic, the course further deals with formal theories, such as arithmetics, and their models. The syntactic approach to mathematical logic is demonstrated on the axiomatic system of propositional logic and its properties. Gödel's incompleteness theorems is explained.			
BI-MA1.21	Mathematical Analysis 1	Z,ZK	5
We begin the course by introducing students to the set of real numbers and its properties, and we note its differences with the set of machine numbers. Then we study real sequences and real functions of a real variable. We gradually introduce the notions of limits of sequences and functions, continuous functions, and derivatives of functions. This theoretical foundation is then applied to root-finding problems (iterative method of bisection and Newtons method), construction of cubic interpolation (spline), and formulation and solution of simple optimization problems (i.e., the issue of finding extrema of functions). The course is closed with the Landaus asymptotic notation and methods of mathematical description of complexity of algorithms.			
BI-MA2.21	Mathematical Analysis 2	Z,ZK	6
The course completes the theme of analysis of real functions of a real variable initiated in BI-MA1 by introducing the Riemann integral. Students will learn how to integrate by parts and use the substitution method.The next part of the course is devoted to number series, and Taylor polynomials and series. We apply Taylors theorem to the computation of elementary functions with a prescribed accuracy. Then we study the linear recurrence equations with constant coefficients, the complexity of recursive algorithms, and its analysis using the Master theorem. Finally, we introduce the student to the theory of multivariate functions. After establishing basic concepts of partial derivative, gradient, and Hessian matrix, we study the analytical method of localization of local extrema of multivariate functions as well as the numerical descent method. We conclude the course with the integration of multivariate functions.			

<table>
<tr><td>BI-MIT</td><td>Mikrotik technologies</td><td>KZ</td><td>3</td></tr>
<tr><td colspan="4">The main motivation of the subject stands in the introduction of the RouterOS operating system and some network Mikrotik technologies which are commonly used by the small and middle internet service providers (ISPs). The students learn how to use and create the architectures of the network solutions which are based on the metallic, optical or wireless links and how to administrate and practically deploy them. The successful completion of this subject requires the previous knowledge of elementary computer networks concepts like protocols and technologies of the data-link, network and transport layer of the OSI model.</td></tr>
<tr><td>BI-ML1.21</td><td>Machine Learning 1</td><td>Z,ZK</td><td>5</td></tr>
<tr><td colspan="4">The goal of this course is to introduce students to the basic methods of machine learning. They get theoretical understanding and practical working knowledge of regression and classification models in the supervised learning scenario and clustering models in the unsupervised scenario. Students will be aware of the relationships between model bias and variance, and know the fundamentals of assessing model quality. Moreover, they learn the basic techniques of data preprocessing and multidimensional data visualization. In practical demonstrations, pandas and scikit libraries in Python will be used.</td></tr>
<tr><td>BI-MMP</td><td>Multimedia team project</td><td>KZ</td><td>4</td></tr>
<tr><td colspan="4">This course is presented in Czech.</td></tr>
<tr><td>BI-MPP.21</td><td>Methods of interfacing peripheral devices</td><td>Z,ZK</td><td>5</td></tr>
<tr><td colspan="4">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.</td></tr>
<tr><td>BI-MVT.21</td><td>Modern Visualisation Technologies</td><td>Z,ZK</td><td>5</td></tr>
<tr><td colspan="4">The goal of the course is to give an overview of modern visualization technologies and their principles, namely technologies related to virtual and augmented reality, visualization on high resolution displays (e.g., SAGE and video mapping) and their applications in practice. Several lectures deal with the content creation for the mentioned technologies, namely fractal and procedural visualization, scientific data visualization, and 3D model scanning.</td></tr>
<tr><td>BI-OOP.21</td><td>Object-Oriented Programming</td><td>Z,ZK</td><td>5</td></tr>
<tr><td colspan="4">Object-oriented programming has been used in the last 50 years to solve computational problems by using graphs of objects that collaborate together by message passing. In this course students get acquainted with the main principles of object-oriented programming and design, used in modern programming languages. The emphasis is on practical techniques for developing software, which includes testing, error handing, refactoring, and application of design pattern.</td></tr>
<tr><td>BI-OPT</td><td>Introduction to Optical Networks</td><td>Z,ZK</td><td>4</td></tr>
