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| **Al-Farabi Kazakh National Univesity**  **Syllabus**  **Models and methods of the theory of neural networks**  **Spring semester 2017-2018 academic year**  **1 course, Master’s degree, spec. Information security systems (6M100200)** | | | | | | | | | | |
| The code of the course | The name of the course | Type | The number of hours per week | | | | | | The number of credits | ECTS |
| Lecture | | Practice | | Laboratory | |  |  |
| MMTHC5208 | Models and methods of the theory of neural networks | MC | 2 | | 0 | | 1 | | 3 | MMTHC5208 |
| Lecturer | Vladislav Karyukin | Office hours | Wednesday 19:00 – 20:50 | | | | | | | |
| Email | vladislav.karyukin@gmail.com |
| The mobile phone | 8 701 940 59 92 | Room | 519 | | | | | | | |
| Academic presentation of the course | **A type of the academic course** (practical; basic)  Artificial intelligence is one of the newest fields in science and engineering. Works in AI started soon after World War II, and the name itself was coined in 1956. Along with molecular biology,  AI is regularly cited as the “field I would most like to be in” by scientists in other disciplines.  AI currently encompasses a huge variety of subfields, ranging from the general (learning  and perception) to the specific, such as playing chess, proving mathematical theorems, writing  poetry, driving a car on a crowded street, and diagnosing diseases. AI is relevant to any  intellectual task; it is truly a universal field.  **The purpose of the course**:  The goal of artificial intelligence (AI) is to equip students with rigorous tools used in different problems in AI. In this course, you will learn the foundational principles and algorithms, and practice implementing some of these systems. Specific topics include intelligent agents, rational agents, standard search problems, adversarial search problems, propositional logic, first order logic, game playing, Bayesian inference, constraint satisfaction, graphical models and so on. The main goal of the course is to equip you with the tools to tackle new AI problems you might encounter in life.  А) cognitive: be able  - to demonstrate received knowledge (building schemes of rational agents, solving search problems and logical assignments)  - to demonstrate understanding the whole structure in a field of study and be able to find connections between its elements (differentiation of intelligent agents, solution of search problems having various categories of elements)  Б) functional: be able  - include new knowledge in intelligent systems;  - analyze academic situation and offer directions of its solutions;  - use methods (research, analysis, calculations and so on) that are specific to a field of study in an individual or group study activities  В) system: be able  - Generalize, interpret and evaluate the learning outcomes obtained in the context of the discipline, the training module, the content of midterm exam (build intelligent systems, create programs that realize games);  - analyze dynamic of scientific problems’ solutions (scientific overviews of specific problems’ research)  - Make an analysis of the results of the course, summarize them in the form of a scientific essay, presentation, review, scientific review and so on;  Г) social: be able  - to constructive academic and social communications and collaborations in groups; propose a problem and tell why it is important;  - teamwork | | | | | | | | | |
| Prerequisites |  | | | | | | | | | |
| Literature and resources | **Basic: “**Artificial intelligence, a modern approach”, 3rd edition, Stuart Russel, Peter Norvig  **Additional:** Simply logical, Intelligent reasoning by example, Peter Flach  Artificial intelligence, foundations of computational agents, David Poole, Alan Mackworth  Algorithms and data structures, A.E.Dusembaev, S.A.Dusembaev, Almaty, 2014. | | | | | | | | | |
| The academic policy of the course in the context of university moral and ethical values | **Rules of academic behavior**  Mandatory presence in the classrooms at lectures and laboratory sessions. Mandatory compliance with the deadlines for the completion and delivery of assignments (for boundary control, laboratory, project, etc.), projects, examinations. In case of violation of the deadlines, the task is evaluated taking into account the deduction of penalty points.  **Academic value**:  Academic honesty and integrity: doing all tasks independently; Inadmissibility of plagiarism, forgery, cheating at all stages of knowledge control, deception of the teacher and disrespectful attitude towards him. (Code of Honor for a student of KazNU) | | | | | | | | | |
| The course requirements | 1. The assignments will be distributed throughout the whole semester as it is shown in the schedule of the course 2. Assignments are given individually for every student. They contain 40% of the final grade 3. You will use the study material during the whole semester in practical purposes 4. Assignments have to be completed in time | | | | | | | | | |
| The grade policy | Description of works | | | Weight | | | | | | |
| Assignments  Laboratory work  Attendance  Quizzes  Aggregate | | | 20%  35%  5%  40%  100% | | | | | | |
|  | Your final grade will be calculated using this formula  The final grade of the course =  There are grades in percentages:  A: 95%-100%  A-: 90%-95%  B+: 85%-89%  B: 80%-84%  B-: 75%-79%  C+: 70%-74%  C: 65%-69%  C-: 60%-64%  D+: 55%-59%  D: 50%-54%  F: 0%-49% | | | | | | | | | |
| The course policy | Corresponding dates of laboratory works and assignments can be prolonged in cases of extenuating circumstances (illness, emergency cases, accidents, unseen circumstances) according to the academic policy of the university. | | | | | | | | | |
| **The schedule of the course (Application 1)** | | | | | | | | | | |
| Week | A name of the topic | | | | | A number of hours | | Maximum points | | |
| 1 | **Lecture(L) 1.** Introduction. Intelligent agents | | | | | 2 | | 1 | | |
|  | **Laboratory work (LW) 1.** Prolog. Editing and testing programs in Test mode | | | | | 1 | | 5 | | |
| 2 | **L2.** Concepts of intelligent agents. Building a rational agent | | | | | 2 | | 1 | | |
|  | **LW2.** A creation of new projects in Prolog. Use of backtracking | | | | | 1 | | 5 | | |
| 3 | **L3.** Search problems | | | | | 2 | | 1 | | |
|  | **LW3.** Building databases in Prolog | | | | | 1 | | 5 | | |
|  | **MSWT**1. Quiz1 | | | | | 1 | | 20 | | |
| 4 | **L4**. Adversarial search | | | | | 2 | | 1 | | |
|  | **LW4**. Computing arithmetical expressions in Prolog | | | | | 1 | | 5 | | |
| 5 | **L5**. Creating knowledge-base. The Wumpus world | | | | | 2 | | 1 | | |
|  | **LW5**. Creating recursion procedures | | | | | 1 | | 5 | | |
|  | **MSWT2**. Building binary trees for search algorithms | | | | | 1 | | 20 | | |
| 6 | **L6**. Logics | | | | | 2 | | 0 | | |
|  | **LW6**.Creating lists in Prolog | | | | | 1 | | 5 | | |
| 7 | **L7**. Propositional logics | | | | | 2 | | 0 | | |
|  | **LW7**. Solution of logical tasks in Prolog | | | | | 1 | | 5 | | |
|  | **MSWT3**. Quiz2 | | | | | 1 | | 20 | | |
|  | **1 Boundary control** | | | | |  | | 100 (COEF. 0.3) | | |
|  | **Midterm exam** | | | | |  | | 100 (COEF. 0.1) | | |
| 8 | **L8**. Inference in first-order logic | | | | | 2 | | 1 | | |
|  | **LW8**. Building a breadth-first search program | | | | | 1 | | 5 | | |
| 9 | **L9**. Classic planning | | | | | 2 | | 1 | | |
|  | **LW9**. Building a depth-first search program | | | | | 1 | | 5 | | |
|  | **MSWT4**. Quiz3 | | | | | 1 | | 20 | | |
| 10 | **L10**. Knowledge representation | | | | | 2 | | 1 | | |
|  | **LW10**. Minimax-problem | | | | | 1 | | 5 | | |
| 11 | **L11**. Probabilistic reasoning over time | | | | | 2 | | 1 | | |
|  | **LW11**. Tic-Tac-Toe part 1 | | | | | 1 | | 5 | | |
|  | **MSWT5**. Probabilistic models | | | | | 1 | | 20 | | |
| 12 | **L12**. Making simple decisions | | | | | 2 | | 1 | | |
|  | **LW12.** Tic-Tac-Toe part 2 | | | | | 1 | | 5 | | |
| 13 | **L13**. Making complex decisions | | | | | 2 | | 1 | | |
|  | **LW13**. The Wumpus world – part 1 | | | | | 1 | | 5 | | |
|  | **MSWT6**. Quiz 4 | | | | | 1 | | 10 | | |
| 14 | **L14**. Learning probabilistic models | | | | | 2 | | 0 | | |
|  | **LW14**. The Wumpus world – part 2 | | | | | 1 | | 5 | | |
| 15 | **L15**. Natural language processing | | | | | 2 | | 0 | | |
|  | **LW15**. The complete intellectual system | | | | | 1 | | 5 | | |
|  | **MSWT7**. Writing conclusions | | | | | 1 | | 4 | | |
|  | 2 Boundary control | | | | |  | | 100 (COEF. 0.3) | | |
|  | Exam | | | | |  | | 100 (COEF. 0.4) | | |
|  | Totally | | | | |  | | 100 | | |

