Study plan

Name of study plan: Open Informatics - Artificial Intelligence

Faculty/Institute/Others: Faculty of Electrical Engineering
Department: Department of Computer Science
Branch of study guaranteed by the department:
Garantor of the study branch: prof. Dr. Michal Pěchouček, MSc.
Program of study: Open Informatics
Type of study: Follow-up master full-time
Required credits: 85
Elective courses credits: 35
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-Berezovskyj, Daniel Průša* ***Daniel Průša*** *Daniel Průša (Gar.)*	Z,ZK	6	2P+2C	Z	P
BE4M35KO	**Combinatorial Optimization** *Zdeněk Hanzálek* ***Zdeněk Hanzálek***	Z,ZK	6	3P+2C	L	P
BE4MSVP	**Software or Research Project** *Petr Pošík, Jaroslav Sloup, Katarína Ťakušová* ***Katarína Ťakušová***	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

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
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.			

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

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: 36
The role of the block: PO

Code of the group: 2018_MOIEPO7
Name of the group: Compulsory subjects of the branch
Requirement credits in the group: In this group you have to gain 36 credits
Requirement courses in the group: In this group you have to complete 6 courses
Credits in the group: 36
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
BE4M36UIR	**Artificial Intelligence in Robotics** *Pavel Rytíř, Tomáš Krajník, Jan Faigl **Jan Faigl** Tomáš Krajník (Gar.)*	Z,ZK	6	2P+2C	Z	PO
BE4M36LUP	**Logical Reasoning and Programming** *Filip Železný, Karel Chvalovský **Filip Železný** Filip Železný (Gar.)*	Z,ZK	6	2P+2C	Z	PO
BE4M36MAS	**Multiagent Systems** *Tomáš Kroupa, Michal Pěchouček, Michal Jakob, Branislav Bošanský **Branislav Bošanský** Michal Pěchouček (Gar.)*	Z,ZK	6	2P+2C	Z	PO
BE4M36PUI	**Planning for Artificial Intelligence** *Branislav Bošanský, Lukáš Chrpa **Branislav Bošanský** Michal Pěchouček (Gar.)*	Z,ZK	6	2P+2C	L	PO
BE4M33SSU	**Statistical Machine Learning** *Jan Drchal, Vojtěch Franc, Boris Flach **Vojtěch Franc** Boris Flach (Gar.)*	Z,ZK	6	2P+2C	Z	PO
BE4M36SMU	**Symbolic Machine Learning** *Filip Železný, Ondřej Kuželka **Filip Železný** Filip Železný (Gar.)*	Z,ZK	6	2P+2C	L	PO

Characteristics of the courses of this group of Study Plan: Code=2018_MOIEPO7 Name=Compulsory subjects of the branch

BE4M36UIR	Artificial Intelligence in Robotics	Z,ZK	6

The aim of the course is to acquaint students with the use planning approaches and decision-making techniques of artificial intelligence for solving problems arising in autonomous robotic systems. Students in the course will use the knowledge of planning algorithms, game theory, solving optimization problems and multi-agent negotiation in selected application scenarios of mobile robotics. Students first learn the basic architectures of autonomous systems based on reactive and behavioral models of autonomous systems. The considered application scenarios and robotic problems includes: path planning, persistent environmental monitoring, robotic exploration of unknown environments, online real-time decision-making, deconfliction in autonomous systems and solutions of antagonistic conflicts. In laboratory exercises, students will practice their problem formulations of robotic challenges and practical solutions in a realistic robotic simulator or using consumer mobile robots.

BE4M36LUP	Logical Reasoning and Programming	Z,ZK	6

The course's aim is to explain selected significant methods of computational logic. These include algorithms for propositional satisfiability checking, logical programming in Prolog, and first-order theorem proving and model-finding. Time permitting, we will also discuss some complexity and decidability issues pertaining to the said methods.