<tr><td colspan="4">Students get basic overview of optical networking technology with the emphasis on practical utilization in Internet and in network infrastructures, on possible problems with deployment of optical network technology and on their solutions. The course will include the history of optical communications, an overview of passive components (optical fibres, multiplexors, dispersion compensators, and others), and an overview of active components (optical switches and amplifiers, high-speed coherent transmission systems). The course will also cover the most up-to-date topics presented at premium research conferences, such as ECOC or OFC. Attention will also be paid to new applications, such as the accurate time on Internet, ultrastable frequency transfer, or sensor networks. The labs will focus on real work with optical components and on measurement of their parameters. Students will solve real tasks from practice.</td></tr>
<tr><td>BI-ORL</td><td>Operations Research and Linear Programming</td><td>KZ</td><td>5</td></tr>
<tr><td colspan="4">The subject aims to introduce students to the issues of operational research and primarily to the practical application of linear programming as a fundamental optimization technique. Operational research primarily focuses on the use of engineering methods (with a mathematical background) to solve practical problems (such as management).</td></tr>
<tr><td>BI-OSY.21</td><td>Operating Systems</td><td>Z,ZK</td><td>5</td></tr>
<tr><td colspan="4">In this course that is a follow-up of the Unix-like operating systems course students deepen their knowledge in areas of OS kernels, process and thread implementations, race conditions, critical regions, thread scheduling, shared resource allocation and deadlocks, management of virtual memory and data storages, file systems, OS monitoring. They are able to design and implement simple multithreaded applications. General principles are illustrated on operating systems Solaris, Linux, or MS Windows.</td></tr>
<tr><td>BI-PA1.21</td><td>Programming and Algorithmics 1</td><td>Z,ZK</td><td>7</td></tr>
<tr><td colspan="4">Students gain the ability to formulate algorithms for solving basic problems and write them in the C language. They understand data types (simple, structured, pointers), expressions, statements, functions, concept of recursion. They learn to analyse simple cases of algorithm complexity. They know fundamental algorithms for searching, sorting, and manipulating with linked lists and trees.</td></tr>
<tr><td>BI-PA2.21</td><td>Programming and Algorithmics 2</td><td>Z,ZK</td><td>7</td></tr>
<tr><td colspan="4">Students know the instruments of object-oriented programming and are able to use them for specifying and implementing abstract data types (stack, queue, enlargeable array, list, set, table). They learn these skills using the C++ programming language and are introduced to all C++ features needed in object-oriented programming (e.g., template programming, copying/moving of objects, operator overloading, inheritance, polymorphism).</td></tr>
<tr><td>BI-PHP.1</td><td>Programing in PHP</td><td>KZ</td><td>4</td></tr>
<tr><td colspan="4">The course is taught in Czech.. Main goal of the course is an introduction to PHP - language and technology. Students will learn also best practices and will use tool that eases development in PHP. The course is recommended for students of BIE-WSI-WI.2015 branch of study and do not have required knowledge to register for BIE-TWA.1. They should register for this course in their 3rd semester of study.</td></tr>
<tr><td>BI-PJP.21</td><td>Programming Languages and Compilers</td><td>Z,ZK</td><td>5</td></tr>
<tr><td colspan="4">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.</td></tr>
<tr><td>BI-PJS.1</td><td>JavaScript Programming</td><td>KZ</td><td>4</td></tr>
<tr><td colspan="4">Main goal of the course is an introduction to Javascript programming. Students will learn also best practices and will use tool that eases development in Javascript. The course is recommended for students of BIE-WSI-WI.2015 branch of study and do not have required knowledge to register for BIE-TWA.1. They should register for this course in their 4th semester of study.</td></tr>
<tr><td>BI-PJV</td><td>Programming in Java</td><td>Z,ZK</td><td>4</td></tr>
<tr><td colspan="4">This course is presented in Czech. However, there is an English variant in the program Informatics (B1801 / 4753).</td></tr>
<tr><td>BI-PKM</td><td>Introduction to mathematics</td><td>Z</td><td>4</td></tr>
<tr><td colspan="4">This course is presented in Czech.</td></tr>
<tr><td>BI-PMA</td><td>Programming in Mathematica</td><td>Z,ZK</td><td>4</td></tr>
<tr><td colspan="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.</td></tr>
<tr><td>BI-PPA.21</td><td>Programming Paradigms</td><td>Z,ZK</td><td>5</td></tr>
<tr><td colspan="4">The course deals with basic paradigms of high-level programming languages, including their basic execution models, benefits, and disadvantages of particular approaches. Functional programming paradigm and its basic principles are explained in details. Logic programming is introduced as another way of declarative programming. The principles are demonstrated on lambda calculus and on Lisp (Racket) and Prolog programming languages. Moreover, usage of these principles is demonstrated on modern mainstream programming languages such as C++ and Java.</td></tr>
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<tr><td>BI-PS2</td><td>Programming in shell 2</td><td>Z,ZK</td><td>4</td></tr>
