

Study plan

Name of study plan: Open Informatics - Bioinformatics

Faculty/Institute/Others: Faculty of Electrical Engineering
 Department:
 Branch of study guaranteed by the department: Welcome page
 Garant of the study branch:
 Program of study: Open Informatics
 Type of study: Follow-up master full-time
 Required credits: 84
 Elective courses credits: 36
 Sum of credits in the plan: 120
 Note on the plan:

Name of the block: Compulsory courses in the program
 Minimal number of credits of the block: 49
 The role of the block: P

Code of the group: 2018_MOIEP
 Name of the group: Compulsory subjects of the programme
 Requirement credits in the group: In this group you have to gain 24 credits
 Requirement courses in the group: In this group you have to complete 4 courses
 Credits in the group: 24
 Note on the group:

| Code | Name of the course / Name of the group of courses (in case of groups of courses the list of codes of their members) Tutors, authors and guarantors (gar.) | Completion | Credits | Scope | Semester | Role |
|-----------|---|------------|---------|-------|----------|------|
| BE4M33PAL | Advanced Algorithms Marko Genyk-Berezovskij, Daniel Pr ša Daniel Pr ša Daniel Pr ša (Gar.) | Z,ZK | 6 | 2P+2C | Z | P |
| BE4M35KO | Combinatorial Optimization Zden k Hanzálek Zden k Hanzálek | Z,ZK | 6 | 3P+2C | L | P |
| BE4MSVP | Software or Research Project Ji í Šebek, Petr Pošík, Jaroslav Šloup, Katarína Žmolíková, Tomáš Drábek Petr Pošík | KZ | 6 | | Z,L | P |
| BE4M01TAL | Theory of Algorithms Marie Demlová, Natalie Žukovec Marie Demlová Marie Demlová (Gar.) | Z,ZK | 6 | 3P+2S | L | P |

Characteristics of the courses of this group of Study Plan: Code=2018_MOIEP Name=Compulsory subjects of the programme

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|-----------|------------------------------|------|---|--|
| BE4M33PAL | Advanced Algorithms | Z,ZK | 6 | Basic graph algorithms and graph representation. Combinatorial algorithms. Application of formal languages theory in computer science - pattern matching. |
| BE4M35KO | Combinatorial Optimization | Z,ZK | 6 | The goal is to show the problems and algorithms of combinatorial optimization (often called discrete optimization; there is a strong overlap with the term operations research). Following the courses on linear algebra, graph theory, and basics of optimization, we show optimization techniques based on graphs, integer linear programming, heuristics, approximation algorithms and state space search methods. We focus on application of optimization in stores, ground transportation, flight transportation, logistics, planning of human resources, scheduling in production lines, message routing, scheduling in parallel computers. |
| BE4MSVP | Software or Research Project | KZ | 6 | Independent work on a problem under the guidance of an advisor. Usually but not mandatory, the problem being solved is a subproblem of approaching diploma thesis and the project advisor is the diploma thesis supervisor too. Therefore, we recommend choosing the topic of the diploma thesis at the beginning of the 3rd semester and not underestimating its timely selection. The topic of the project should be relevant to the major branch of the study. The software and research project course must have a clearly defined output, such as a technical report or a computer program. The output is defended, evaluated and graded. Important note: - By default, it is not possible to complete more than one subject of this type. - An exception may be granted by the guarantor of the major branch of the study. A possible reason for granting an exemption is that the work-project has a different topic and is led by another supervisor. A typical example is working on a project abroad. Note: The student enrolls in the course of SVP at the department of the supervisor. If the course does not list the course, then at the department 13139 (variant A4M39SVP). The contact email in case of further questions: oi@fel.cvut.cz. More instructions for entering and elaborating the project can be found on the website of the Department of Computer Graphics and Interaction http://dcgi.felk.cvut.cz/cs/study/predmetprojekt . |
| BE4M01TAL | Theory of Algorithms | Z,ZK | 6 | The course brings theoretical background of the theory of algorithms with the focus at first on the time and space complexity of algorithms and problems, secondly on the correctness of algorithms. Further it is dealt with the theory of complexity; the classes P, NP, NP-complete, PSPACE and NPSPACE are treated and properties of them investigated. Probabilistic algorithms are studied and the classes RP and ZPP introduced. |

Code of the group: 2018_MOIEDIP
 Name of the group: Diploma Thesis

Requirement credits in the group: In this group you have to gain 25 credits

Requirement courses in the group: In this group you have to complete 1 course

Credits in the group: 25

Note on the group:

| Code | Name of the course / Name of the group of courses (in case of groups of courses the list of codes of their members) Tutors, authors and guarantors (gar.) | Completion | Credits | Scope | Semester | Role |
|--------|---|------------|---------|-------|----------|------|
| BDIP25 | Diploma Thesis | Z | 25 | 22s | L | P |

Characteristics of the courses of this group of Study Plan: Code=2018_MOIEDIP Name=Diploma Thesis