BE4M36MAS	Multiagent Systems	Z,ZK	6

The course provides an introduction to concepts, models, and algorithms for autonomous agents and multi-agent systems. The first part of the course introduces single-agent models and control architectures; the second part explains key multi-agent models and algorithms, both for cooperative and non-cooperative multi-agent settings. Upon successful completion of the course, students will be able to understand main multi-agent concepts, be able to map real-world multi-agent problems to multi-agent formal models and apply algorithmic techniques to solve them.

BE4M36PUI	Planning for Artificial Intelligence	Z,ZK	6

The course covers the problematic of automated planning in artificial intelligence and focuses especially on domain independent models of planning problems: planning as a search in the space of states (state-space planning), in the space of plans (plan-space planning), heuristic planning, planning in graph representation of planning problems (graph-plan) or hierarchical planning. The students will also learn about the problematic of planning under uncertainty and the planning model as a decision-making in MDP and POMDP.

BE4M33SSU	Statistical Machine Learning	Z,ZK	6

The aim of statistical machine learning is to develop systems (models and algorithms) able to learn 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

The course will explain methods through which an intelligent agent can learn, that is, improve its behavior from observed data and background knowledge. The learning scenarios will include on-line learning and learning from i.i.d. data (along with the PAC theory of learnability), as well as the active and reinforcement learning scenarios. Symbolic knowledge representations (mainly through logic and graphs) will be used where possible. The course is given in English to all students.

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 themagister'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

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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.			
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) able to learn 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.			
BE4M36LUP	Logical Reasoning and Programming	Z,ZK	6
The course's aim is to explain selected significant methods of computational logic. These include algorithms for propositional satisfiability checking, logical programming in Prolog, and first-order theorem proving and model-finding. Time permitting, we will also discuss some complexity and decidability issues pertaining to the said methods.			
BE4M36MAS	Multiagent Systems	Z,ZK	6
The course provides an introduction to concepts, models, and algorithms for autonomous agents and multi-agent systems. The first part of the course introduces single-agent models and control architectures; the second part explains key multi-agent models and algorithms, both for cooperative and non-cooperative multi-agent settings. Upon successful completion of the course, students will be able to understand main multi-agent concepts, be able to map real-world multi-agent problems to multi-agent formal models and apply algorithmic techniques to solve them.			
BE4M36PUI	Planning for Artificial Intelligence	Z,ZK	6
The course covers the problematic of automated planning in artificial intelligence and focuses especially on domain independent models of planning problems: planning as a search in the space of states (state-space planning), in the space of plans (plan-space planning), heuristic planning, planning in graph representation of planning problems (graph-plan) or hierarchical planning. The students will also learn about the problematic of planning under uncertainty and the planning model as a decision-making in MDP and POMDP.			
BE4M36SMU	Symbolic Machine Learning	Z,ZK	6
The course will explain methods through which an intelligent agent can learn, that is, improve its behavior from observed data and background knowledge. The learning scenarios will include on-line learning and learning from i.i.d. data (along with the PAC theory of learnability), as well as the active and reinforcement learning scenarios. Symbolic knowledge representations (mainly through logic and graphs) will be used where possible. The course is given in English to all students.			
BE4M36UIR	Artificial Intelligence in Robotics	Z,ZK	6
The aim of the course is to acquaint students with the use planning approaches and decision-making techniques of artificial intelligence for solving problems arising in autonomous robotic systems. Students in the course will use the knowledge of planning algorithms, game theory, solving optimization problems and multi-agent negotiation in selected application scenarios of mobile robotics. Students first learn the basic architectures of autonomous systems based on reactive and behavioral models of autonomous systems. The considered application scenarios and robotic problems includes: path planning, persistent environmental monitoring, robotic exploration of unknown environments, online real-time decision-making, deconfliction in autonomous systems and solutions of antagonistic conflicts. In laboratory exercises, students will practice their problem formulations of robotic challenges and practical solutions in a realistic robotic simulator or using consumer mobile robots.			
BE4MSVP	Software or Research Project	KZ	6