<tr><td colspan="4">Students gain a general overview of available scripting languages, their syntax, semantics, programming style, data structures, pros and cons. In addition, they gain a deeper insight into shell and some other particular scripting languages and will get practical experience with shell script programming.</td></tr>
<tr><td>BI-PSI.21</td><td>Computer Networks</td><td>Z,ZK</td><td>5</td></tr>
<tr><td colspan="4">The course introduces students to the principles of computer networking. It covers basic technologies, protocols, and services commonly used in local networks and in the Internet as well. The lectures will be amended by proseminars that introduce students into network programming and demonstrate the abilities of advanced network technologies. Students practically verify configurations and management of network devices in the lab within the environment of the operating systems Linux and Cisco IOS.</td></tr>
<tr><td>BI-PST.21</td><td>Probability and Statistics</td><td>Z,ZK</td><td>5</td></tr>
<tr><td colspan="4">Students will learn the basics of probabilistic thinking, the ability to synthesize prior and posterior information and learn to work with random variables. They will be able to apply basic models of random variable distributions and solve applied probabilistic problems in informatics and computer science. Using the statistical induction they will be able to perform estimations of unknown distributional parameters from random sample characteristics. They will also be introduced to the methods for testing statistical hypotheses and determining the statistical dependence of two or more random variables.</td></tr>
<tr><td>BI-QAP</td><td>Quantum algorithms and programming</td><td>KZ</td><td>5</td></tr>
<tr><td colspan="4">Course aims at giving students hands-on experience with quantum computers and their programming. We focus on fundaments of quantum mechanics, on which quantum technologies are based, and algorithms showing advantages and limitations of quantum computing. During tutorials students work in open-source software development kit Qiskit, which is based on Python language. Knowledge of linear algebra at the level of BI-LA1 and BI-LA2 (or BI-LIN) is necessary. Previous completion of BI-MA2 or BI-VMM and experience with Python might be an advantage. No previous knowledge of physics is assumed.</td></tr>
<tr><td>BI-QUA</td><td>Quality Assurance</td><td>KZ</td><td>4</td></tr>
<tr><td colspan="4">This course introduces students to the fundamentals of testing and quality management. Students will learn what the role of a tester is in the context of different types of software development and will experience hands-on application testing using both manual and automated testing. At the end of the semester, the student should be prepared to perform a test analysis, design a set of test scenarios, prepare test data, automate an appropriate portion of the scenarios, and prepare a report on the bugs found in the product under test.</td></tr>
<tr><td>BI-SAP.21</td><td>Computer Structure and Architecture</td><td>Z,ZK</td><td>5</td></tr>
<tr><td colspan="4">Students will get acquainted with the basic architecture and units of a digital computer, understand the structure, function, and implementation of arithmetic-logic unit , controllers, memory, I/O communication, methods of data transfers between the units. The logic design and the implementation of a program-controlled simple processor is practically implemented in the labs using programmable circuits (FPGA), a single-chip microcomputer, and modern design (EDA) tools.</td></tr>
<tr><td>BI-SCE1</td><td>Computer Engineering Seminar I</td><td>Z</td><td>4</td></tr>
<tr><td colspan="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 KČN laboratories. The capacity of the subject is limited by the possibilities of the seminar teachers. The topics are new for each semester.</td></tr>
<tr><td>BI-SCE2</td><td>Computer Engineering Seminar II</td><td>Z</td><td>4</td></tr>
<tr><td colspan="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 KČN laboratories. The capacity of the subject is limited by the possibilities of the seminar teachers. The topics are new for each semester.</td></tr>
<tr><td>BI-SEP</td><td>World Economy and Business</td><td>Z,ZK</td><td>4</td></tr>
<tr><td colspan="4">This course is presented in Czech. The course introduces students of technical university to the international business. It does that predominantly by comparing individual countries and key regions of world economy. Students get to know about different religions and cultures, necessary for doing business in diverse societies as well as indexes of economic freedom, corruption and economic development, which are needed for the right investment decision. Seminars help to improve on the knowledge in the form of discussions based on individual readings. It is advised to take bachelor level of this course BIE-SEP as a prerequisite.</td></tr>
<tr><td>BI-SKJ.21</td><td>Scripting Languages</td><td>Z,ZK</td><td>4</td></tr>
<tr><td colspan="4">Students gain a general overview of available scripting languages, their syntax, semantics, programming style, data structures, pros and cons. In addition, they gain a deeper insight into shell and some other particular scripting languages and will get practical experience with shell script programming.</td></tr>