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|--------|----------------|---|----|---|--|--|
| BDIP25 | Diploma Thesis | Z | 25 | Independent final comprehensive work for the Master's degree study programme. A student will choose a topic from a range of topics related to his or her branch of study, which will be specified by branch department or branch departments. The diploma thesis will be defended in front of the board of examiners for the comprehensive final examination. | | |
|--------|----------------|---|----|---|--|--|

Name of the block: Compulsory courses of the specialization

Minimal number of credits of the block: 35

The role of the block: PO

Code of the group: 2018_MOIEPO8

Name of the group: Compulsory subjects of the branch

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 6 courses

Credits in the group: 35

Note on the group:

| Code | Name of the course / Name of the group of courses (in case of groups of courses the list of codes of their members) Tutors, authors and guarantors (gar.) | Completion | Credits | Scope | Semester | Role |
|-----------|---|------------|---------|-------|----------|------|
| BE4M36BIN | Bioinformatics Ji í Kléma | Z,ZK | 5 | 2P+2C | L | PO |
| BE4M33DZO | Digital Image Daniel Sýkora Daniel Sýkora Daniel Sýkora (Gar.) | Z,ZK | 6 | 2P+2C | Z | PO |
| BE4M36MBG | Molecular Biology and Genetics Martin Pospíšek Martin Pospíšek Martin Pospíšek (Gar.) | Z,ZK | 6 | 3P+1C | L | PO |
| BE4M36SAN | Statistical data analysis Ji í Kléma Ji í Kléma Ji í Kléma (Gar.) | Z,ZK | 6 | 2P+2C | Z | PO |
| BE4M33SSU | Statistical Machine Learning Jan Drchal, Vojt ch Franc, Boris Flach Vojt ch Franc Boris Flach (Gar.) | Z,ZK | 6 | 2P+2C | Z | PO |
| BE4M36SMU | Symbolic Machine Learning Filip Železný, Ond ej Kuželka, Gustav Šír Ond ej Kuželka Ond ej Kuželka (Gar.) | Z,ZK | 6 | 2P+2C | L | PO |

Characteristics of the courses of this group of Study Plan: Code=2018_MOIEPO8 Name=Compulsory subjects of the branch

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|-----------|--------------------------------|------|---|--|--|--|
| BE4M36BIN | Bioinformatics | Z,ZK | 5 | | | |
| BE4M33DZO | Digital Image | Z,ZK | 6 | This course presents an overview of basic methods for digital image processing. It deals with practical techniques that have an interesting theoretical basis but are not difficult to implement. Seemingly abstract concepts from mathematical analysis, probability theory, or optimization come to life through visually engaging applications. The course focuses on fundamental principles (signal sampling and reconstruction, monadic operations, histogram, Fourier transform, convolution, linear and non-linear filtering) and more advanced editing techniques, including image stitching, deformation, registration, and segmentation. Students will practice the selected topics through six implementation tasks, which will help them learn the theoretical knowledge from the lectures and use it to solve practical problems. | | |
| BE4M36MBG | Molecular Biology and Genetics | Z,ZK | 6 | | | |
| BE4M36SAN | Statistical data analysis | Z,ZK | 6 | This course builds on the skills developed in introductory statistics courses. It is practically oriented and gives an introduction to applied statistics. It mainly aims at multivariate statistical analysis and modelling, i.e., the methods that help to understand, interpret, visualize and model potentially high-dimensional data. It can be seen as a purely statistical counterpart to machine learning and data mining courses. | | |
| BE4M33SSU | Statistical Machine Learning | Z,ZK | 6 | The aim of statistical machine learning is to develop systems (models and algorithms) for learning to solve tasks given a set of examples and some prior knowledge about the task. This includes typical tasks in speech and image recognition. The course has the following two main objectives 1. to present fundamental learning concepts such as risk minimisation, maximum likelihood estimation and Bayesian learning including their theoretical aspects, 2. to consider important state-of-the-art models for classification and regression and to show how they can be learned by those concepts. | | |
| BE4M36SMU | Symbolic Machine Learning | Z,ZK | 6 | This course consists of four parts. The first part of the course will explain methods through which an intelligent agent can learn by interacting with its environment, also known as reinforcement learning. This will include deep reinforcement learning. The second part focuses on Bayesian networks, specifically methods for inference. The third part will cover fundamental topics from natural language learning, starting from the basics and ending with state-of-the-art architectures such as transformer. Finally, the last part will provide an introduction to several topics from the computational learning theory, including the online and batch learning settings. | | |

Name of the block: Elective courses

Minimal number of credits of the block: 0

The role of the block: V

Code of the group: 2018_MOIEVOL

Name of the group: Elective subjects

Requirement credits in the group:

Requirement courses in the group:

Credits in the group: 0

Note on the group: ~Student can choose arbitrary subject of the master's program (EEM - Electrical Engineering, Power Engineering and Management, EK - Electronics and Communications, KYR - Cybernetics and Robotics, OI - Open Informatics, OES - Open Electronics Systems) which is not part of his curriculum. Student can choose with consideration of recommendation of the branch guarantee. You can find a selection of optional courses organized by the departments on the web site <http://www.fel.cvut.cz/cz/education/volitelne-predmety.html>