**Application 2**

**Description of expected results as a system of formed competence**

**(Dublin descriptors)**

**Cognitive competence:**

**Knowledge:** A) Memorization and reproduction of the studied material - from concrete facts to integral theory, B) organize, define, repeat, fill tables, memorize, name, order, recognize, treat, remind, repeat, reproduce, make a list, highlight, tell, show and so on.

**Perception:** A) an ability to convert materials from one form of expression to another one, interpret information, make an assumption about a further course of events; B) Classify, describe, discuss, explain, express, certify, find, recognize, report, reformulate, analyze, choose, translate

**Functional competence:**

**Application**. A) an ability to use the material studied in specific conditions and new situations; B) apply, select, demonstrate, dramatize, illustrate, interpret, work, practice, develop a schedule, decide, use, write.  
**Analysis**. A) an ability to isolate parts of the whole; identify relationships between them; Determine the principles of the organization of the whole; makes a distinction between facts and consequences; B) analyze, evaluate, calculate, classify, compare, criticize, differentiate, distinguish, distinguish, study, experiment, conduct an experiment, identify similarities and differences, clarify parameters, perform a test.

**System competence**:  
**Synthesis**. A) an ability to combine elements in order to obtain a whole with novelty, (composition, speech, report, abstract, project, case, quest, etc.); B) organize, collect, compile, build, create, develop, formulate, prove their point of view, manage, organize, plan, forecast, prepare, offer, create, write.  
**Evaluation**. A) an ability to assess the value of a material, the logic of the presentation of information, the construction of the text, the conformity of conclusions, the significance of a product activity; B) evaluate, discuss, select, compare, protect, predict, select, support, defend a point of view, prove, predict, present the argumentation.

**Social competence**:  
Willingness to cooperate: A) communicate information, ideas, problems and solutions, work in a team; B) formulate (problem, goal, task, conclusions, regulations, etc.); identify (requirements, criteria, principles); Take decisions and report on them, draw conclusions, argue, justify, insist, persuade, etc.

**Metacompetence**:  
Skills in the field of training: A) develop such skills in the field of training, which are necessary for continuing education with a high degree of autonomy; B) Be capable of reflection, an objective assessment of their achievements; To realize the necessity of forming new competencies; Determine the direction of further personal and professional development, etc.

Lector Karyukin V.I.

Chair’s chief Tukeyev U.A.

Dean of the faculty Zhakevayev D.B.