<tr><td>BI-SOJ</td><td>Machine Oriented Languages</td><td>Z,ZK</td><td>4</td></tr>
<tr><td colspan="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.</td></tr>
<tr><td>BI-SQL.1</td><td>Language SQL, advanced</td><td>KZ</td><td>4</td></tr>
<tr><td colspan="4">Module is based on knowledge obtained in BI-DBS. Students become familiar with advanced relational and non-relational features of SQL language. In particular stored program unites, triggers, recursive queries, OLAP support, object-relational constructions. Part of the course is dedicated to practical database optimization from the point of view of specialized database structures like indexes, clusters, index-organized tables, and materialized views. as well as from the point of view query optimization. Execution plan and possibilities of its. changes will be discussed. Lectures will usually discuss SQL standard, but many features will be demonstrated on Oracle DBMS. Seminars are based on Oracle DBMS and partially on PostgreSQL.</td></tr>
<tr><td>BI-ST1</td><td>Network Technology 1</td><td>Z</td><td>3</td></tr>
<tr><td colspan="4">The subject is oriented to providing the students basic information and practical skills from the area of digital and IP networks. The subject is acredited under the Cisco Netacad - CCNA1 - R&S Introduction to Networks.</td></tr>
<tr><td>BI-ST2</td><td>Network Technology 2</td><td>Z</td><td>3</td></tr>
<tr><td colspan="4">This course is presented in Czech.</td></tr>
<tr><td>BI-ST3</td><td>Network Technology 3</td><td>Z</td><td>3</td></tr>
<tr><td colspan="4">Students will further enhance their knowledge acquired from previous BI-ST1 and BI-ST2 courses. Principles of routing and switching presented during BI-ST1 and BI-ST2 courses will get further extended in the course. Students will be able to start fine-tune protocols' settings to gain certain advantages like increased efficiency, predictability, extension beyond a simple topology, security, etc.</td></tr>
<tr><td>BI-ST4</td><td>Network Technology 4</td><td>Z</td><td>3</td></tr>
<tr><td colspan="4">Students will further enhance their knowledge already acquired from previous BI-ST1, BI-ST2, and BI-ST3 courses. Principles of routing and switching presented during BI-ST1 and BI-ST2 courses got further extended in BI-ST3. Students were able to start fine-tune protocols' settings to gain certain advantages like increased efficiency, predictability, extension beyond a simple topology, security, etc. This module teaches students to configure and fine-tune Wide Area Networks and to experience a completely other type of network (Non Broadcast Multiple Access) which radically differs from well-known Ethernet (broadcast) type of networks. Students will also manage router and switch firmware, perform password recoveries, and emergency procedures. Also the security aspect is treated; students will learn possible intra- and inter-network attacks and the mitigation ways while maintaining the network running.</td></tr>
<tr><td>BI-STO</td><td>Storage and Filesystems</td><td>Z,ZK</td><td>4</td></tr>
<tr><td colspan="4">The student will learn principles and current solutions of storage systems architecture. The module explains principles of data store, protection, and archiving, as so as storage scaling, load balancing and high availability.</td></tr>
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BI-SWI.21	Software Engineering	Z,ZK	5
Students get acquainted with methods of analysis and design of larger software projects that are typically designed and implemented in teams. They consolidate and practically verify their knowledge during the analysis and design of larger software systems that will be developed in the concurrent course BIE-SP1. Students get hands-on experience with CASE tools using the visual language UML for modeling and solving software problems. Students learn the basics of object-oriented analysis, architecture design and testing. Within the course, students also gain a theoretical basis in the field of project management, estimation of costs of software projects, and methods of their development.			
BI-TDA	Test driven architecture	KZ	4
The course is focused on practical examples of how to develop, test, and deploy software with tools like GitLab, Docker, Kubernetes, and more that are well known in the DevOps world. This course has a strong connection on courses like BI(E)-SI1 and BI(E)-SI2. The main goal of this course is to learn by examples that occur in the semester project.			
BI-TDP.21	Documentation and Presentation	KZ	3
The course is focused on the basics of creating electronic documentation with emphasis on the creation of technical reports of a larger scope, typically final university theses. Students learn to create text of a technical report in the LaTeX system, process an electronic presentation using the LaTeX Beamer system, and practically present it in front of classmates and the teacher. The course is intended primarily for those students who have chosen the topic of their bachelor's thesis or will choose it within the first 14 days of teaching. Within the exercises of the course, an active approach to the creation of individual parts of the bachelor's thesis is assumed.			