List of courses of this pass:

| Code | Name of the course | Completion | Credits |
|---|--------------------------------|------------|---------|
| BDIP25 | Diploma Thesis | Z | 25 |
| Independent final comprehensive work for the Master's degree study programme. A student will choose a topic from a range of topics related to his or her branch of study, which will be specified by branch department or branch departments. The diploma thesis will be defended in front of the board of examiners for the comprehensive final examination. | | | |
| BE4M01TAL | Theory of Algorithms | Z,ZK | 6 |
| The course brings theoretical background of the theory of algorithms with the focus at first on the time and space complexity of algorithms and problems, secondly on the correctness of algorithms. Further it is dealt with the theory of complexity; the classes P, NP, NP-complete, PSPACE and NPSpace are treated and properties of them investigated. Probabilistic algorithms are studied and the classes RP and ZZP introduced. | | | |
| BE4M33DZO | Digital Image | Z,ZK | 6 |
| This course presents an overview of basic methods for digital image processing. It deals with practical techniques that have an interesting theoretical basis but are not difficult to implement. Seemingly abstract concepts from mathematical analysis, probability theory, or optimization come to life through visually engaging applications. The course focuses on fundamental principles (signal sampling and reconstruction, monadic operations, histogram, Fourier transform, convolution, linear and non-linear filtering) and more advanced editing techniques, including image stitching, deformation, registration, and segmentation. Students will practice the selected topics through six implementation tasks, which will help them learn the theoretical knowledge from the lectures and use it to solve practical problems. | | | |
| BE4M33PAL | Advanced Algorithms | Z,ZK | 6 |
| Basic graph algorithms and graph representation. Combinatorial algorithms. Application of formal languages theory in computer science - pattern matching. | | | |
| BE4M33SSU | Statistical Machine Learning | Z,ZK | 6 |
| The aim of statistical machine learning is to develop systems (models and algorithms) for learning to solve tasks given a set of examples and some prior knowledge about the task. This includes typical tasks in speech and image recognition. The course has the following two main objectives 1. to present fundamental learning concepts such as risk minimisation, maximum likelihood estimation and Bayesian learning including their theoretical aspects, 2. to consider important state-of-the-art models for classification and regression and to show how they can be learned by those concepts. | | | |
| BE4M35KO | Combinatorial Optimization | Z,ZK | 6 |
| The goal is to show the problems and algorithms of combinatorial optimization (often called discrete optimization; there is a strong overlap with the term operations research). Following the courses on linear algebra, graph theory, and basics of optimization, we show optimization techniques based on graphs, integer linear programming, heuristics, approximation algorithms and state space search methods. We focus on application of optimization in stores, ground transportation, flight transportation, logistics, planning of human resources, scheduling in production lines, message routing, scheduling in parallel computers. | | | |
| BE4M36BIN | Bioinformatics | Z,ZK | 5 |
| BE4M36MBG | Molecular Biology and Genetics | Z,ZK | 6 |
| BE4M36SAN | Statistical data analysis | Z,ZK | 6 |
| This course builds on the skills developed in introductory statistics courses. It is practically oriented and gives an introduction to applied statistics. It mainly aims at multivariate statistical analysis and modelling, i.e., the methods that help to understand, interpret, visualize and model potentially high-dimensional data. It can be seen as a purely statistical counterpart to machine learning and data mining courses. | | | |
| BE4M36SMU | Symbolic Machine Learning | Z,ZK | 6 |
| This course consists of four parts. The first part of the course will explain methods through which an intelligent agent can learn by interacting with its environment, also known as reinforcement learning. This will include deep reinforcement learning. The second part focuses on Bayesian networks, specifically methods for inference. The third part will cover fundamental topics from natural language learning, starting from the basics and ending with state-of-the-art architectures such as transformer. Finally, the last part will provide an introduction to several topics from the computational learning theory, including the online and batch learning settings. | | | |
| BE4MSVP | Software or Research Project | KZ | 6 |
| Independent work on a problem under the guidance of an advisor. Usually but not mandatory, the problem being solved is a subproblem of approaching diploma thesis and the project advisor is the diploma thesis supervisor too. Therefore, we recommend choosing the topic of the diploma thesis at the beginning of the 3rd semester and not underestimating its timely selection. The topic of the project should be relevant to the major branch of the study. The software and research project course must have a clearly defined output, such as a technical report or a computer program. The output is defended, evaluated and graded. Important note: - By default, it is not possible to complete more than one subject of this type. - An exception may be granted by the guarantor of the major branch of the study. A possible reason for granting an exemption is that the work-project has a different topic and is led by another supervisor. A typical example is working on a project abroad. Note: The student enrolls in the course of SVP at the department of the supervisor. If the course does not list the course, | | | |

For updated information see <http://bilakniha.cvut.cz/en/f3.html>

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