BI-TEX	TeX and Typography	Z,ZK	4
This course is presented in Czech. This course gives basics of programming in TeX (plain TeX, ConTeXt, LaTeX, OpTeX, LuaTeX). Te second part of the course focuses on typographic rules.			
BI-TS1	Theoretical Seminar I	Z	4
Theoretical seminar is intended for students which want to come in deeper contact with contemporary theoretical computer science. It is mostly a classical reading group. The students are treated individually and concern themselves with interesting topics from the latest research in the area. Therefore, an integral part of the course is a work with scientific papers and other scholarly literature. The capacity is limited by the the potentials of the teachers of the seminar.			
BI-TS2	Theoretical Seminar II	Z	4
Theoretical seminar is intended for students which want to come in deeper contact with contemporary theoretical computer science. It is mostly a classical reading group. The students are treated individually and concern themselves with interesting topics from the latest research in the area. Therefore, an integral part of the course is a work with scientific papers and other scholarly literature. The capacity is limited by the the potentials of the teachers of the seminar.			
BI-TS3	Theoretical Seminar III	Z	4
Theoretical seminar is intended for students which want to come in deeper contact with contemporary theoretical computer science. It is mostly a classical reading group. The students are treated individually and concern themselves with interesting topics from the latest research in the area. Therefore, an integral part of the course is a work with scientific papers and other scholarly literature. The capacity is limited by the the potentials of the teachers of the seminar.			
BI-TS4	Theoretical Seminar IV	Z	4
Theoretical seminar is intended for students which want to come in deeper contact with contemporary theoretical computer science. It is mostly a classical reading group. The students are treated individually and concern themselves with interesting topics from the latest research in the area. Therefore, an integral part of the course is a work with scientific papers and other scholarly literature. The capacity is limited by the the potentials of the teachers of the seminar.			
BI-TZP.21	Technological Fundamentals of Computers	Z,ZK	5
Students get acquainted with the fundamentals of digital and analog circuits, as well as basic methods of analyzing them. Students learn how computer structures look like at the lowest level. They are introduced to the function of a transistor. They will understand why processors generate heat, why cooling is necessary, and how to reduce the consumption; what the limits to the maximum operating frequency are and how to raise them; why a computer bus needs to be terminated, what happens if it is not; how a computer power supply looks like (in principle). In the labs, students model the behavior of basic electrical circuits in SW Mathematica.			
BI-ULI	Introduction to Linux	Z	2
Students become familiar with the basics of the Linux operating system using e-learning form. They learn to work with the command line and become familiar with basic commands and techniques of a Unix-like system. Topics can be studied first theoretically and then practically verified in a virtual machine (terminal).			
BI-UOS.21	Unix-like Operating Systems	KZ	5
Unix-like operating systems represent a large family mostly open-source codes that kept bringing during the history of computers efficient innovative functions of multiuser operating systems for computers and their networks and clusters. The most popular OS today, Android, has a unix kernel. Students get overview of basic properties of this OS family, such as processes and threads, access rights and user identity, filters, or handling files in a file system. They learn to use practically these systems at the level of advanced users who are not only able to utilize powerful system tools that are available to users, but are also able to automatize routine agenda using the unix scripting interface, called shell.			
BI-VAK.21	Selected Applications of Combinatorics	Z	3
The course aims to introduce students in an accessible form to various branches of theoretical computer science and combinatorics. In contrast to the basic courses, we approach the issue from applications to theory. Together, we will first refresh the basic knowledge needed to design and analyze algorithms and introduce some basic data structures. Furthermore, with the active participation of students, we will focus on solving popular and easily formulated problems from various areas of (not only theoretical) informatics. Areas from which we will select problems to be solved will include, for example, graph theory, combinatorial and algorithmic game theory, approximation algorithms, optimization and more. Students will also try to implement solutions to the studied problems with a special focus on the effective use of existing tools.			
BI-VHS	Virtual game worlds	ZK	4
The course leads students to create a complex virtual world. The course is a continuation of basic graphical courses (MGA, PGR, BLE,). This current students knowledge is furthermore complemented by the theory of game design, principles of writing dialogues and characters in order to create a functional and complex virtual world. The course can be followed by the course MI-PVR with the task of converting scenes and their dynamics into a fully virtual environment suitable for VR devices.			
BI-VMM	Selected Mathematical Methods	Z,ZK	4
The lecture begins with an introduction to the analysis of complex functions of a complex variable. Next, we present the Lebesgue integral. We then address Fourier series and their properties. Further, we introduce and study the properties of the Discrete Fourier Transform (DFT) and its fast implementation (FFT). We discuss the wavelet transform. We examine the linear programming problem in more detail and its solution using the Simplex algorithm. Each topic is demonstrated with interesting examples.			
BI-VR1	Virtual reality I	KZ	4
Introduction to Virtual Reality (VR), virtual reality operating system and virtual reality creation. Another objective is to meet the rules and requirements of virtual worlds communication. The course focuses on the ways of teaching using virtual reality technologies and interactive activities in educational virtual 3D worlds. It improves computational thinking, empathy and shared social activities.			
BI-VR2	Virtual reality II	KZ	3
Continuation of the course Virtual Reality I. The new course focuses on collaborative telepresence, spatial computing and social life of avatars. The objective is to develop applications for computer science and gamification in various social metaverse and desktop engines.			
BI-ZIVS	Intelligent Embedded System Fundamentals	KZ	4
Intelligent embedded system fundamentals course is focused on high-level technology embedded systems integrating artificial intelligence. The aim of the course is to teach students modern humanoid robot control and development of applications in a graphical development environment. Lectures provide fundamentals of motion control, sensor reading, application interfaces, robot navigation and development tools. In labs, students program a set of basic task by using the robot simulator and real hardware to get practical experience with these technologies.			

BI-ZNF	PHP Framework Nette - basics	KZ	3	Students will gain the basics of PHP framework Nette. They will learn how to practically work with MVP architecture and various libraries of this Czech popular framework. The resulting knowledge should serve for the efficient creation of a web backend in PHP language.
BI-ZPI	Process engineering	KZ	4	Students will learn fundamentals of process engineering in this subject. Students will get necessary foundations for understanding formal principles of process modelling and they will learn basics of the used notations (UML, BPMN, BORM). The focus in this subject lies in training of practical skills of formalisation and modelling of business processes using modern CASE tools. The role of process engineering for information systems development is discussed as well as its importance in the overall context of information and business strategy of an enterprise.
BI-ZS10	Bachelor internship abroad for 10 credits	Z	10	Each student can once within his / her bachelor's study programme 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 BI-ZS10, BI-ZS20, BI-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.
BI-ZS20	Bachelor internship abroad for 20 credits	Z	20	Each student can once within his / her bachelor's study programme 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 BI-ZS10, BI-ZS20, BI-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.
BI-ZS30	Bachelor internship abroad for 30 credits	Z	30	Each student can once within his / her bachelor's study programme 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 BI-ZS10, BI-ZS20, BI-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.
BI-ZUM.21	Artificial Intelligence Fundamentals	Z,ZK	5	Basic course on introduction to artificial intelligence with emphasis on symbolic techniques. The design of an intelligent agent and the techniques needed to create it will be discussed, especially at the decision-making level. The intelligent agent in the context of the course can be represented for example by a physical robot, but also by a non-physical entity, such as a virtual assistant or a character in a computer game. We will not only introduce the basics, but also show the current state-of-the-art during the course.
BI-ZWU	Introduction to Web and User Interfaces	Z,ZK	4	This course is presented in Czech.
BIE-CSI	Introduction to Computer Science	Z	2	This is an introductory class on Elementary Computer Science for broad audiences: bachelor students in computer science, students majoring in other fields but interested in computer science, high-school students, anybody with a background in basic math and the desire to understand the absolute basics of computer science. The goal of the class is to introduce and relate basic principles of computer science for students to understand, early on, what computer science is, why things such as high-level programming languages and tools are done the way they are, and even how, on a basic yet representative and practically relevant level. After taking the class, students are able to answer not just basic computer science questions but also questions about themselves such as which courses to take next and which books to follow up with, ideally realizing if they are interested in computer science more than expected, or even less than before.
BIE-DIF	Differential equations	Z,ZK	5	This course provides a foundational overview of differential equations, starting with basic motivation and examples of ODEs and progressing to essential solution methods like separation of variables. Key theorems on existence and uniqueness establish when solutions can be guaranteed. Linear and system-based ODEs are covered with methods like characteristic polynomial analysis, followed by examples of non-linear models such as predator-prey and epidemiological models to showcase real-world applications. Finally, an introduction to partial differential equations (PDEs) extends these concepts to multi-variable contexts. The course will also cover numerical methods for solving ODEs and PDEs, including implicit and explicit Euler methods, Runge-Kutta methods, and finite element methods for both ODEs and PDEs.
BIE-EEC	English language external certificate	Z	4	The BIE-ECC course can be recognized for any active semester after the submission of a certificate certificate that demonstrates their proficiency in English comparable to or exceeding the B2 level of the Common European Framework of Reference for Languages.
BIE-IMA2	Introduction to Mathematics 2	Z	2	Students refresh and extend knowledge of elementary functions and their properties. Students understand basic mathematical principles and they are able to apply them in particular examples.
BIE-SEG	Systems Engineering	Z	0	This is an introductory class on systems engineering for bachelor students in computer science. The goal of the class is to introduce basic principles of operating systems for students to understand processor and memory virtualization. Seeing and actually understanding virtualization is the overarching theme of the class. After taking the class, students are able to understand the difference between processes and threads as well as emulation and virtualization, what virtual memory is and how it works, what concurrency is, as opposed to parallelism, and how processes and threads synchronize efficiently to overcome concurrency for communication.
BIE-ZUM	Artificial Intelligence Fundamentals	Z,ZK	4	Students are introduced to the fundamental problems in the Artificial Intelligence, and the basic methods for their solving. It focuses mainly on the classical tasks from the areas of state space search, multi-agent systems, game theory, planning, and machine learning. Modern soft-computing methods, including the evolutionary algorithms and the neural networks, will be presented as well.
FI-TOP	Academic writing	Z	2	Publishing is an important and required part of research activity. It is not only about obtaining research results but also about applying them in the form of publication. Writing scientific publications can be useful for students not only in their own publishing activities but also in the preparation of a bachelor's or master's thesis. In the course, students will learn how to write a scientific article, what parts such an article should have, and how the peer review process works. Students will also try their hand at presenting an article and reviewing someone else's article. The course will be taught in blocks, with one lecture at the beginning of the semester and one practicum in the middle of the semester. Dates will be determined based on the availability of enrolled students.
FIT-ACM1	Programming Practices 1	KZ	5	This is a selective course for preparing talented student for representation in international programming contests.
FIT-ACM2	Programming Practices 2	KZ	5	This is a selective course for preparing talented student for representation in international programming contests.
FIT-ACM3	Programming Practices 3	KZ	5	This is a selective course for preparing talented student for representation in international programming contests.

FIT-ACM4	Programming Practices 4 This is a selective course for preparing talented student for representation in international programming contests.	KZ	5
FIT-ACM5	Programming Practices 5 This is a selective course for preparing talented student for representation in international programming contests.	KZ	5
FIT-ACM6	Programming Practices 6 This is a selective course for preparing talented student for representation in international programming contests.	KZ	5
FIT-SEP	World Economy and Business This course is presented in Czech. The course introduces students of technical university to the international business. It does that predominantly by comparing individual countries and key regions of world economy. Students get to know about different religions and cultures, necessary for doing business in diverse societies as well as indexes of economic freedom, corruption and economic development, which are needed for the right investment decision. Seminars help to improve on the knowledge in the form of discussions based on individual readings. It is advised to take bachelor level of this course BIE-SEP as a prerequisite.	Z,ZK	4
FITE-EHD	Introduction to European Economic History The course introduces a selection of themes from the European economic history. It gives the student basic knowledge about forming of the global economy through the description of the key periods in history. As European countries have been dominant actors in this process it focuses predominantly on their roles in the economic history. From large economic area of Roman Empire to fragmentation of the Middle Ages, from destruction of WWII to the current affairs, the development of modern financial institutions is deciphered. The course does not cover detailed economic history of particular European countries but rather the impact of trade and role of particular events, institutions and organizations in history. Class meetings will consist of a mixture of lecture and discussion.	Z,ZK	3
NI-AFP	Applied Functional Programming 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.	KZ	5
NI-DDM	Distributed Data Mining Course focuses on state-of-the-art approaches for distributed data mining and parallelization of machine learning algorithms. Students will gain hands on experience with large scale data processing framework Apache Spark and with existing distributed DM / ML algorithms. They will learn principles of their parallel implementations and will be capable to propose approaches to parallelize other algorithms. The course is prezented in czech language.	KZ	4
NI-DSP	Database Systems in Practes This course is presented in Czech.	Z,ZK	4
NI-DZO	Digital Image Processing This course presents a comprehensive overview of modern methods for interactive editing of digital images and video. It mainly deals with practical algorithms that are both easy to implement and have an interesting theoretical basis. Visually attractive applications provide better understanding of basic theoretical background that is also valuable outside the domain of digital image processing. This course will introduce algorithms solving the following practical applications: edge-aware editing, tone mapping, HDR compression, de-blurring in frequency domain, abstraction, hybrid images, gradient domain editing, seamless image stitching and cloning, digital photo-montage, color-to-gray conversion, context enhancement, interactive as-rigid-as-possible image deformation, free-form image registration, texture synthesis, interactive segmentation, colorization, painting, adding depth, alpha matting.	Z,ZK	4
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 for audience.	Z,ZK	4
NI-LSM	Statistical Modelling Lab The subject is oriented on a single and multi-target tracking. The student both learns the existing methods and tries to implement them. The stress is put on the effective use of the available information and its modeling using numpy and scipy. The second half of the semester is focused on the design of methods and algorithms, and analyses of their properties. At this point, the subject is on the border of own research and may result in the topic of final work (diploma or bachelor thesis).	KZ	5
NI-MOP	Modern Object-Oriented Programming in Pharo Object-oriented programming is currently one of the most widespread paradigms of software creation, especially enterprise information systems, where its ability to natural abstraction is used to build complex modern applications. In this course, we build on the knowledge acquired in the course BI-OOP and aim to further deepen the skills of design and implementation of object systems in modern pure object system Pharo (https://pharo.org). The course focuses on individual approach to students, their development needs and areas of interest. In addition to deepening object programming skills, which are generally applicable in other OO languages, students will also gain the opportunity to work on interesting projects and OO technologies in terms of semestral work with the possibility of cooperation with practice and related bachelor, diploma, postgraduate our direct involvement in the Pharo Consortium.	KZ	4
NI-MPL	Managerial Psychology	ZK	2
NI-MSI	Mathematical Structures in Computer Science Mathematical semantics of programming languages. Data types as continous lattices, Scott topology. Procedures as continuous mappings. The Scott model of lambda calculus. Introduction to category theory.	Z,ZK	4
NI-OLI	Linux Drivers The Linux operating system is an important operating system for personal computer and also for embedded systems. Systems on chip and combining powerful processors and FPGAs increase the variability of peripheral subsystems requiring specific software drivers. This course is an advanced course in the Linux driver development for master's students. The course provides knowledge of Linux operating system architecture, principles of development of various types drivers, including practical experience.	Z,ZK	4
NI-PDD	Data Preprocessing Students learn to prepare raw data for further processing and analysis. They learn what algorithms can be used to extract information from various data sources, such as images, texts, time series, etc., and learn the skills to apply these theoretical concepts to solve specific problems in individual projects - e.g., extraction of characteristics from images or from web pages.	Z,ZK	5
NI-PSD	Public Services Design The course will introduce students to specifics of UX, Service design and development for public sector. We will look into the design and development process from the perspective of suppliers (devs and designesr) as well as clients. In small teams students will work on projects from partner organizations and will try out collaboration with client representatives. Course is aimed at students-designers as well as clients.	KZ	4
NI-PSL	Programming in Scala The course introduces the modern programming language Scala which exploits object-functional paradigm. Scala comprises advance language features - e.g.pattern matching and advance standard library. Scala enables to use of applications functional patterns e.g. H-List, Monads, etc. Scala is used by many powerful frameworks and libraries e.g. Play, Cassandra, Scalaz, etc.	Z,ZK	4
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	Z,ZK	5

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-SYP	Parsing and Compilers	Z,ZK	5
The module builds upon the knowledge of fundamentals of automata theory, formal language and formal translation theories. Students gain knowledge of various variants and applications of LR parsing and are introduced to special applications of parsers, such as incremental and parallel parsing.			
NI-TSP	Testing and Reliability	Z,ZK	5
Students will gain knowledge about circuit testing and about methods for increasing reliability and security. They will get practical skills to be able to prepare a test set with the help of the intuitive path sensitization and to use an ATPG for automatic test generation. They will be able to design easily testable circuits and systems with built-in-self-test equipment. They will be able to compute, analyze, and control the reliability and availability of the designed circuits.			
NI-VCC	Virtualization and Cloud Computing	Z,ZK	5
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-VYC	Computability	Z,ZK	4
Classical theory of recursive functions and effective computability.			
TV1	Physical Education	Z	0
TV2	Physical Education	Z	0
TV2K1	Physical Education 2	Z	1
TVK1	Physical Education	Z	1
TVKLV	Physical Education Course	Z	0
TVKZV	Physical Education Course	Z	0
TVV	Physical education	Z	0
TVV0	Physical education	Z	0

For updated information see http://bilakniha.cvut.cz/en/FF.html
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